Final **Amendment 10**
to the Atlantic Sea Scallop Fishery Management Plan
with a
Supplemental Environmental Impact Statement,
Regulatory Impact Review, and
Regulatory Flexibility Analysis

Prepared by the New England Fishery Management Council
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In consultation with the National Marine Fisheries Service
and the Mid-Atlantic Fishery Management Council

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About the cover: Cover photo shows scallop catch of a single dredge from the Nantucket Lightship Area during August 2001. The photo was taken immediately after the catch was dumped on deck, before the crew picked large scallops out or finfish were discarded.

Cover Sheet

Abstract

Amendment 10 to the Scallop Fishery Management Plan has been in development for approximately four years. The goals of the amendment are to improve the FMP's ability to meet its objectives and achieve optimum yield, to update the analysis of cumulative impacts of the FMP on the human environment, and to re-evaluate the Essential Fish Habitat (EFH) components of the FMP and minimize adverse effects on EFH.

To achieve the goals, the amendment introduces a formal adaptive rotation area management strategy supported by cooperative industry surveys and implemented by framework adjustments to close and re-open scallop areas. It also sets forth a procedure for allocating area-specific days-at-sea and trips, that when coupled with a day-at-sea tradeoff, larger rings and twine top mesh, and crew limits is expected to reduce fishing time, having positive effects on bycatch species and essential fish habitat. Habitat impacts are further addressed by designating a portion of the scallop fishing grounds as a habitat closure, areas that have been closed to scallop fishing since 1995 and will therefore see continuing habitat recovery.

As shown in the analyses presented in this document, the management measures included in Amendment 10 will improve yield from the scallop resource through area rotation and will reduce the adverse effects of the scallop fishery on the environment, including the physical environment and other living resources.

The Council completed the Draft Amendment and Draft Supplemental Environmental Impact Statement in April 2003, conducted public hearings in May 2003, accepted and evaluated extensive public comments during a 90-day comment period, and selected final alternatives in August and September 2003, based on public comment and scientific advice.

The Final SEIS and its supporting documentation will be available to the public for a 30-day comment period following a notice published in the Federal Register. Additional comments will be due to the National Marine Fisheries Service on the date provided in the Notice of Availability and proposed rule to be published in the Federal Register.

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2.0 Executive Summary

Amendment 10 to the Atlantic Sea Scallop FMP proposes new management alternatives to improve scallop management and net benefits, as well as consider a broad range of alternatives to minimize impacts on habitat and bycatch. The purpose and need for Amendment 10 is described in Section 4.0. The goals and objectives are identified in Sections 4.1 and 4.2, but the major issues that are addressed in the amendment include:

- New science indicates that higher scallop yield can be achieved with less impact on the marine environment, through pre-planned, adaptive rotational fishing.

- A more formal process was needed to allow periodic access to the surplus biomass of sea scallops in the Georges Bank groundfish closed areas, relying on a comprehensive environmental impact statement that analyzed the cumulative impacts of scallop management. Uncertainties about habitat and bycatch impacts from fishing in the Georges Bank groundfish closed areas were preventing the scallop fishery from achieving optimum yield.

- The impacts of scallop fishing gear and methods on sensitive habitat, including Essential Fish Habitat (EFH) as defined by the Magnuson-Stevens Act, required further analysis. As discussed further in Section 3.1.2.3, Amendment 10 was required to specifically remedy the deficiencies in Amendment 9's analysis of measures relating to EFH as part of the decision/Settlement Agreement resulting from a legal challenge in the U.S. District Court for the District of Columbia (American Oceans Campaign et. al. V. Daley et. al., Civil Action No. 99-982(GK)).

- The existing management program did not address all of the differences between the vessels in the scallop fleet: (1) vessels using trawl gear were catching smaller scallops than vessels using dredge gear; (2) vessels with permits in the General category (open access permits) were not being allowed to participate in programs that allowed controlled access to closure areas and thus were not benefiting from the improved yields in those areas.

- Data collection and research needed to be improved, and the timing of the management process needed to be better coordinated with the availability of information from the annual sea scallop resource survey.

Because of the complexity of the issues the Council was addressing, Amendment 10 is a complex document. Section 3.1.2 describes the evolution of the current fishery management program and Section 4.0 describes the purpose and need for change, including a list of the goals and objectives to be achieved by the amendment. Section 5.0 describes the proposed management alternatives in the final amendment and the preferred and non-preferred alternatives under consideration in the DSEIS. The proposed action is summarized in Section 5.1, and Section 5.3 describes both preferred and non-preferred management alternatives that the Council took to public hearing for the DSEIS, including other management approaches that were considered and rejected during development of the amendment (Section 5.4).

The affected environment, including a description of the fishery, scallop biology, the economic and social infrastructure, and the related ecosystem are analyzed and described in Section 7.0. Based in part on the issues identified during scoping and during the public hearing on the DSEIS, the FSEIS includes an evaluation of the effects of fishing on EFH and an analysis of alternatives to improve scallop management, improve net benefits, and minimize to the extent practicable the adverse effects on EFH and bycatch from fishing in Section 8.0. The EIS considers and evaluates alternatives to minimize adverse effects to the extent practicable and include consideration of measures such as closed areas, effort reductions and gear modifications.

The analysis considers the no-action, along with a range of other reasonable alternatives. Information from the 1998 EA (included in Amendment 9 to the Scallop FMP) is reflected in this analysis. However, additional information and the selection of alternatives come from a review of the best scientific information available, including new information made available since the fishery management plan amendments were originally completed.

In Sections 7.2.6 and 8.5, the document also includes material to satisfy the requirements of the NMFS guidelines at 50 CFR part 600, Subpart J for mandatory requirements of an FMP to:

(1) Identify any fishing activities that are not managed under the MSA that may adversely affect EFH.

(2) Identify activities other than fishing that may adversely affect EFH. For each activity, the FMP should describe known and potential adverse effects to EFH.

(3) Identify actions to encourage the conservation and enhancement of EFH, including recommended options to avoid, minimize, or compensate for the adverse effects, especially in HAPCs.

(4) List the major prey species for the species in the fishery management unit and discuss the location of prey species' habitat. Consider adverse effects on prey species and their habitats that may result from actions that reduce their availability, either through direct harm or capture, or through adverse effects to prey species' habitats.

(5) Recommendations, in priority order, for research efforts necessary to improve upon the description and identification of EFH, the identification of threats to EFH from fishing and other activities ad the development of conservation and enhancement measures for EFH.

(6) Conduct a cumulative impact analysis that describes impacts on an ecosystem or watershed scale (Cumulative effects of multiple gear types are included in the Gear Effects Evaluation Section)

This document was developed to comply with all of the legal requirements relating to the implementation of a fishery management program. Section 6.0 evaluates the consistency of the proposed management program with the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). Section 13.0 evaluates the impacts on state coastal zones, as required by the Coastal Zone Management Act (CZMA). Section 14.0 evaluates the information collection requirements relating to the proposed measures, as required by the Paperwork Reduction Act (PRA).

Following a 90-day public comment period on the DSEIS and considering public comment and scientific analysis and advice, the Council selected final alternatives to include in the proposed action for Amendment 10. The Council and committee reviewed the public comments and additional analyses that were updated to include new data that became available from the summer resource surveys. These data allowed the Council to update the projected TACs and DAS/trip allocations, and also more accurately identify a rotation area management closure that will protect small scallops observed in the 2003 surveys. Initially, the Council selected the status quo overfishing definition (Section 5.3.1.2) with area-specific

DAS/trip allocations (Section 5.3.3.2) and Habitat Alternative 2 (Section 5.3.4.2) for the final alternative. Further analysis by NMFS resulted in their recommendation that the final alternative was insufficiently conservative and without additional action, the FMP had a low probability of achieving OY.

NMFS recommended that the Council re-evaluate the reliance on Habitat Alternative 2 (Sections 5.1.6.1 and 5.3.4.2) to achieve the conservation objectives for the amendment, and strengthen the framework adjustment process to ensure that future management actions had a higher probability of achieving OY. After considerable debate at the September Council meeting on the merits of the nine habitat closure alternatives, in relationship to the cumulative effects of likely actions in other FMPs, the Council approved Habitat Alternative 6 which will prevent access to and keep closed areas with important scallop resources, but which have been closed since 1994 and contain important EFH and hard bottom. The Council also modified the framework adjustment process to allow the Regional Administrator the ability to substitute other alternatives shown to achieve OY, if the Council's recommendation does not do this.

In the public comments, fishing industry representatives and fishermen wanted management measures that allowed a 120 full-time DAS allocation with area rotation and well-defined habitat closures if they were necessary to conserve complex and sensitive habitat. Before the Council adopted any habitat closures, industry wanted the analysis to demonstrate that the benefits of habitat closures outweighed the costs to the industry of being prohibited from harvesting scallops in these areas. They were also strongly supportive of continuing to use the status quo overfishing definition, because they felt that the proposed alternative was unnecessarily conservative and would cause too much short-term economic harm. The industry was strongly supportive of a fully-adaptive, flexible boundary rotation area management system, supported by cooperative industry surveys and scallop/habitat research funded through set-asides. Most also sided with not making changes to general category rules, except to obtain better reporting that might allow more effective enforcement of the 400 lb. scallop possession limit.

Representatives of conservation organizations did not feel that the proposed management alternatives were sufficiently conservative, arguing that none of the alternatives provided sufficient protection for EFH or achieved OY because they allowed too much fishing effort. They pointed out that the status quo overfishing definition targets were projected to allow higher amounts of total area swept, and that under this circumstance the Council had no justification for relying on Habitat Alternative 2 to minimize impacts on EFH. They also felt that the DSEIS did not adequately demonstrate the adverse impacts of scallop dredging on EFH or that the benefits of the proposed habitat alternatives were demonstrated.

In the end, the Council took a balanced approach that uses the status quo overfishing definition to allow DAS allocations near present levels, but uses a conservative DAS tradeoff to reduce total fishing time and area swept. The Council also chose Habitat Alternative 6 to continue habitat conservation associated with the existing groundfish closed areas, at least until actions taken in other plans to improve conservation of groundfish EFH were analyzed and chosen to apply to many other types of bottom tending mobile fishing gears. It furthermore decided to strengthen the framework adjustment process to evaluate future management changes with respect to achieving OY, even though the status quo overfishing definition might suggest a more liberal target. In addition to recommending a fully-adaptive, flexible boundary rotation area management system, Amendment 10 also includes an increase to 4-inch minimum dredge rings and to a minimum 10-inch twine top mesh. The former will improve conservation and increase yield by reducing mortality on smaller scallops while increasing dredge efficiency for larger scallops, thus reducing bottom contact time and impacts on EFH and bycatch. The 10-inch twine top will allow for greater escapement of many finfish species, thus minimizing bycatch.

Although Section 5.1 clearly describes the Council's rationale for selecting the proposed action, it may not be clear why the Council did not select a preferred or non-preferred alternative in Section 5.3, which described alternatives that the Council published in the DSEIS and took public comment. To aid the reader, the following table summarizes these alternatives, the rationale provided in the DSEIS explaining the potential benefits, and the rationale why the Council did or did not select the alternative for the final, proposed action.

This table is intended to provide the reader with an at-a-glance view of how the Council progressed from the draft stage of Amendment 10 to the final action submitted to NMFS. Due to the complex nature of many of the alternatives, particularly the area rotation scheme alternatives, only brief descriptions are provided in this table. Detailed descriptions of each alternative are included in Section 5.1 (Summary of Proposed Action and Initial Allocations) and in Section 5.3 (Preferred and Non-preferred Alternatives). The table does not include a discussion of alternatives that were considered and rejected without further analysis prior to the completion of the DSEIS (discussion of these alternatives is found in Section 5.4).

Table 1. Summary of Amendment 10 alternatives and rationale for decision. Alternatives included in the proposed action are **boldfaced**.

Management alternative	Description	DSEIS rationale	FSEIS rationale
Overfishing definition (Section 3.4)			
Status quo (Proposed action)	Maintain existing overfishing definition, which is based on reference points that maximize yield per recruit	The Council could select this alternative if it determines that the status quo overfishing definition will achieve optimum yield. Status quo overfishing definition would achieve optimum yield if sufficient areas remain or become open to scallop fishing. Zero mortality in long-term closed areas will have conservation benefits and act as a source of spawning activity.	The Council determined that the status quo overfishing definition, with an increase in the minimum stock size threshold from ¼ to ½B_{MSY}, and a modification to the status determination criteria, would achieve optimum yield and prevent overfishing on a continuing basis provided that the framework provisions require the Council's future management decisions to be based on multiple resource and fishery condition factors.

Management alternative	Description	DSEIS rationale	FSEIS rationale
Alternative "Proposed" Overfishing Definition	A new overfishing definition would set annual fishing mortality thresholds to achieve maximum yield-per-recruit from scallops that are or will potentially become available to fishing. Annual thresholds would vary according to the rotation area management situation at the time. The biomass target would continue to be defined as Bmax, but the minimum biomass threshold would be revised to ½ B_{max}.	Achieves optimum yield with area rotation by establishing annual mortality targets by area. Allows fluctuations in annual fishing mortality rate to achieve optimum yield.	Projections using this definition gave DAS allocation estimates without closed groundfish area access were much lower than the status quo, having an unacceptable impact on the fishery.
Improving Scallop Yield (Section 5.3.2)			
Adaptive closures and re-openings w/adaptive boundaries (Proposed action)	Areas would be closed or opened based on distribution and abundance of scallops of various sizes; an industry supported resource survey would provide biological information about candidate areas	Would produce the greatest benefits by protecting small scallops during their highest growth rates, and more accurately determine areas that should be closed. Would provide improvements in yield and fishing efficiency, compared with fixed boundary area rotation alternatives.	Same as for DSEIS.
Initial Area Rotation in 2004 (Proposed action)	The Hudson Canyon Access Area would remain a controlled access area, and an area just to the south of the Hudson Canyon Access Area -- the "Elephant Trunk Area" -- would be closed to scallop fishing until 2008.	Fishing mortality controls in the Virginia Beach area no longer necessary. Fishing mortality controls in the Hudson Canyon Access Area necessary for 2 additional years (through 2005). Protection of a very large concentration of small scallops to the south of the Hudson Canyon Access Area through complete closure to scallop fishing needed until 2008.	Same as for DSEIS.

Management alternative	Description	DSEIS rationale	FSEIS rationale
Increase minimum ring size to 4" (Proposed action)	Increase the minimum size of rings used in scallop dredge gear from 3-1/2" to 4" in all areas or in selected areas	Would reduce discard mortality of small scallops and improve yield. Increased gear efficiency will reduce tow time to catch a possession limit or an amount crew can shuck. Reduced tow time will yield reduced total area swept, non-catch mortality of sea scallops, amount of bycatch, and habitat effects. Will increase scallop survival and yield.	Same as for DSEIS.
Mechanical area rotation w/fixed boundaries	Pre-defined areas would be closed and opened for pre-determined period of time	Mechanical rotation would be the most simple, and easiest to administer. Benefits accrue because the areas scheduled to close have been opened for longest time period and age structure of those scallops are the most affected by fishing.	Predetermined opening and closing dates may not affect the resource in need of protection - e.g., areas may re-open when large concentration of small scallops present. Fixed boundaries lack precision for best application to changing resource condition.
Adaptive closures for fixed duration w/fixed boundaries	Pre-defined areas would be closed based on growth rate criteria for a pre-determined period of time	Would depend on the age structure of the resource; thus, providing conservation benefits for areas of previous high fishing effort for lengthy periods and/or areas with recent above average recruitment. Monitoring costs would remain at practical levels because a detailed survey would only be needed in the year before an area re-opens.	Higher benefits might be achieved by using an adaptive strategy with flexible area boundaries

Management alternative	Description	DSEIS rationale	FSEIS rationale
Adaptive closures and re-openings w/fixed boundaries	Defined areas would be closed or opened based on growth rate criteria	Length of rotational closures is flexible; thus, preventing a fixed duration closure that may be too short or too long. Would provide conservation benefits for small scallops by preventing a rotational closure from opening too early, and adaptive re-opening would allow for areas with higher potential biomass growth rates to be candidate rotational closures.	Higher benefits might be achieved by using an adaptive strategy with flexible area boundaries
Adaptive closures and re-openings w/fixed boundaries; fishing mortality targets and frequency of access to areas may vary for each area	Pre-defined areas would be closed or opened based on characteristics of the areas (size of scallops, growth rate, presence of sensitive habitat, bycatch of other species including endangered or threatened species); fishing mortality targets and vessel access would be specified for each area	Would allow greater flexibility to set target fishing mortality rates in special management areas. Would allow much of the resource to be open to general fishing because of lower biomass limits in closed or special management areas. Would not require costly one-to-one trading of area-specific day-at-sea allocations or trips. Fishing mortality targets in re-opened areas would consider bycatch and habitat objectives rather than relying on seasons, bycatch total allowable catch (TAC), or indefinite closures.	Uncertainty about the effects compared with other area rotation alternatives. Fixed boundaries lack precision for best application to changing resource condition.
Area based management w/area-specific fishing mortality targets and without formal area rotation	Management areas would be defined with area-specific effort allocations made to vessels based on resource characteristics within each area. No area rotation policies would apply.	Would reduce localized overfishing and would provide conservation benefits for strong year classes. Areas could be fine-tuned in the future (e.g., closed seed beds).	Area based management with different fishing mortality targets and allocations were thought to be too complex for practical management.

Management alternative	Description	DSEIS rationale	FSEIS rationale
Access to groundfish closed areas on Georges Bank	Access would be allowed for scallop fishing in the 4 year-round groundfish closed areas (Nantucket Lightship, Closed Area I, Closed Area II). Three alternatives within this proposal: access allowed to one area each year; access allowed only when landings from open fishing areas declines below specified level; or access allowed by including these areas or portions of them, under one of the other rotational management schemes	Would reduce mortality and promote rebuilding of scallop stock elsewhere, while also reducing number of used days and swept area by gear. May also reduce bycatch and habitat impacts.	Same as for DSEIS. (NOTE: Access cannot be provided through Scallop FMP alone. Council developing a companion framework action to allow access under the Northeast Multispecies FMP.)
Gear-specific days-at-sea (DAS)	Allocated fishing DAS to vessels based on the type of fishing gear used; allocations would be determined to equalize the rate of fishing mortality per DAS associated with each type of gear	Differential allocations by gear category would reduce mortality on small scallops, improve yield, and encourage vessels to develop or use more size selective gear	Action would unfairly penalize a fishery sector that was incapable of switching to more selective gear
Allocating effort (Section 5.3.3)			
Area-specific trip allocations with possession limits and DAS tradeoffs (Proposed action)	Vessels would be allowed to fish in areas recently reopened for fishing; scallop retention would be limited to a specified possession limit, the number of trips would be capped, and the vessel would be charged a specified number of DAS.	Alternative would allow area-specific fishing effort allocations to optimize yield while reducing the potential for overexploitation in regular, open fishing areas without resorting to complicated tradeoffs	Same as for DSEIS.
Exchanges of area-specific allocations (Proposed action)	Vessels allocated DAS or trips to fish in areas recently reopened for fishing could exchange their allocations	Will enable vessel owners and captains to decide where to fish, and will allow more flexibility during the fishing year. Will restore some flexibility in deciding where to fish.	Same as for DSEIS.

Management alternative	Description	DSEIS rationale	FSEIS rationale
Individual DAS allocations to vessels based on fishing area	Under rotational management, vessels would be allocated specific number of DAS that could be utilized when fishing in areas recently reopened for fishing	Could allow area-specific fishing effort allocations to optimize yield and reduces the potential for overexploitation in regular, open fishing areas without resorting to complicated and difficult to administer tradeoffs.	Area-specific allocations without tradeoffs would reduce limited access DAS allocations to unacceptable levels.
Status quo	DAS would be allocated to vessels based on their permit category and could be used to fish in any open area. Other than total day-at-sea allocations, there would be no limit on the amount of fishing effort directed towards scallops once an area re-opens to fishing	The Council would select this alternative if area-specific controls would not be necessary.	Mortality in regular, open fishing areas would continue to be too high and not produce optimum yield
Reducing habitat impacts (Section 5.3.4)			
Rely on incidental habitat benefits of other measures in Amendment 10 (Proposed action)	No specific measures established to reduce habitat impact (Habitat alternative #2)	Incidental habitat benefits resulting from other measures included in Amendment 10 would minimize adverse effects of fishing on EFH.	Same as for DSEIS. Most practicable approach for minimizing adverse effects of fishing on EFH because it requires no additional measures. However, Council determined that additional measures necessary (see Habitat Alternative 6 below).
Closed areas based on scallop Framework 13 (Proposed action)	Existing groundfish closed areas on Georges Bank and in Gulf of Maine are maintained except that scallop fishery is allowed inside the portions of the closed areas that were opened for fishing in Framework 13 (habitat alt #6)	Closure of the "Framework 13" portions of groundfish closed areas specifically for long-term EFH protection would allow for continued recovery of EFH in these areas without requiring new closures for bottom-tending mobile gear in other plans.	Same as for DSEIS.

Management alternative	Description	DSEIS rationale	FSEIS rationale
Increase minimum ring size to 4" (Proposed action)	The increase the minimum size of rings used in scallop dredge gear from 3½" to 4" in all areas or in selected areas specified under the Improving Scallop Yield section also has habitat benefits (Habitat alternative #11).	Would reduce mortality on small scallops where scallops are of mixed sizes. Would increase efficiency of harvesting larger scallops. Thus, improved dredge efficiency has the potential for reducing bottom time, non-catch mortality, bycatch, and possibly habitat effects.	Same as for DSEIS.
Habitat research funded by scallop TAC set-aside (Proposed action)	Research would be conducted on impacts of scallop gear on habitat with funding from scallop catch or DAS set aside for research (Habitat alternative #12)	Would broaden the range of research types that could be funded through the scallop research TAC set aside. May identify fishing gear or methods that have fewer habitat impacts or that might be useful to identify ways that fishing is managed to minimize related habitat impacts through funded research.	Same as DSEIS.
No Action/Status quo	Scalloping prohibited in the groundfish closure areas on Georges Bank; Hudson Canyon and Virginia Beach Scallop Closed Areas would re-open to regular scallop fishing; annual specifications establish DAS allocations consistent with fishing mortality rate target in Amendment 7 (Habitat alternative #1)	The Council would select this alternative if it could determine that DAS reductions, with changing in gear restrictions and limits on shucking capacity (crew size limits) have already minimized total area swept and associated habitat impacts to the extent practicable. Existing closures under the Multispecies FMP provided EFH protection.	The Council determined that status quo measures would not minimize habitat impacts. Council determined that more certain EFH protection could be gained by establishing portions of the Multispecies FMP closures as EFH closed areas to protect EFH from scallop fishing.
Habitat closed areas	Boundaries of existing groundfish closed areas on Georges Bank and in Western Gulf of Maine are modified to improve habitat benefits (Habitat alternatives #3a and 3b)	Would better protect complex hard-bottom and other sensitive habitats.	Unacceptable and inequitable economic effects, especially without access to Georges Bank closed groundfish areas; uncertainty whether complimentary actions would be taken in other plan amendments

Management alternative	Description	DSEIS rationale	FSEIS rationale
Modified groundfish closed areas with habitat component	Existing groundfish closed areas are modified and some of the closed area is specifically to reduce habitat impacts (Habitat alternative #4)	Would better protect complex hard-bottom and other sensitive habitats from any adverse impacts associated with fishing.	Complimentary action to modify groundfish closed areas in Multispecies FMP no longer were viable because complimentary action in the Multispecies FMP no longer applied.
Closed areas are developed to balance habitat protection with fishery productivity for scallops, groundfish, monkfish	A computer model is used to designate closed areas and consider fishery productivity (Habitat alternatives #5a, 5b, 5c, 5d)	Would balance the protection of EFH and fishery productivity.	Strong opposition due to economic impacts in groundfish fishery and that the proposed areas failed to include some hard bottom areas that would be included in other alternatives. Model did not include physical characteristics in the selection criteria. Alternative included areas closer inshore than other alternatives and therefore had inequitable and local impacts that were unacceptable.
Habitat closed areas minimizing scallop fishing in less productive fishing areas and in areas with high EFH value	Habitat closures would be based on EFH designations, with scallop fishing prohibited in least productive scallop areas (Habitat alternative #7)	Protect areas of high EFH value and low scallop productivity.	Alternative would have to apply to fisheries using other bottom-tending mobile gear to be effective and included areas that had mainly sandy sediments and would have a high cost to other fisheries.
Close cod habitat area of particular concern to scallop fishery	Scallop fishing would be prohibited in existing or new areas on Georges Bank designated as HAPC for cod (Habitat alternatives #8a and 8b)	Would change the status of the cod HAPC from mortality closure to a habitat closure providing more conservation benefit for habitat.	Uncertainty whehter complimentary action would be taken in other plan amendments. Lower habitat benefits than other alternatives when analyzed across the entire management area.

Management alternative	Description	DSEIS rationale	FSEIS rationale
Existing groundfish closed areas would be closed to scallop fishery	Scallop fishing would be prohibited in the groundfish closed areas on Georges Bank (Closed Area I, Closed Area II), theNantucket Lightship Closed Area in Southern New England, Western Gulf of Maine closed area, and Cashes Ledge closed area (Habitat alternative #9)	Would change the status of the closed areas from mortality closure to a habitat closure providing more conservation benefit for habitat.	Economic costs to society and the industry are higher than most of the other alternatives.
Restrictions on rock chains	Specific regulations would limit the use of rock chains by scallop vessels (Habitat alternative #10)	Would prevent vessels from fishing in more rugged areas, having complex bottom habitats.	May not decrease bottom area fished by scallop industry and may have unintended safety hazard concerns.
Area based management and rotation based on habitat protection	Areas designated for closure in a rotational management scheme would be specified in part based on habitat protection (Habitat alternative #13).	Would rely on increased conservation benefits for habitat through adjustments in area rotation strategies rather than long-term, indefinite closures.	Although the conceptual approach had merit, the alternative needed more work to be practical. More information is needed about habitat sensitivity and recovery potential in localized areas, in order to develop specific management procedures.
Reducing bycatch and bycatch mortality (Section 5.3.5)			
Area rotation alternatives (Proposed action)	Area rotation alternatives under the section Improving Scallop Yield also result in reductions in bycatch and bycatch mortality	Area rotation thought to improve efficiency and therefore reduce effective fishing effort on finfish.	Same as for DSEIS.
Increase minimum ring size to 4" (Proposed action)	Area rotation alternatives under the section Improving Scallop Yield also result in reductions in bycatch and bycatch mortality	Will increase efficiency for harvesting large scallops by about 10-15 percent. Increased release of small scallops. Would reduce the area swept by commercial dredges 10-15 percent. Reduction of area swept would result in reduction of finfish bycatch.	Same as for DSEIS.
Increase minimum twine top mesh to 10" (Proposed action)	Increase the minimum twine top mesh size in scallop dredge gear to 10" in all or select areas; and/or specify how twine tops must be installed	Increase of minimum twine top will reduce finfish bycatch.	Same as for DSEIS.

Management alternative	Description	DSEIS rationale	FSEIS rationale
Proactive protected species program (Proposed action)	The Council would be required to address new take information on sea turtles or other protected species by initiating a framework process to consider time/area closures or other measures to minimize bycatch potential.	Would provide a mechanism to mitigate takes of turtles and other protected species as new information becomes available. Would promote enhanced observer coverage and further research.	Same as for DSEIS.
Gear modifications	Use results of recent research to require modifications to the dredge bail on scallop gear to reduce finfish bycatch	Would allow for additional research in other areas that may show consistently better results. Such research may be used to require gear modifications that would reduce bycatch and/or bycatch mortality.	No new data or analysis available that justifies implementation of a specific new gear restrictions. Gear identified through future research may be implemented by framework adjustment or amendment.
Area-specific possession limits for finfish	Maximum possession limits would be established for some species of finfish to provide an incentive for scallop vessels to avoid areas of high bycatch	Prohibiting scallop vessels from landing finfish would reduce the incentive to fish in portions of rotational management areas that have greater bycatch than in other areas.	Area-specific possession limits would be hard to monitor and enforce, unless combined with a special controlled access program, which would be developed by framework action.
Area specific TACs for finfish	Total Allowed Catch (TAC) would be specified for some finfish species in specific areas, with the area closed to scallop fishing when a TAC was attained	Would reduce/prevent incidental catches from exceeding biological limits from greater than average scallop fishing effort in re-opened areas. Would influence fishermen to fish in portions of the area with lower bycatch and/or use gear or methods that reduce bycatch. May result in re-opened area staying open as long as allowed if scallop fishermen avoid catching non-target species.	Measures are suitable for controlled access programs implemented by future framework adjustments.
Area specific seasons	Specified management areas would be seasonally closed to scallop fishing in order to avoid bycatch of finfish	Seasonal closures would avoid times when finfish bycatch was high, without preventing access to the scallop biomass.	Other measures to minimize bycatch would be more effective, without reducing opportunities to fish for scallops.

Management alternative	Description	DSEIS rationale	FSEIS rationale
Long term closures of areas with high bycatch	Areas with high levels of finfish bycatch would be closed indefinitely to scallop fishing	Would result in reduced bycatch and bycatch mortality. Would ensure that National Standard 9 is achieved.	Other measures to minimize bycatch would be more effective, without reducing opportunities to fish for scallops.
Status quo	The existing management program would be deemed sufficient to address bycatch	The Council would select the status quo/no action alternative if it determines that the management measures in Amendment 10 are not necessary to minimize bycatch and bycatch mortality at levels deemed practicable.	The Council determined that additional measures were necessary and practicable to minimize bycatch and bycatch mortality, consistent with purpose and need for Amendment 10.
Managing general category vessels & limited access scallop vessels not fishing on a DAS (Section 5.3.6)			
Status quo (Proposed action)	Any vessel can obtain General category permit and land up to 400 lb/trip; limited access vessels can fish under General category when not on DAS	The Council could select this alternative if it determined that the current management measures in place to manage, monitor, and assess the general category portion of the scallop fleet are adequate.	Mortality and fishing effort by vessels with general category permits appear to have declined recently in response to price, reducing the need to apply stricter regulations.
Prohibit limited access scallop vessels from fishing for scallops outside of DAS under general category rules (Proposed action)	Limited access scallop vessels would be prohibited from fishing for or landing more than 40 lb of shucked (5 bushel in-shell) scallops outside of DAS.	Landings of scallops by limited access vessels fishing outside of DAS increasing. Higher landings of scallops outside of DAS may reduce DAS available for limited access vessels. Consistent with other fisheries that do not allow the targeting of managed species outside of DAS.	Same as for DSEIS.
Incidental catch and general category permits and management measures	New measures for vessels issued a General category permit could include vessel monitoring systems (VMS), TACs, possession limits and reports; limited access vessels could not obtain General category permit; a new incidental category vessel permit would allow retention of small amounts of scallops	Would allow vessels with general category permits to fish more economically and be consistent with the change in scallop biomass. It would limit the total catch of scallops by vessels with general category permits to a reasonable fraction of the overall and area-specific TACs.	Compliance cost and administrative burden exceeded benefits at this time.

Management alternative	Description	DSEIS rationale	FSEIS rationale
Incidental catch and general category permits and management measures	Similar to previous measure but no TACs would be established except in areas recently reopened for fishing; possession limits would be established for both permit categories	Would allow any vessel to obtain a general category scallop permit, target scallops, and possibly fish in re-opened rotation areas.	Compliance cost and administrative burden exceeded benefits at this time.
Improving data collection and monitoring (Section 5.3.7)			
Set asides for observer coverage (Proposed action)	Establish DAS and/or TAC set-asides to fund bycatch monitoring	Would aid monitoring TACs for scallops, help to quantify the amount of finfish bycatch, and determine the level of sea turtle takes in the scallop fishery. The TAC and/or DAS set-asides would allow compensation to vessel owners and crews that have paid for observers.	Same as for DSEIS.
Set asides for cooperative industry assisted resource surveys (Proposed action)	Establish DAS or TAC set-asides to fund resource surveys conducted by industry vessels	Would promote an increase sampling intensity and would support area rotation.	Same as for DSEIS.
Bag tags and standard bags-Alternative 1	Require the use of a standardized bag for landing scallops, labeled with a tag identifying the vessel	The bag tag would maintain accountability after scallops leave the possession of the harvester until the first point of wholesale processing. Would provide for better enforcement of possession limits. Scallop possession limits would be easier to monitor because they would be expressed in number of standard bags.	Bag tag monitoring system needed more study before being considered for broad application

Management alternative	Description	DSEIS rationale	FSEIS rationale
Bag tags and standard bags-Alternative 2	Require the use of a standardized bag for landing scallops, labeled with unique number/color to identify fishing vessel and fishing area; limited access vessels would be allocated specific number of bags	Same as alternative 1 above, but greater requirements would improve accountability and compliance.	Bag tag monitoring system needed more study before being considered for broad application
Require daily vessel reporting via VMS	Vessel trip reports would be submitted daily via VMS	Would improve timeliness of data for real time monitoring of TACs. Failure to make reports can be flagged immediately.	Without quota monitoring, the benefits of real-time reporting were unclear.
Require daily vessel reporting via VMS and real time landings reports by dealers	Vessel trip reports would be submitted daily via VMS; landings would be reported by dealers in real time	Would replace vessel trip report (VTR) data collection with more efficient and reliable systems by requiring vessels to make reasonable daily reports via VMS equipment. Unreliable discard data would not be collected.	Reporting system needed more study before being considered for broad application. No public support to replace the VTR system with electronic reporting by VMS.
Require all limited access vessels to operate VMS	Expand requirement for VMS to include occasional category vessels in addition to full- and part-time	Would be equitable among all limited access vessels to obtain and operate VMS equipment, particularly if general category vessels required to operate VMS units.	Without general category VMS requirements, this measure is not necessary.
Expand number of VMS suppliers	NMFS would be encouraged to secure additional VMS vendors	Would result in competitive pricing and would spark innovation in VMS design.	Same as for DSEIS. No associated management action required.
Status quo	Maintain existing monitoring and reporting requirements	The Council could select this alternative if it determined that current reporting and monitoring requirements and provisions are adequate.	The Council determined that additional measures would improve data collection and monitoring
Enabling scallop research (Section 5.3.8)			
Process for managing research funded through research set-asides (Proposed action)	DAS or TAC set aside for research would be allocated through a long term process specified in Amendment 10, including research priorities and establishment of research priorities	DAS and/or TAC set-asides would provide certainty for funding of research identified as priority by the Council.	Same as for DSEIS.

Management alternative	Description	DSEIS rationale	FSEIS rationale
Alternative process for managing research funded through research set-asides	DAS or TAC set aside for research would be allocated annually through the annual framework process	Would provide additional information on the impacts of experimental fishing.	Other alternatives in Amendment 10 are adequate.
Status quo	Maintain existing process	The Council would select this alternative if it determines that the current process works sufficiently well.	Expanded funding and a more formal priority-setting procedure was needed.
Adjusting management measures (Section 5.3.9)			
Two-year cycle for framework adjustments (Proposed action)	A range of management measures could be revised through framework actions taken every other year	Would allow the Council and NMFS time to administer a more complicated area rotation management system and to develop future plan amendments when necessary. May reduce administrative costs arising from frequent extensive analysis, review, and approval currently associated with framework adjustments.	Same as for DSEIS.
Adjustments for broken trips (Proposed action)	DAS charged to vessels fishing under area access programs could be adjusted if a trip is terminated early	Will reduce business risk of fishing in re-opened rotation management areas. Will decrease the need and/or size of an in-season adjustment to re-allocate unused trips, and would improve safety.	Same as for DSEIS.
Notice action to establish closed areas	A process would be established to allow area management measures to be imposed through notice in Federal Register (either closed to protect small scallops or reopened to harvest large scallops).	Would provide a mechanism to quickly close areas where small scallops occur.	Procedural details needed more work to be effective.
Annual specifications	DAS and TACs could be revised annually through annual specifications	Would allow for routine, annual management adjustments (i.e. DAS and TAC specifications).	Not needed as long as the Council could initiate an ad hoc framework adjustment when necessary.

Management alternative	Description	DSEIS rationale	FSEIS rationale
Scallop fishing year	The starting date for the scallop fishing year would be revised to fall between July 1 and Sept 1	Would streamline annual adjustments to take into account the most recent annual resource survey data. Would reduce the amount of duplicative analyses that are currently required for framework adjustments, which otherwise could cause delays in implementation beyond the start of the fishing year.	Strong industry opposition due to business risk required to reserve DAS allocations to the second half of a new fishing year, when fishing is most productive.
Increase DAS carryover	The number of DAS that can be carried over from one fishing year to the next would be between 10 and 30 DAS	Would reduce the business risk associated with changing the fishing year to start in mid-summer, if vessels are caught in a situation where needed.	Adjustment was not needed to mitigate fishing year change.
Status quo	Maintain annual review of fishing measures	The Council would select this alternative if it determined that no new measures are necessary to improve the management adjustment process.	Council determined that additional measures are necessary, consistent with purpose and need of Amendment 10.

Under the Northeast Multispecies FMP, large areas are closed to "all gears capable of catching groundfish" to avoid disruptions in spawning and to promote rebuilding of depleted groundfish stocks. Due to the groundfish bycatch levels observed in the early 1990s and observations of scallop vessels targeting groundfish with scallop dredges, this 1994 action included scallop fishing gear. Amendment 10 includes several alternatives that will require management action under the Northeast Multispecies FMP primarily to allow scallop fishing access to these groundfish closed areas and to enable certain aspects of area rotation. These measures are intended to reduce and minimize groundfish bycatch and/or impacts on groundfish stocks potentially through incidental finfish catch TACs, possession limits, and areas closed to scallop fishing to prevent bycatch.

Framework Adjustment 16 will be a Scallop FMP action to re-estimate the scallop TACs and trip allocations using new survey data that will become available. In addition, it will consider modifying the access boundaries approved in Amendment 10 to make them consistent with the habitat closure boundaries that the Council approved in Multispecies FMP Amendment 13, relying on data and analyses in the two amendments. Framework Adjustment 39 is a companion Multispecies FMP framework adjustment to consider and evaluate alternatives to minimize finfish bycatch and impacts on groundfish resources. The initial framework meeting for both frameworks (developed as one document and action) was in November 2003. A final framework meeting is planned for late February 2004, with implementation anticipated in late summer or early fall, 2004.

The following alternatives related to controlled access options in Amendment 10, but are related to or may require management action under the framework adjustment process include the following alternatives to reduce, minimize, or monitor groundfish bycatch. Some of these alternatives may be included in Framework Adjustment 16/39 to allow access to scallops beds in the groundfish closed areas (see discussion below).

Georges Bank access to groundfish closed areas	Section 5.3.2.8	Page 5-81
Increase minimum twine top mesh to 10-inches in all or select areas, and/or specify how twine tops should be installed in dredges	Section 5.3.5.3	Page 5-118
Gear modifications (to reduce bycatch) based on recent research	Section 5.3.5.4	Page 5-120
Area-specific possession limits for some finfish species	Section 5.3.5.5	Page 5-121
Area-specific TACs for some finfish species	Section 5.3.5.6	Page 5-121
Area-specific seasons to avoid bycatch	Section 5.3.5.7	Page 5-122
Long-term indefinite closures to avoid areas with high bycatch levels	Section 5.3.5.8	Page 5-125
Adequate observer coverage (to estimate bycatch) and funding by day-at-sea or TAC set aside	Section 5.3.7.1	Page 5-1345-137
Require vessels to make daily reports of vessel trip report (VTR) data through the vessel monitoring system (VMS)	Section 5.3.7.4	Page 5-93
Require all limited access vessels to operate a vessel monitoring system (VMS)	Section 5.3.7.6	Page 5-138

While the draft amendment and DSEIS were open for public comment, the Council intended to develop a companion framework adjustment to evaluate and recommend measures to minimize finfish bycatch during a Georges Bank closed area access program. Fishing by gear capable of catching groundfish is otherwise prohibited under current regulations and would remain prohibited according to Multispecies FMP Amendment 13, which is under review. The Multispecies FMP closed these areas to enhance rebuilding and protect spawning activity, but under special access programs may allow certain types of fishing under the Council's Northeast Multispecies FMP.

Although Amendment 10 analyzed the effects of periodic, rotational scallop fishing access with boundaries that existed during the 2000 fishing year (Framework Adjustment 13 and a preferred alternative in Amendment 10), the Council was unable to properly consider alternatives to minimize finfish bycatch during the proposed access. Due to the uncertainties and workload issues associated with a groundfish amendment simultaneously under development (Amendment 13), the Council was unable to initiate Framework Adjustment 16/39 until November 2003. As a result, the Amendment 10 comment period and the Council's choice of final alternatives was completed before the companion framework adjustment (16/39) began.

As a result of the delayed start of Framework Adjustment 16/39 and the plan for area rotation in Amendment 10, the proposed scallop management and limited access scallop fishing allocations in Amendment 10 are calculated and analyzed with and without access to the Georges Bank closed groundfish areas, in Section 5.1.2.1. Initially, Amendment 10 proposes to allocate open-area DAS as if there will be access to the groundfish areas during the 2004 fishing year and the fleet will be able to harvest optimum yield at the target fishing mortality rate.

If Framework Adjustment 16/39 is approved and allows access to these closed areas, then full-time scallop fishing vessels would receive 36 additional DAS for three total trips to the Nantucket Lightship Area and Closed Area I during 2004 (see Table 8; subject to revision by Framework Adjustment 16 using 2003 survey data). If this approval does not occur, more fishing effort would be needed in regular, open fishing areas to achieve the resource-wide fishing mortality target (F=0.2). Thus if Framework Adjustment 16/39 is not approved or does not allow access to the Georges Bank closed groundfish areas, the full-time open area DAS allocations would increase by 20, totaling 62 DAS in 2004. Should Framework Adjustment 16/39 not be approved, Amendment 10 also estimates and analyzes the effects of higher open area DAS allocations in future years as well as the allocations and effects with access. Biological (Section 8.2.3), habitat (Section 8.5.4.14), and economic (Section 8.7.2.3) effects of these allocations on the scallop resource, other marine resources, and the scallop fishery are analyzed in Amendment 10 with and without access.

The FSEIS (this document) contains references to implementation of approved measures at the beginning of the fishing year on March 1, 2004. However, given the timing of the action, it now appears unlikely that implementation will occur on March 1 2004, if Amendment 10 is approved. In cases where March 1, 2004 is anticipated, actual implementation will occur following the publication of the final rule for Amendment 10, along with appropriate delay in effectiveness under the Administrative Procedures Act, if the measures are ultimately approved by the Department of Commerce.

Also, several sections of the amendment and FSEIS contain references to a “Proposed Overfishing Definition”. This proposal for a new overfishing definition was considered and analyzed in the DSEIS, but ultimately the Council decided to modify the status quo overfishing definition instead of taking an entirely new approach. Since this original alternative overfishing definition did not have another name, it may be confused with a proposed action that the Council approved in Section 5.1. Rather than rename the alternative overfishing definition that was under consideration, the existing nomenclature was retained and Section 5.1.1clearly identifies that the proposed action includes the status quo overfishing definition with changes in the biological reference points.

The description of the alternatives and the comparative analyses of their impacts are presented in order to comply with multiple legal requirements including those specified within the National Environmental Policy Act (NEPA), the Regulatory Flexibility Act (RFA), Executive Order 12866, the Endangered Species Act (ESA), and the Marine Mammal Protection Act (MMPA). This document serves as the Final Supplemental Environmental Impact Statement (FSEIS) required by NEPA and as the Preliminary Regulatory Economic Evaluation (PREE). These analyses are presented for public comment, as required by those laws. NMFS initiated Section 7 consultation for the Atlantic Sea Scallop FMP during the development of Amendment 10. Based on existing data, NMFS has concluded that the continued operation of the scallop fishery may adversely affect but is not likely to jeopardize the existence of Kemp’s ridely, loggerhead, green, and leatherback sea turtles. As required in the biological opinion, NMFS will collect more data and evaluate the potential for sea turtle and scallop gear interactions. The biological opinion is available from NMFS (Gloucester, MA) or from their web site at http://www.nefsc.noaa.gov/ro/doc/nero.html.

This document contains a description of the final alternative (Section 5.1), descriptions of the preferred and non-preferred alternatives that were considered in the DSEIS (Section 5.3), an analysis of the cumulative effects of past and present management actions (Section 7.1.2), and an analysis of direct and indirect impacts of the final, preferred, and non-preferred alternatives (Section 8.0). Section 8.1 summarizes these impacts and assesses the cumulative impacts of these actions, as well as highlights cumulative effects of non-fishing activities that are likely to have effects on valuable environmental components.

Finally, several of the maps and figures in this document were originally created in color. However, the printed document was not able to reproduce the color format of these figures and, therefore, some figures are somewhat difficult to interpret. Readers and reviewers interested in examining the figures in their original color format are referred to http://www.nefmc.org/documents/scallops/ or they may request copies of specific color figures from the Council office.

Because of the multiple purposes of this document, the crosswalk below is intended to help the reader identify the portions of the document that satisfy specific legal requirements. Readers may find this supplemental TOCs related to specific applicable laws affecting fisheries management useful in identifying how the document satisfies the content requirements of individual laws.

2.1 APPLICABLE LAW CROSSWALK

2.1.1 Magnuson-Stevens Act Required Provisions and National Standards

2.1.2 Environmental Impact Statement (NEPA) Table of Contents

2.1.3 Regulatory Flexibility Analysis

2.1.4 Endangered Species Act and Marine Mammal Protection Act

2.1.5 Coastal Zone Management Act

3.0 CONTEXT OF AMENDMENT 10 AND MANAGEMENT BACKGROUND (EIS, RFA)

3.1 Management Background

The Council began managing Atlantic Sea Scallop in 1982 when NMFS approved and implemented the Atlantic Sea Scallop Fishery Management Plan. Before that time, the fishery was loosely managed by various state fishery and health regulations, as well as an industry agreement that governed the length of trips and the number of days a vessel must remain in port between trips (i.e. "layover" days.

Initially, the Scallop FMP regulated the fishery with an open access permit, a minimum average scallop meat count, and reporting or associated regulations to ensure compliance. These regulations were intended to maximize yield by preventing scallop vessels from landing small scallops, while maintaining a high degree of flexibility to determine when and where to fish.

Three factors contributed to the failure of these regulations to have the intended effect. First, the Department of Justice found that the industry agreement on trip length and other controls was anti-competitive and an injunction prevented the industry from enforcing them. Second, a large year class appeared in the South Channel area of Georges Bank, attracting more fishing effort when capital for new boat construction was readily available. Last, the Council considered and approved seasonal changes in the minimum meat weight with a tolerance for landings not complying with the minimum meat count. This made it difficult to enforce the minimum meat count and unobserved violations were believed to be frequent.

Finally, the minimum average meat count regulation, about 35 to 40 meats per pound was flawed because it enforcement and compliance was based on a statistical average that required subsampling the catch. It did not prevent the fishing industry from landing, and even targeting smaller scallops. The exceptionally strong 1989 year class was almost entirely caught by the fishery in the 1991-1992 fishing season as three year old scallops. At that time, fishing was considered 'good' if the boat landed 1,000 to 1,200 pounds per day at sea, with an 11 to 13 man crew (Table 2).

To make the average meat count minimum, vessels mainly targeted the abundant small scallops and then raised their average meat count by targeting a bed of much less abundant large scallops. A small proportion of very large scallops were sometimes sufficient to raise the average meat count to comply with the fishery regulation. Other methods were also used to increase the meat weight, including 'tricks' to make the scallops take up water weight before landing.

Thus, the FMP regulations were becoming more ineffective at preventing the fishery from targeting small scallops, at preventing mortality from increasing, and in maximizing yield from the scallop resource.

3.1.1 Limited Access and Mortality Reduction

In 1992 and 1993, the Council began evaluating new ways to achieve the FMP goals because catches declined quickly after the demise of the 1989 year class, because the industry found it more difficult to comply with the minimum meat count, and because mortality was too high to maximize yield.

Amendment 4 introduced major changes in scallop management, including a limited access program to stop the influx of new vessels, a day-at-sea reduction plan to reduce mortality and prevent recruitment overfishing, new gear regulations to improve size selection and reduce bycatch, a vessel monitoring system to track a vessel's fishing effort, and a new annual framework adjustment process to improve the ability of the FMP to respond to variations and contingencies.

Vessels could qualify for either a full-time, part-time, or occasional limited access scallop permit, based on its scallop fishing history between 1985 and 1990. Initially capped at 403 permits (NEFMC 1993), the number of permits has declined to 280 permits in 1999 and has since increased to 310 permits in 2001 as catches improved. Thirty-five of these permits are inactive permits that used none of the 2001 day-at-sea allocations. Another forty-three permits were temporarily retired as a Confirmation of Permit History and not associated with an active fishing vessel.

Amendment 4 also established a planned reduction in the annual day-at-sea allocations for vessels with limited access scallop permits. In 1994, full-time vessels were authorized to fish no more than 204 days during the fishing year (March 1 to February 28/29). Vessels with part-time and occasional permits received 40 and 8.3 percent, respectively, of a full-time allocation. The day-at-sea allocation schedule gradually declined to 120 full-time days in 2000 where it was intended to remain, subject to annual adjustment to meet the Amendment 4 fishing mortality targets.

In 1998, the NMFS approved and implemented Amendment 7 to the Atlantic Sea Scallop FMP which was needed to change the overfishing definition and the day-at-sea schedule, meeting new lower mortality targets that were intended to comply with the Sustainable Fisheries Act and the new National Standard 1 guidelines. In addition, Amendment 7 also established two new scallop closed areas (Hudson Canyon and VA/NC Areas) in the Mid-Atlantic, following up on a previous interim action. These closures were intended to postpone mortality until March 1, 2001 when they would automatically re-open unless the Council took other action.

Amendment 7 changed the original annual day-at-sea allocation schedule. On one hand, Amendment 7 established further reductions in the day-at-sea allocations during a 10-year 'rebuilding' period. Once rebuilt, Amendment 7 estimated that the plan could annually allocate 60 full-time days per fishing year and keep mortality below the new maximum fishing mortality threshold, F_{max}. On the other hand, Amendment 7 also advanced for one year, the planned day-at-sea reduction for 2000 in Amendment 4. This postponement of the more substantial reduction to meet the new SFA mortality targets was meant to allow industry time to adjust to the new, more restrictive regulations and for the Council to consider ways to promote industry consolidation.

The day-at-sea estimates in Amendment 7 did not fully recognize the effects of closures on the ability for the plan to meet the new mortality objectives, however. Because of higher survival of sea scallops in closed areas, more scallops were subject to no fishing mortality compared to the proportion of the scallop resource that was open to fishing. Although fishing mortality remained above F_{max} in much of the open fishing areas, the plan could meet the annual mortality targets with more days than had been estimated by Amendment 7. New estimates in Framework Adjustments 12 (NEFMC 1999) and 14 (NEFMC 2001) indicated that the Amendment 7 fishing mortality targets could be met by allocating 120 days per fishing year to full-time vessels during 2000, 2001, and 2002.

Table 2. Annual full-time day-at-sea allocation schedules, active permits, landings, and landings per day-at-sea .

Fishing year	Amendment 4[1]		Amendment 7[2]		Frameworks	Active limited access permits[3]	Days used[4]	Days accumulated[5]	Fishing mortality[6]		Annual landings (million lbs.)[7]	Landings (lbs.) per day-at-sea
	Annual day-at-sea allocation	Fishing mortality target	Annual day-at-sea allocation	Fishing mortality target	Annual day-at-sea allocation				Georges Bank	Mid-Atlantic		
1990												
1991									1.51	1.31	37.5	
1992							44,934		1.11	1.54	31.0	689
1993							40,490		1.28	1.12	16.1	397
1994	204	1.69				358	36,747	36,747	0.34	1.20	16.6	452
1995	182	1.51				347	33,490	33,490	0.23	0.95	17.6	524
1996	182	1.51				326	34,404	34,404	0.19	1.12	17.2	501
1997	164	1.33				305	30,830	30,830	0.16	0.92	14.4	468
1998	142	1.15				292	27,089	27,089	0.05	0.69	13.0	478
1999	142	1.15	120	0.83	120	248	23,074	25,155	0.16	0.20	22.7	983
2000	120	0.97	51	0.34	120	272	24,958	27,492	0.07	0.34	32.7	1,309
2001	120	0.97	49	0.28	120	286	28,198	29,174	-	-	46.7	1,665
2002	120	0.97	46	0.24	120	300	30,065	30,314	-	-	53.0	1,764
2003	120		45	0.22	120	279	30,082[8]	30,276[9]	-	-	30.6[10]	1,906

1 Table 45 (NEFMC 1993)
2 Tables 4.2.1 and 4.2.7 (NEFMC 1998)
3 Summaries from NMFS permit data base records.
4 Includes days used by vessels with full-time, part-time, and occasional limited access permits. 1992 – 1997 (NEFMC 1999); 1998 – 2001 summaries from NMFS VMS and call in data.
5 Accumulated days differ from used days because of the extra days charged for trips to the Georges Bank groundfish closed areas and to the Hudson Canyon and VA/NC Areas.
6 Survey year fishing mortality rates: 1991 – 1998 (NEFSC 2001a), 1999 – 2000 PDT monitoring report, January 14, 2002.
7 Annual landings 1991-1997 (NEFSC 2001); Fishing year landings 1998-2001 NMFS Fisheries Statistics Office (http://www.nero.nmfs.gov/ro/fso/tac0502.pdf)
8 Projected based on March to July DAS use in 2003, compared to the seasonal DAS use pattern in 2002.
9 Assumes the same number of Hudson Canyon and VA/NC Area trips are taken. The scallop possession limit increased to 21,000 lbs. in the Hudson Canyon and VA/NC Areas, however.
10 Through July 2003.

3.1.2 History of Management Actions

In addition to the above actions to achieve the FMP mortality targets, other measures were also implemented to achieve plan goals, comply with National Standard guidelines, or implement regulations that would respond to required or discretionary provisions of FMPs in the Magnuson Act. The management actions taken by the Council since the implementation of the FMP in 1982 are listed chronologically below.

The Fishery Management Plan for Atlantic Sea Scallops, Placopecten magellanicus (Gmelin) initially implemented on May 15, 1982, included the following objectives:

1) To restore adult stock abundance and age distribution;
2) To increase yield per recruit for each stock;
3) To evaluate plan research, development and enforcement costs; and
4) To minimize adverse environmental impacts on sea scallops.

The management unit consists of the sea scallop resource throughout its range in waters under the jurisdiction of the United States. This includes all populations of sea scallops from the shoreline to the outer boundary of the Exclusive Economic Zone (EEZ). The principal resource areas are the Northeast Peak of Georges Bank, westward to the Great South Channel, and southward along the continental shelf of the Mid-Atlantic.

The management unit also includes populations found within the Gulf of Maine and Cape Cod Bay. These areas include the territorial seas throughout the range, primarily in ME and MA. Fishing for sea scallops within state territorial waters is not subject to regulation under the FMP except for vessels that do not hold a federal scallop permit when scalloping in state waters. Nonetheless, populations within state waters are included within the management unit in recognition of market interactions and the need for complementary state management action.

The management measures within the original plan included a 30 average meat count standard, a 3½-inch minimum shell height standard, and a temporary adjustment of standards. The plan took effect on May 15, 1982 through emergency rules. The 1982 meat count standard was 40 meats per pound for shucked scallop and a minimum shell height of 3¼ inches for scallops landed in the shell. These measures remained in effect during a one-year phase-in period, after which the measures were to be adjusted to 30 meats per pound and a 3½-inch shell height standard. In June 1983, the Regional Director invoked the Plan's temporary adjustment provision and set the meat count at 35 meats per pound and shell height standard at 3? inches. These restrictions remained in place until a Secretarial amendment was implemented.

Although the Amendment 10 proposed alternatives have separate treatments of the scallops on Georges Bank and in the Mid-Atlantic regions, five resource areas are generally recognized within the management unit: Delmarva, New York Bight, South Channel and Southeast Part of Georges Bank, Northeast Peak and Northern Part of Georges Bank, and the Gulf of Maine (Wigley et al. 1991, Wigley and Serchuk 1992). The Delmarva area includes scallops as far south as NC.

3.1.2.1 Description of past management actions

Because scallop management actions are closely linked to past and current fishing practices as well as historic landings, a description of past management actions is provided in the Description of the Fisheries, in Section 7.1 .

3.1.2.2 Rebuilding

Amendment 7 for the first time established a biomass target that would produce MSY. The Georges Bank and Mid-Atlantic stock estimates were 8.19 and 3.90 kg/tow respectively in Amendment 7. These estimates were computed as an index, rather than as total biomass, because scallop dredge efficiency was not estimated at that time and the scallop survey does not cover the entire resource[11]. In 1998, when the Amendment 7 SEIS was prepared, the scallop biomass index values were less than 25 percent of these targets and a rebuilding plan was included in Amendment 7.

Subsequently, these estimates of B_{max} for the Georges Bank and Mid-Atlantic regions were re-estimated using revised strata sets by SAW 29 (NEFSC 1999) ranging from 5.68 to 7.83 kg/tow for Georges Bank scallops and from 6.30 to 7.31 for Mid-Atlantic scallops. Due to the above management actions, reductions in fishing mortality through lower day-at-sea allocations and closed areas, the scallop resource has largely recovered to the Amendment 7 biomass targets for Georges Bank scallops and somewhat less than the revised Mid-Atlantic B_{max} estimates. The values stratified mean weight per tow in the 2001 R/V Albatross survey were 10.9 kg/tow for Georges Bank and 4.4 kg/tow for the Mid-Atlantic.

Most of the biomass increase was associated with closed fishing areas (Figure 1 and Figure 2), but lower fishing mortality levels and above average recruitment in recent years has allowed moderate increases in open fishing areas as well. The 2002 R/V Albatross survey has not yet occurred, but biomass projections indicate that the 2002 biomass should be around 11.4 kg/tow for Georges Bank and 5.6 kg/tow in the Mid-Atlantic. In 2003, projections indicate that total stock biomass will increase to 13.8 kg/tow for Georges Bank and 4.4 kg/tow in the Mid-Atlantic.

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11 Areas with low abundance or that are difficult to survey are not routinely sampled by the annual resource survey. These areas include inshore strata in the Mid-Atlantic region, parts of Southern New England offshore of Long Island, NY and Nantucket Island, MA, and most of the Gulf of Maine. Landings from these areas are a small fraction of the total catch.

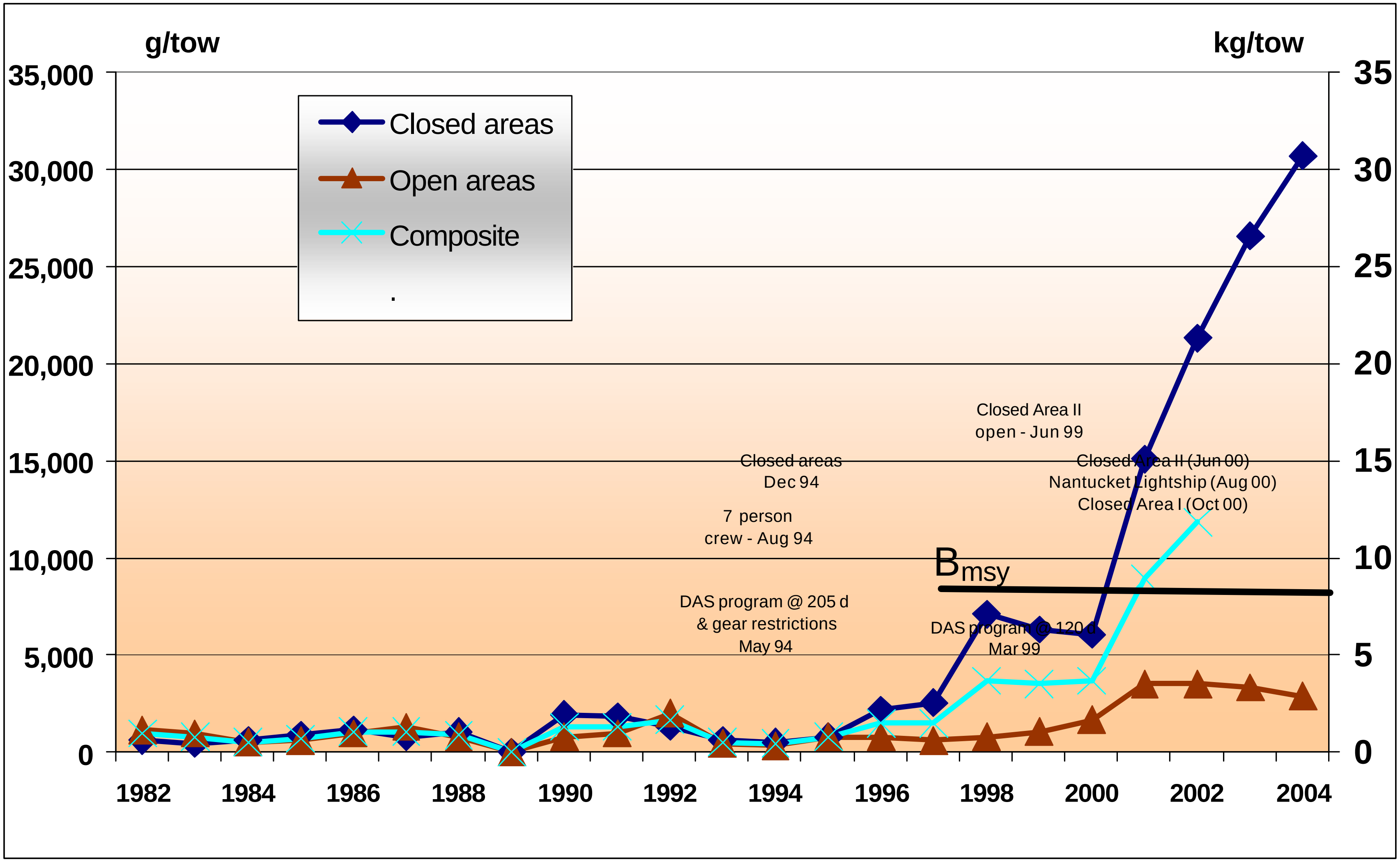


Figure 1. **Trend in survey biomass for Georges Bank scallops in closed and open scallop fishing areas , 1982 to 2001. Trends from 2002 to 2005 are projections assuming status quo management where the Georges Bank groundfish areas remain closed to scallop fishing.**

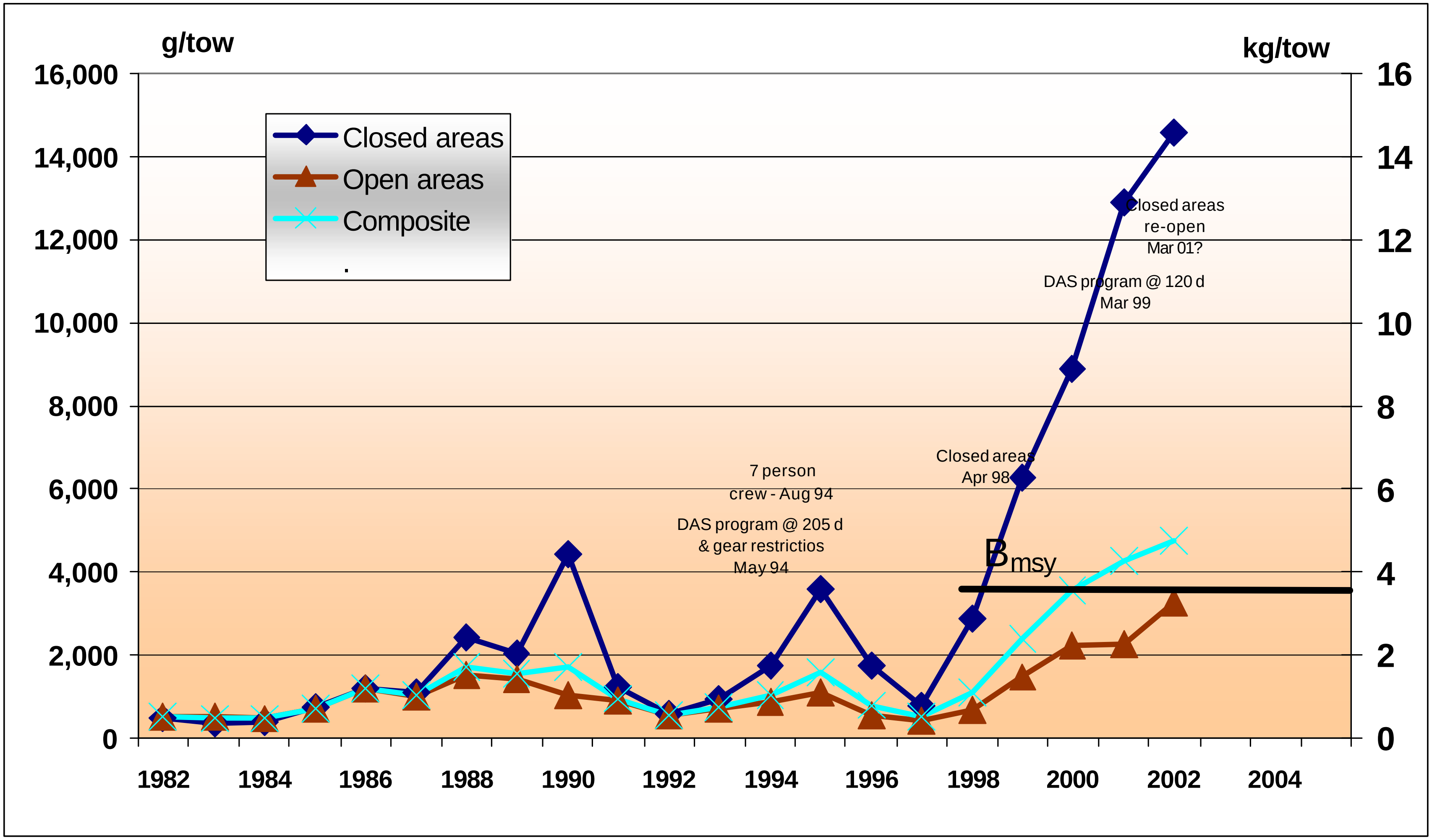


Figure 2. **Trend in survey biomass for Mid-Atlantic scallops in closed and open scallop fishing areas , 1982 to 2001. Trends from 2002 to 2005 are projections assuming the Hudson Canyon Area is treated as a re-opened rotation management area with fishing mortality targets of 0.32, 0.40, and 0.48 in 2003 to 2005, respectively.**

3.1.2.3 Essential Fish Habitat (Scallop EFH)

As required by the Magnuson-Stevens Act, NMFS developed guidelines at 50 CFR part 600, Subpart J, to assist the Councils in the description and identification of EFH and in the consideration of actions to ensure the conservation and enhancement of EFH. Section 600.815(a)(9) recommends that Councils identify habitat areas of particular concern (HAPCs) within EFH to provide greater focus for conservation and enhancement efforts. HAPCs are subsets of EFH that are especially important ecologically, sensitive to human-induced environmental degradation, stressed by development activities, and/or rare. This EIS does not include the consideration of new descriptions and identifications of EFH and new HAPCs. This exercise will take place in the Council's upcoming Omnibus Habitat Amendment (likely Amendment 11 to the Scallop FMP) which the Council started in fall 2004 to achieve an October 2004 submission (see below). For the purposes of this Plan Amendment, the existing and approved EFH designations and HAPCs from the Amendment 9 to the Scallop FMP of 1998 will continue. The EFH regulations include guidelines for identifying adverse impacts from both fishing and non-fishing activities and considering the practicability of actions for minimizing adverse effects on EFH from fishing.

NEPA provides a mechanism for identifying and evaluating the full spectrum of environmental issues associated with Federal actions, and for considering a reasonable range of alternatives to avoid or minimize adverse environmental impacts. NMFS and the New England Fishery Management Council will consider any new information and alternatives discussed in the EIS to determine whether changes to the EFH provisions of the fishery management plans previously approved by NMFS are warranted. As noted in the court's decision in AOC v. Daley, the alternatives NMFS must consider under NEPA are not restricted to the options originally presented in the fishery management plan amendments submitted by the Council.

During 2003, the Council initiated a Habitat Omnibus Amendment that will be considered Amendment 11 to the Scallop FMP. It will also amend the Northeast Multispecies (Amendment 14), Monkfish (Amendment 3), Herring (Amendment 1), Skate (Amendment 1), Red Crab (Amendment 1) and Atlantic Salmon FMPs. This Omnibus Amendment will be completed by October 2004 and, tentatively, will contain the following components:

- **Description and identification of EFH.** Consideration of a range of alternatives for EFH designations. Update all NMFS Source Documents for Species Reports

- **Non-Magnuson-Stevens Act fishing activities that may adversely effect EFH.** Update current section on identifying any fishing activities that are not managed under the MSA that may adversely effect EFH.

- **Non-fishing related activities that may adversely effect EFH.** Update current section on identifying activities other than fishing that may adversely effect EFH. For each activity, the FMP should describe known and potential adverse effects to EFH.

- **Conservation and enhancement.** Update current section on identifying actions to encourage the conservation and enhancement of EFH, including recommended options to avoid, minimize, or compensate for the adverse effects, especially in HAPCs.

- **Prey Species.** Review and update the current list the major prey species for the species in the fishery management unit and discuss the location of prey species' habitat. Consider adverse effects on prey species and their habitats that may result from actions that reduce their availability, either through direct harm or capture, or through adverse effects to prey species' habitats.

- **Development and adoption of a habitat susceptibility and recovery index** for the Northeastern US will be a focus of further analysis.

- **Identification of habitat areas of particular concern** (HAPCs) will be done through the HAPC process approved by the Council and included in a formal RFP. The RFP will be initiated in NOI for the Omnibus Amendment 2 and terminated 6 months later.

- **Consideration and identification of Dedicated Habitat Research Areas**, using the same type of process as the HAPC process and work closely with the Research Steering Committee on this effort.

- **Research and Information Needs.** Review and update the current recommendations, in priority order, for research effects necessary to improve upon the description and identification of EFH, the identification of threats to EFH from fishing and other activities ad the development of conservation and enhancement measures for EFH.

3.2 Current Fishery Regulations

The fishery is presently regulated as two directed fisheries, using a combination of regulations including day-at-sea limits, gear restrictions, limits on the number of crew, area closures, trip allocations, and possession limits. One directed fishery is a limited access fleet categorized as full-time, part-time, and occasional, distinguished by different annual day-at-sea allocations. A second directed fishery is comprised of primarily smaller vessels that seasonally or opportunistically target local beds of scallops when commercial quantities are available. These vessels are regulated by an open access permit, a scallop possession limit, and area/season exemptions.

3.2.1 Limited access fleet

Vessels that participated in the directed scallop fishery between 1988 and 1990 were able to qualify for a limited access permit, created in 1994 by Amendment 4 to the Sea Scallop FMP. Permits are categorized as full-time, part-time, or occasional, based on the vessel's scallop fishing activity from 1985 to 1990. Most vessels are authorized to use two dredges having a combined of no greater than 30 feet with rings no less than 3½-inches. Smaller or single dredges may be used. Additional restrictions govern the use of cookies, chafing gear, donuts, and links to prevent fishermen from decreasing the gear's size selectivity by closing the gaps between or within the rings. Dredges must have a twine top with mesh no less than 8-inches square or diamond to improve finfish escapement and reduce bycatch. Some vessels with a limited access scallop permit are also authorized to use a scallop trawl, no greater than 144 feet wide with a mesh no less than 5½-inches stretch.

As a limit on the fishing power of a day-at-sea, limited access vessels using either legal gear may carry no more than seven crew members and may not possess or land more than 50 US bushels of in-shell scallop while the vessel is not on a day-at-sea. The 50-bushel shell-stock limit became effective through Framework Adjustment 14 in 2001 as catches rose and fishermen began deckloading scallops to shuck off the day-at-sea clock. There is a 3½-inch minimum shell height limit for landed shell stock. For the same reasons, automatic sorting and shucking machines are prohibited. The present limits on the day-at-sea allocations are specified by Amendment 7, as amended by annual framework adjustments to achieve the annual fishing mortality targets established by Amendment 7 (see table below). Vessel may also carry up to 10 unused days from one year to the next. There is a small-dredge program that allocates the next highest day-at-sea category to vessels that participate in the program. Vessels in the small-dredge program may use one dredge no greater than 10 feet in width and carry no more than five crewmembers.

Table 3. Annual day-at-sea allocations

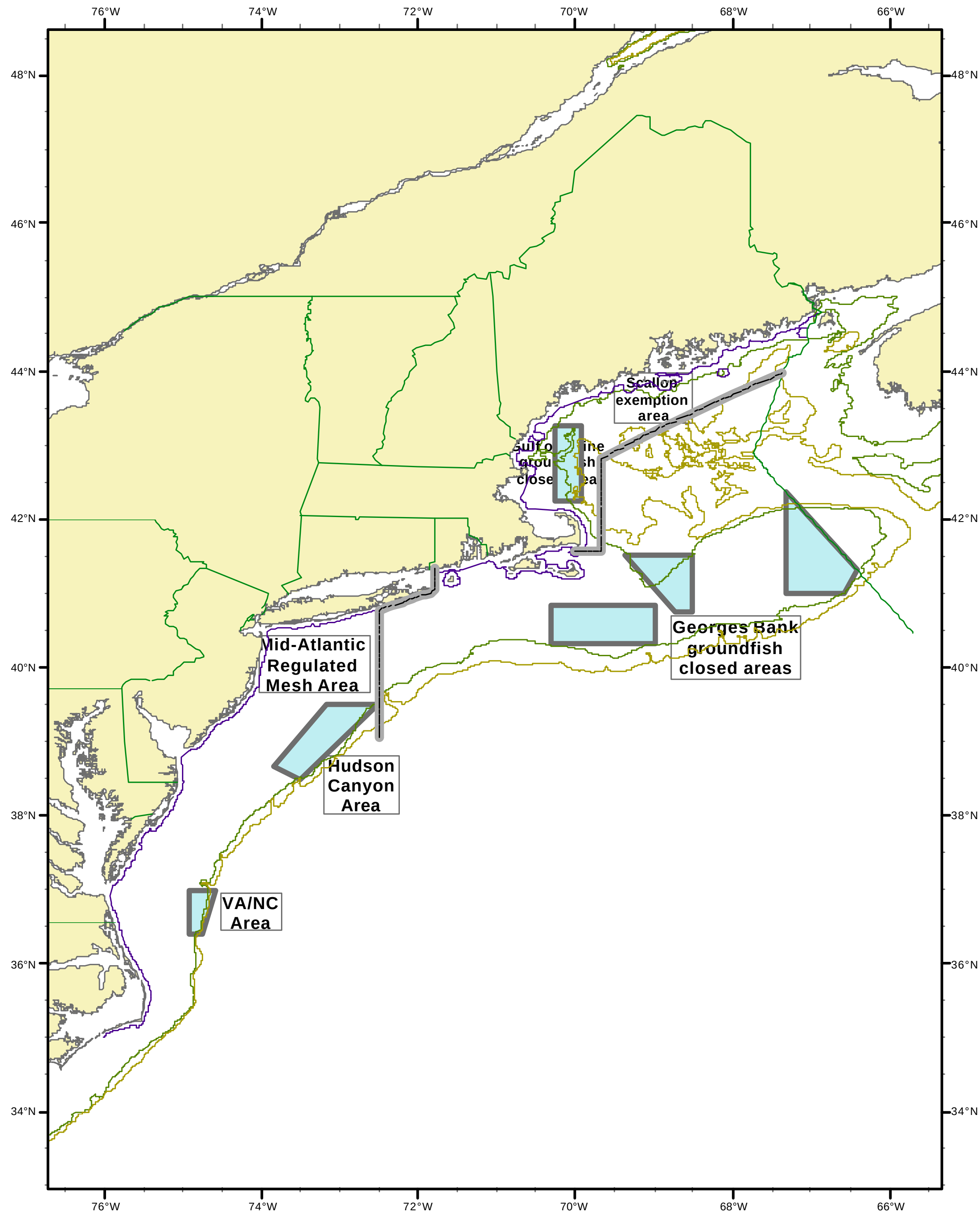
	Fishing year						
	2002	2003	2004	2005	2006	2007	2008 or rebuilt[12]
Fishing mortality target	0.24	0.22	0.15	0.15	0.15	0.15	0.20
Full-time allocation	120	45	34	35	38	36	60
Part-time allocation	48	18	14	14	15	17	24
Occasional allocation	10	4	3	3	3	4	5

Days are counted as time away from port when the vessel is seaward of the COLREGS line, monitored by automated vessel monitoring systems (VMS). Full-time and part-time vessels are required to maintain and operate VMS equipment, but vessels with an occasional limited access scallop permit may participate in an optional call-in system in lieu of the VMS program. Limited access vessels may call out of the scallop fishery to transit to other ports or participate in other fisheries. While not on a scallop day-at-sea, the scallop possession limit is 400 pounds per day or trip (if longer than 24 hours) and other fishery regulations may apply. Thus limited access scallop vessels may target scallops under general category management regulations while not on a scallop day-at-sea.

Under the Sea Scallop FMP, vessels on a scallop day-at-sea may fish in any area except for the Hudson Canyon and VA/NC Areas (Map 1), which are presently under special management regulations. Regulations for the Northeast Multispecies FMP also prohibit scallop fishermen from using scallop dredges and trawls within year around groundfish closed areas on Georges Bank and in the Gulf of Maine. Limited access scallop vessels are authorized to fish up to three trips in the Hudson Canyon and VA/NC Areas with an 18,000 pound (meat weight) scallop possession limit. Additional rules specify when vessels may take Hudson Canyon and VA/NC Area trips and the Regional Administrator may adjust the trip allocations and scallop possession limit for these areas. Dredges must have a twine top with mesh no less than 10-inches square or diamond to improve finfish escapement and reduce bycatch. On March 1, 2004, these special restrictions developed in Framework Adjustment 15 will expire and the Hudson Canyon and VA/NC Areas would re-open to limited access scallop fishing under general management rules[13].

[12] Stocks are deemed rebuilt with the stratified mean catch per tow in the annual resource survey equals or exceeds the biomass target value associated with B_{max}, the expected catch per tow if the stock is fished at F_{max}. Amendment 7 expected the stock to rebuild by 2008.

[13] Amendment 10 proposes to continue the controlled access program for the Hudson Canyon Area, but allow the VA/NC Area to re-open as planned, due to different resource conditions.



Map 1. **Closed areas, groundfish exemption areas, and state exemption line (3-mile limit in ME, NH, and MA) governing scallop fishing.**

3.2.2 General category fleet and state waters exemption

Any fishing vessel may obtain an open access general category scallop permit that enables it to retain more scallops than the 40-pound (meat weight) personal use limit. Vessels may retain and land up to 400 pounds (meat weight) or 50 US bushels of scallops per day or trip (if longer than 24 hours). Any legal fishing gear may be used, but scallop dredge and trawl size and configurations are regulated the same as those for limited access vessels, unless the vessel is fishing in an exempted groundfish fishery or a state-exempted scallop fishery. In addition, the scallop possession limit for vessels that fish in the Hudson Canyon and VA/NC Areas with a general category scallop permit or vessels not on a scallop day-at-sea is 100 pounds (meat weight), or 12½ US bushels of in-shell scallops. This 100-pound/12.5 bushel possession limit expires on March 1, 2004.

According to the Northeast Multispecies FMP regulations, vessels with general category permits using a scallop dredge may fish in the Mid-Atlantic regulated mesh area or in the Gulf of Maine Northern Shrimp Fishery Exemption Area. If fishing in the latter area, vessels using scallop dredges may not use dredges with a combined width greater than 10½ feet.

The original purpose of this permit and fleet category was meant to accommodate vessels that opportunistically or seasonally targeted sea scallops, but could not qualify for a limited access scallop permit. The Council also intended that this permit would accommodate incidental scallop catches on longer trips, such at those that target squid and summer flounder.

Under the Sea Scallop FMP, vessels fishing for sea scallops exclusively within state waters are exempt from the day-at-sea restrictions and scallop possession limits, if the state's scallop fishing does not jeopardize the fishing mortality and effort reduction objectives of the Sea Scallop FMP. The Regional Administrator has determined that scallop fishing in the state waters of ME, NH, and MA meet this requirement.

3.2.3 Incidental catches

If a vessel has an open access general category permit, it may retain and land up to 400 pounds (meat weight) or 50 US bushels of sea scallops on any trip, including those targeting other species. In addition, any vessel without a scallop permit may retain and land up to 40 pounds of scallop meats or 5 US bushels of in-shell scallops for personal use.

3.3 Development of Amendment 10

Amendment 10 for the Atlantic Sea Scallop FMP was initiated in 2000 to introduce a formal area rotation system for scallop management, building on the results that were observed from the Georges Bank groundfish closed areas in 1994, which coincidentally promoted rebuilding of scallop biomass from an overfished condition, and from the Hudson Canyon and VA/NC Area closures in 1998, which postponed mortality on the strong 1997 and 1998 year classes and led to higher yield and net benefits when re-opened. A system of controlled access with day-at-sea tradeoffs, implemented by Frameworks 11, 13, and 14, were mostly successful and allowed the industry to catch large, valuable scallops during specific seasons (to avoid bycatch problems) while reducing scallop exploitation elsewhere.

NMFS published a Notice of Intent on February 11, 2000 and the Council held Amendment 10 scoping hearings on February 15 to 17, 2000. Three hearings were held in Fairhaven, MA; Norfolk, VA;

and Cape May, NJ. A summary of the salient concerns and recommendations on scallop management issues are shown below.

Fairhaven, MA – February 15, 2000

1. Broad support for using rotational area management to boost yield, i.e. increase the size of the pie.
2. Support for increasing research to improve scallop productivity.
3. Broad support for increasing crew size to improve safety, possibly through a training program for the extra crewmember.
4. Support for reducing discard mortality by prohibiting deck-loading.
5. Majority opposed to new measure that would allocate the resource, since this would bog down Amendment 10 and possibly give fishermen a smaller piece of the pie.
6. All but one were opposed to developing an ITQ system for scallop management.

Virginia Beach, VA – February 16, 2000

1. Support for area-based management to keep the industry from harvesting the seed piles, when and where they occur.
2. Some expressed concern that an area would not reopen to fishing once it was closed to rebuild scallop biomass or allow habitat to recover.
3. Strong support for a change allowing vessels to transit to fishing areas without counting days-at-sea, provided that fishing gear is properly stored.
4. Some spoke in favor of an ITQ system.
5. Support given for a buyback program.
6. 50/50 split about balancing mortality in for a day-at-sea used by a vessel using trawls vs. vessels using dredges. Some thought that bycatch amounts and habitat impacts were less for vessels using trawls, although the trawls caught small scallops better than dredges when the small scallops are abundant.

Cape May, NJ – February 17, 2000

1. Amendment 4 is working, so large changes are unnecessary.
2. Should have access to the Mid-Atlantic closed areas when the scallops are at marketable size.
3. Support given for quota management, with additional research and improved enforcement and monitoring.
4. A buyback program is needed to remove inactive vessel capacity.
5. Support for sorting machines or other methods that would increase survival of discarded scallops.

Following these hearings, the Council began developing an area rotation and other alternatives to improve scallop management. At the time, the resource was rebuilding but had not yet reached the biomass targets. Moreover, several concerns over the scallop access program for the Georges Bank closed areas in 1999 and 2000 arose and the Council intended to address the concerns, allowing future access via Amendment 10. Subsequently, the Omnibus EFH Amendment lawsuit had been settled (see below), which required the Council to address the deficiencies in the Omnibus Amendment in the next amendment to its plans.

After developing and considering a range of area rotation alternatives, the Scallop Oversight Committee recommended one area rotation alternative to the Council in the fall of 2000. This alternative had been proposed by the Fisheries Survival Fund, involving an adaptive area management approach with flexible boundaries. Other area rotation alternatives were considered, but the committee recommended rejecting them before public hearings due to the perceived superiority of the adaptive, flexible boundary approach.

The Council received the committee recommendations and remanded the issue back to committee, with a charge to develop a broader range of management alternatives, addressing a broader range of issues, including measures to minimize impacts on habitat (see EFH discussion below). Essentially restarting the Amendment 10 process, the Council adopted a set of goals and objectives in January 2001 for Amendment 10, charging the Scallop Plan Development Team (PDT) with developing management alternatives for consideration. The PDT developed a 60-page document with a broad range of alternatives (including measures to minimize bycatch and habitat impacts) and area rotation strategies in July 2001, which were later approved by the Oversight Committee and Council for analysis in the Amendment 10 DSEIS.

NMFS published a Notice of Intent (NOI) to prepare a supplemental EIS for the EFH components of the Northeast Multispecies and Atlantic Sea Scallop Fishery Management Plans on February 1, 2001 (66 FR 8568). The public comment period was open until April 4, 2001. NMFS (and/or the Council) solicited public comment to identify a range of alternatives for identifying and describing EFH and HAPCs and requested information on adverse effects of fishing activities on EFH and HAPCs. NMFS (and/or the Council) solicited public comment on appropriate management measures and alternatives to minimize, to the extent practicable, any adverse effects of fishing on EFH. NMFS (and/or the Council) held one public scoping meeting. The meeting occurred in Gloucester, MA on February 22, 2001. A summary of the public comments and primary issues raised during the meetings is in the Scoping Report (Appendix 2).

While developing a broader range of alternatives and following the EFH scoping hearings, it became apparent that more work was needed on the alternatives to minimize habitat impacts. This issue was remanded back to the PDT for more work, in coordination with other PDTs and technical teams, leading to a joint meeting of the Scallop PDT, the Groundfish PDT, and the Habitat Technical Team (HTT) in January 2002. Further communication between the Council's technical teams lead to an approach that the Council adopted in March 2002 and further developed during the rest of 2002. Working with the Council's Habitat Technical Team, several alternatives were developed, including an objective model-based approach whose concept the Council approved for analysis in March 2002. Both model-based and ad hoc closure alternatives were recommended for inclusion and analysis in the DSEIS, which the Council approved in September 2002.

3.4 Definition of Overfishing

Following a two-meeting review by the Council's Scientific and Statistical Committee of the proposed overfishing definition and the status quo overfishing definition, the Committee reached the following conclusions:

1. Under the current overfishing definition policy, while the current closed areas are likely protecting the stock from recruitment overfishing, the stock will not be protected from growth overfishing, that is loss of yield due to excessive fishing mortality rates will occur in the open areas. In particular, closed areas do not justify excessive fishing mortality rates in the open areas. What matters (from a yield per recruit perspective) are the fishing mortality rates in the open areas, not the average fishing mortality (averaged over the open and closed areas).

2. Under the overfishing definition guidelines, we need to define targets and thresholds. The biomass reference points should provide primary protection against recruitment overfishing. The fishing mortality rate reference points should protect against overfishing the stock as well as loss of yield per recruiting scallop (growth overfishing).

3. Permanently closed areas clearly offer a way to help keep the total biomass above minimum biomass thresholds but potentially restrict fishing opportunities. A system of temporarily closed areas (i.e., a system of rotating closures) is likely to enhance fishing opportunities.

4. The proposed overfishing definition developed by the PDT provides an appropriate scheme for addressing area rotation and protects against the loss of yield due to excessive fishing in the open areas. It allows management flexibility both in terms of which areas are opened and the time frame over which the stock is utilized. The committee felt that substantial benefits could be gained from the use of area rotation.

5. The technical details of the overfishing definition and control rule need to be continually evaluated as new information becomes available and new analyses are done concerning issues such as the form of the stock-recruitment relationship and the relationship between yield per recruit based reference points and B_{MSY}.

6. There are some reasonable arguments for moving toward a real time monitoring scheme on an area-by-area basis, but a lot more work needs to be done to take advantage of such a scheme. To do this, real time management is needed in addition to real time assessments.

The DSEIS presented two potential overfishing definitions and evaluated them in a way that provided the Council with a basis to consider a new overfishing definition. The presentation was intended to identify to the Council that its decision to use an area rotation scheme might benefit from the selection of a new overfishing definition designed specifically for area rotation. However, it was not intended to force the Council to select the proposed overfishing definition if management measures selected by the Council, combined with the status quo overfishing definition, could continue to achieve the FMP's objectives and comply with the requirements of the Magnuson-Stevens Act and other applicable laws. Section 3.4 remains unchanged from the DSEIS so that the original choices in front of the Council are not lost. Section 5.1.1 explains the Council's rationale for recommending that the current overfishing definition remains in effect and Section 6.1.1 explains how the management measures proposed in Amendment 10, along with the status quo overfishing definition, would continue to comply with National Standards of the Magnuson-Stevens Act.

3.4.1 Proposed Overfishing Definition

3.4.1.1 Biological reference points and control rule

The biological reference points associated with the overfishing definition control rule are based on F_{max}, the fishing mortality rate that produces maximum yield per recruit, and B_{max}, the average stock biomass that results when fishing is held constant at F_{max}. Current estimates of F_{max} remain unchanged and the fishing mortality target is 80% of F_{max}. Estimates of B_{max} have been updated to include the recruitment (40 – 72 mm observed in the survey from 1982 to 2001.

3.4.1.2 Status determination – overfishing and overfished conditions

For each of the three stocks currently recognized (Gulf of Maine, Georges Bank, Mid-Atlantic Bight) the proposed definition of overfishing will comprise two parts: a biomass criterion that applies to the whole stock as described below, and separate fishing mortality criteria for the complex of areas under area rotation and for the areas under the ordinary management system [excluding long term area closures that are unlikely to contribute to future yield].

1. **The target biomass for the scallop resource is Bmax (the biomass of scallops that would result from fishing at Fmax, a proxy for Fmsy).** The target biomass for an entire stock remains, as before, at B_{msy} proxy and is defined to be the conventional B_{max} per recruit multiplied by the average number of recruits per tow over the entire stock area surveyed by NMFS. (Scallops in the shallow water unsurveyed areas are not included). There is no specific target biomass for the areas under rotation management (either singly or in aggregate). This is because the purpose of biomass targets and thresholds are to insure that reproductive capacity is not seriously reduced and, given the widespread dispersal of larval scallops, this only makes sense when biomass is considered on an appropriately large scale.

2. **The scallop stocks are overfished when the biomass is below 50% of B_{max}, when a formal rebuilding program would be needed to initiate recovery to B_{max}.** Although the control rule below would define overfishing at values below F_{max} when the stock is less than 75% of Bmax, the stock would be defined as being overfished (i.e. the FMP would be out of compliance) in a manner consistent with the National Standard 1 guidelines.

3. **Control rule: Fishing mortality thresholds and targets decrease linearly between zero and Fmax when the biomass is between 25% and 75%** of B_{max}. The control rule modifies the fishing mortality threshold for the stock that defines overfishing as well as the operational limits for rotation management areas. The biomass limit is 25% of B_{target} (i.e., 25% of B_{MSY} proxy). Thus, fishing mortality in an entire stock area should be as close to zero as possible if the biomass falls below 25% of B_{max}.

   Provided that biomass exceeds 75% of B_{target}, the fishing mortality limit for each area under area rotation, is 0 if the area is closed, and for open areas it is that fishing mortality which, when averaged over the fishing mortalities that have occurred in the area since area rotation was declared (or over the past 10 years, whichever is a shorter period of time), will result in an average equal to F_{max} where F_{max} is computed according to the existing method. When biomass for a stock is between 25% Btarget and 75% Btarget, the limit for each area under area rotation is $F = (2B/Btarget - 0.5)\ F_{limit}$ where F is the limit fishing mortality for the area, B is the stock biomass, and F_{limit} is the fishing mortality that would be the limit fishing mortality if the stock were above 0.75 Btarget. This simply ramps the fishing mortality down linearly as the stock biomass declines. Reducing fishing mortality when the stock is below 75% of B_{max} can be achieved by reducing the area-specific fishing mortality limits (see below) across the board or by temporarily closing more areas than specified by the area rotation rules.

4. Overfishing occurs if the number-weighted fishing mortality averaged over the rotation areas exceeds the threshold fishing mortality. For determining compliance with the overfishing definition, the threshold fishing mortality for the entire complex of areas under area rotation (within a stock) is the average of the fishing mortality limits in the rotation areas computed as a numbers-weighted average. Overfishing does not occur if the fishing mortality in an area under rotation management exceeds the limit fishing mortality for that area provided the average

mortality over all areas under rotation management does not exceed the area-wide threshold.

5. **Area management implementation**: The target fishing mortality in any area under area rotation can be any value not exceeding the area's limit fishing mortality, subject to the restriction that the numbers-weighted average of the target fishing mortalities does not exceed 90% of the threshold fishing mortality.. (However, if the mortality in an area under area rotation exceeds that area's limit, the limit for the next year would be included in the time-averaged mortality limit for the following year.)For the areas not under rotation management, the limit and target fishing mortalities remain as before, i.e., are calculated as if the areas under rotation management were a separate stock

3.4.1.3 Options considered

The PDT reviewed the present overfishing definition and determined that it is clear that the definition is inconsistent with area based management, whether or not it includes area rotation. The present overfishing definition allows for excessive localized overfishing in open fishing areas. This localized overfishing prevents the plan from meeting its maximum yield objectives, whether the closed areas are permanent (i.e. HAPC) or temporary (area rotation). In addition, area rotation introduces variations in fishing effort that need to be taken into account to maximize yield when closed areas re-open to fishing. The three options considered by the Scallop PDT take different approaches on this point. In all cases, the annual day-at-sea allocations would depend on the combined product of the number of open fishing areas, the annual fishing mortality threshold within each area, the expected average catch per day-at-sea (constrained by crew limits), the number of active fishing vessels, and either the general category TAC or the expected landings by vessels fishing under general category rules.

Although the application of the current overfishing definition has problems (i.e. including unexploitable biomass in permanently closed areas to allow overfishing in open areas; the inflexibility to allow fishing mortality to temporarily exceed F_{max} after rotational closures), none of the options for revising the overfishing definition suggest that F_{max} and B_{max}, the current proxies for F_{msy} and B_{msy} respectively, are inappropriate. In addition, the current estimate of F_{max} (F=0.24) and a target F (F=0.2) are also deemed acceptable. The options for redefining overfishing do not suggest that the current B_{max} as a target and proxy for B_{msy} are inappropriate for the scallop stocks as currently defined.

The PDT reviewed all three options presented to it and agreed to recommend proposal one as the most appropriate approach to defining overfishing in a way that is consistent with area based management.

During the discussion, the PDT agreed to use the following six principles to judge the suitability for any overfishing definition developed to be compatible with area based management or rotation:

1. Overfishing definitions **<u>must</u>** be based on **<u>current</u>** fishing mortality, not past events (i.e. mistakes).

2. Area specific TACs can take into account past mortality history (i.e. closures).

3. The reference points and TACs cannot take 'credit' for future, planned management that may not be guaranteed.

4. Zero fishing mortality in permanent closures cannot be considered in spatial averaging for overfishing or status determinations.

5. Long-term average mortality should not exceed F_{max}.

6. Overfishing should be determined for the **stock**, not area by area, on an annual basis.

Considering the above principles, three proposals were developed and presented to the PDT, taking three different approaches to correct the inconsistency with area based management and the proposed area rotation alternatives. They are:

1. Time-averaged fishing morality
A method to determine area-specific fishing mortality thresholds based on past fishing mortality rates and area rotation policies

Fishing mortality in re-opened areas depends on the number of years when an area is closed to fishing and the number of years managed as a re-built, re-opened area. Thus, the time-averaged fishing mortality should not exceed the fishing mortality target (F=0.2), regardless of the fishing mortality and biomass in other areas. Overfishing in this proposal is defined as a time-averaged mortality rate that exceeds F_{max}. Since the fishing mortality threshold for an area would depend on the past fishing mortality history for a defined area, it would be very difficult, but not impossible to calculate thresholds for areas with adaptive boundaries. Since scallops are relatively immobile and recruitment appears to be not at risk at target biomass levels, this approach is applicable and maximizes yield. If biomass is below the target for the stock, the individual area annual fishing mortality targets would follow the same controls that exist in the present overfishing definition.

If the majority of areas open to fishing are in a re-opened status, the resource-wide fishing mortality rate could temporarily exceed the fishing mortality target (F=0.2). The variation in annual resource-wide fishing mortality will be constrained by ceilings on the amount of the resource that could be closed in any single year. One variant on this theme, which appears to reduce variation in annual landings, is to ramp annual fishing mortality during the re-opened management period. The following tables provide two examples of how this might work. The actual closure duration may be set for all areas in Amendment 10 or could vary for each area according to resource conditions.

Table 4. Example of time-averaged fishing mortality overfishing definition with a three-year closure, followed by a three-year period of re-opened management status.

Year	Year N	1	2	3	4	5	6	7 - N	1	All
Status	**Open**	**Closed**	**Closed**	**Closed**	**Re-opened**	**Re-opened**	**Re-opened**	**Open**	**Closed**	**Average**
No rotation	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Simple rotation	0.20	0.00	0.00	0.00	0.40	0.40	0.4	0.20	0.0	0.20
Ramped rotation	0.20	0.00	0.00	0.00	0.32	0.40	0.48	0.20	0.0	0.20

Table 5. Example of time-averaged fishing mortality overfishing definition with a two-year closure, followed by a three-year period of re-opened management status.

Year	Year N	1	2	3	4	5	6	7 - N	1	All
Status	**Open**	**Closed**	**Closed**	**Closed**	**Re-opened**	**Re-opened**	**Re-opened**	**Open**	**Closed**	**Average**
No rotation	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Simple rotation	0.20	0.00	0.00	0.30	0.30	0.30	0.30	0.20	0.0	0.20
Ramped rotation	0.20	0.00	0.00	0.21	0.27	0.33	0.39	0.20	0.0	0.20

2. **Size mitigated fishing mortality targets**
   A method to determine area-specific fishing mortality thresholds based on current scallop size frequencies

Like the time-averaged mortality threshold in Proposal 1, this method allows for area-specific fishing mortality targets that are higher than the stock-wide target. On the other hand, the annual mortality target for an area would depend on the size of scallops, compared to the average size of scallops when fished constantly at F_{max}. Larger scallops in a re-opened fishing area would mean that the annual mortality target for that area would be greater than F_{max} and vice versa. The annual target would be determined from the ratio of the average size of exploitable scallops in an area to the average size of exploitable scallops when fished constantly at F_{max}. Overfishing in this case would be determined from a biomass-weighted average of open fishing areas.

Thus, the mortality target in an area would depend not on the length of time in which the area was closed or the actual past fishing mortality history, but on the size of scallops occurring there when re-opened and in each year the area remains open. If high recruitment occurs in an area during its closure, this method would reduce mortality and protect the smaller scallop, even though the area might have been closed for a long period. Conversely, an area that closes late (i.e. the scallops are intermediate size, rather than small when the closure occurs) and recruitment is low, this method would allow a higher annual fishing mortality target even if the closure duration is short.

3. **Synthetic F_{max}**
   A method to determine resource-wide fishing mortality thresholds through projections of future fishing mortality and area rotation policy

A third alternative would modify the F_{max} threshold based on the amount of closed areas and the size of scallops in the resource. Thus, the synthetic F_{max} (the fishing mortality threshold) would vary from year to year and the fishing mortality target would be a fraction (80%?) of the synthetic F_{max} value.

In some ways, this is similar to Proposal 2 above, but the change in F_{max} is calculated by a dynamic yield per recruit model or simulation, rather than a ratio of size method. On the other hand, it is conceptually a little different from Proposal 2 in that the long-term threshold F is undefined and allows for specification of an annual synthetic F_{max} for the entire resource instead of an area-specific fishing mortality threshold as proposed under proposals 1 and 2.

It also requires a iterative simulation to determine the synthetic F_{max} value that maximizes future yield based on the current size structure, assumed recruitment, size selectivity of the current and future fishery, and future fishing mortality and area management policy. The projected synthetic F_{max} could be a single value through time (which may vary in the future) or a time-stream of fishing mortality rates that vary through time to maximize yield. Although not part of the original proposal, this could be taken one step further by calculating net benefits and discounting for time, or F_{npv}.

3.4.2 Status quo

The present overfishing definition is also based on reference points (B_{max} and F_{max}) that maximize yield per recruit, an acceptable proxy for MSY when there is no stock recruitment relationship (Applegate et al. 1998). These reference points depend on the average amount of recruitment and size selection by the fishery.

B_{max} has been approved as the target biomass in the overfishing definition. It is calculated as the product of the average meat weight at age and the number of scallops that would survive age-specific fishing mortality and a constant natural mortality, such that the fishing mortality maximizes yield. Higher and lower fishing mortality produce less yield either because scallops would be harvested before they reach optimum size or harvested too slow so that natural mortality reduces the total biomass more than growth adds to it. This parameter is known as F_{max} (Hilborn and Walters 1992). Bmax is the expected biomass per recruit that survives when fished at the F_{max} rate.

The present overfishing definition reads:

"If stock biomass is equal or greater than B_{max} as measured by the resource survey weight per tow index (currently estimated at 8.16 kg/tow for the Georges Bank resource and 3.90 kg/tow for the Mid-Atlantic resource area), overfishing occurs when fishing mortality exceeds F_{max}, currently estimated as 0.24. If stock biomass is below B_{max}, overfishing occurs when fishing mortality exceeds the level that has a 50 percent probability to rebuild stock biomass to B_{max} in 10 years. The stock is in an overfished condition when stock biomass is below ¼B_{max} and overfishing occurs when fishing mortality is above zero. These reference points are thresholds and form the basis for the control rule."

In the present overfishing definition, the minimum biomass threshold is 25 percent of B_{max} and the stock is deemed overfished when biomass is less than this value. The value of B_{max} differs for Georges Bank and Mid-Atlantic scallops because the average recruitment level is different. Differences in size selection and mortality in the two regions are believed to be negligible, but growth differences have been accounted for when estimating the biological reference points (NEFSC 2001b). The reference points are also valid for Gulf of Maine scallops, but surveys have been insufficient to be able to estimate biological reference points for the Gulf of Maine.

Overfishing occurs when fishing mortality exceeds the fishing mortality threshold. The threshold is F_{max} when biomass is above B_{max} and declines to zero as the stock approaches the minimum biomass threshold, 25 percent of B_{max} (Figure 4). Between ¼B_{max} and B_{max}, the fishing mortality threshold was determined from the calculated rate of logistic biomass growth, assuming that the intrinsic rate of population growth is two times the value of F_{max} and F_{max} is a valid proxy for F_{MSY}. When biomass is between ½B_{max} and B_{max}, the threshold is based on a ten-year rebuilding calculation. A more risk-adverse strategy is employed in the current overfishing definition when biomass is lower, between ¼B_{max} and ½B_{max} a more aggressive five-year rebuilding calculation is employed. The target fishing mortality rate is 80% of the threshold value.

Both B_{max} and F_{max} apply to all stock areas, regardless of their status (i.e. open or closed). Thus, it is possible to increase biomass or reduce mortality by closing more of the scallop resource area, as has occurred since 1994. Greater survival in the closed areas will increase biomass as scallops there grow and reduce mortality, if fishing mortality does not increase an equal amount in the remaining open areas.

In the extreme case, the stock-wide biomass target could be achieved without overfishing the resource if 80 percent or more of the exploitable scallop abundance occurs in closed areas. Even if fishing mortality in the open areas is unlimited (thousands of boats fishing 365 days per year, for example), it could meet the overfishing definition criteria through closures, although there might be no scallops available to the fishery!

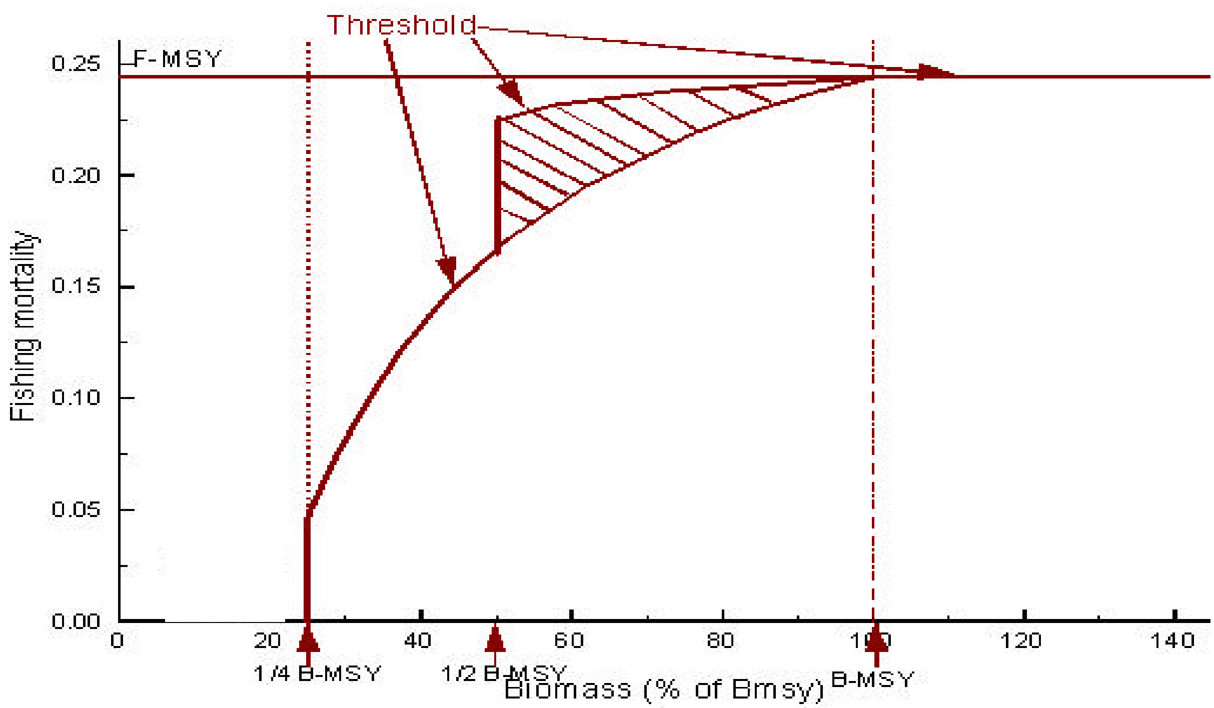


Figure 3. Existing overfishing definition control rule for sea scallops. Calculated threshold fishing mortality rates assume that the intrinsic rate of population growth is two times the value of F_{max}, then estimated to be F=0.24.

While the above outcome might seem absurd, about 80 percent of the exploitable biomass of Georges Bank scallops are presently in long-term closed areas and it totals about 50 percent of the resource in both regions. At the same time, fishing mortality in the open areas of the Mid-Atlantic is about 0.7, or almost three times higher than F_{max}. As such, the application of F_{max} and B_{max} as acceptable proxies for F_{MSY} and B_{MSY} is debatable.

The maximum fishing mortality threshold and target are also inflexible, i.e. they apply in all stock areas regardless of the age structure of the stock and its recent management history. Even if the majority of the resource had been subject to several years of closure and scallops were larger than optimum (i.e. natural mortality was removing more biomass than growth was adding), the fishing mortality target could not exceed F_{max}, even temporarily when it would improve long-term yield. Even with spatial averaging, inherent in the present overfishing definition, it would be difficult to accommodate a control rule that would maximize yield from the fishery after a period of greater than average closures to postpone mortality on strong year classes. With area rotation and the current overfishing definition, it would also be questionable whether F_{max} and B_{max} would be acceptable proxies for F_{MSY} and B_{MSY}, respectively, without modifying the overfishing definition to account for long term closures and area rotation.

Lastly, the basis for the control rule (Figure 4) presumes that F_{max} is a valid proxy for Fmsy and rebuilding would occur according to a logistic growth curve whose rate is maximized when biomass is some fraction of the carrying capacity (Pella and Tomlison 1969). In many cases, it is assumed that this maximum population growth rate occurs at 50 percent of carrying capacity. With a heterogeneous resource caused by long-term closures, its probable that the population growth is not maximized when the spatial average of the two types of areas (closed and open) are near ½ of the carrying capacity when averaged together. In this case, the scallops in long-term closures have slow growth rates and density dependent factors may adversely affect productivity. In open areas with high exploitation rates (as permitted with the present overfishing definition), the young scallops contribute less than optimum amount of spawning.

3.5 Optimum Yield

Optimum yield (OY) is a long term average, defined as the amount of biomass that can be landed when the stock biomass is at B_{max} by using regulated fishing gear in resource areas that are not managed as long term closures, at a rate equivalent to the open area fishing mortality target. The stock-wide fishing mortality target is 80% of Fmax, accounting for the risk that the numerical estimate exceeds the true value of F_{max}. The open area fishing mortality target increases linearly from 80% of F_{max} in proportion to the amount of exploitable biomass in long-term closed areas, but cannot exceed F_{max}.

Table 6. Open area target fishing mortality for determining optimum yield.

Percent of scallop productivity in long-term closed areas	Stock wide target fishing mortality	Open area target fishing mortality for defining OY
0	80% of F_{max}	80% of F_{max}
5	80% of F_{max}	85% of F_{max}
10	80% of F_{max}	90% of F_{max}
20	80% of F_{max}	F_{max}
> 20	80% of F_{max}	F_{max}

Long term closures are excluded from the calculation of OY, because other than an insignificant movement of large scallops, long term area closures contribute to total scallop productivity only through the amount of spawning activity that produces settlement elsewhere. The recruitment from spawning activity is a component of Bmax, which may change due to differences in long-term average recruitment.

Annual yield targets may differ from the long-term average optimum due to variations in exploitable stock biomass and age structure of the scallop stocks. When stock biomass is less than B_{max} or when the abundance of older scallops is low, the annual yield target that achieves this long-term average optimum is less than optimum yield. This may be determined from the control rule (see above) that defines overfishing when stock biomass is less than B_{max}. When stock biomass is greater than B_{max}

and the abundance of older scallops is high, the annual yield target that achieves this long-term average optimum is more than optimum yield.

4.0 PURPOSE AND NEED FOR ACTION (Amendment, EIS, RFA)

The primary intent of Amendment 10 is to introduce spatial management of adult scallops, taking advantage of resource heterogeneity to improve yield and minimize collateral adverse impacts on other fisheries and the marine environment. Although the Scallop FMP has employed limited spatial management on an ad hoc basis since 1994, the primary conservation measures currently rely on annual fleet day-at-sea allocations, gear restrictions, and crew limits to achieve the FMP objectives. These objectives included rebuilding the scallop resource, producing optimum yield, ensuring equitability and regulatory flexibility, minimizing bycatch and habitat impacts, maximizing safety, and other mandates of the Magnuson Stevens Act (MSY) and the National Environmental Policy Act (NEPA). With some minor exceptions, these primary management measures apply to the entire scallop resource and fishery, essentially from the Gulf of Maine and Georges Bank to Cape Hatteras, NC.

Although Amendment 7 and subsequent amendments were approved and implemented after passage of the Sustainable Fisheries Act[14] (SFA), Amendment 10 takes additional steps to improve the FMP performance for achieving optimum yield, for defining overfishing consistently with area-based management by reducing the potential for localized overfishing, for reducing the risks from potential overfishing through temporary area closures, for reducing bycatch and bycatch mortality, for reducing essential fish habitat impacts, and for improving data collection and monitoring.

Another primary purpose of Amendment 10 is to amend the Fishery Management Plan for Scallops to comply with section 303(a)(7) of the Magnuson-Stevens Act. More specifically, the purpose is to identify and describe adverse effects of fishing on EFH and to minimize to the extent practicable these adverse effects. These actions are being undertaken to ensure the conservation and enhancement of EFH as required under the Magnuson-Stevens Act.

In part, these mandates are being achieved through effort limits and gear restrictions, but more can be done. A recent court decree (Court Order from US District Court for the District of Columbia in American Oceans Campaign v. William M. Daley, September 14, 2000) moreover requires the Council to analyze a broad range of alternatives to minimize the effects of the scallop fishery on essential fish habitat for other species, and the effects of other fisheries on essential fish habitat for scallops. Specifically, Amendment 10 re-evaluates the effectiveness of the present closed areas and management regulations and considers different and possibly expanded closures in sensitive habitat areas. Amendment 10 also considers and analyzes the impacts of new technology that promises to reduce bycatch and bycatch mortality.

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) required the National Marine Fisheries Service (NMFS) and regional Fishery Management Councils (Councils) to describe and identify essential fish habitat (EFH) within fishery management plans, minimize to the extent practicable adverse effects on EFH caused by fishing, and identify other actions to encourage the conservation and enhancement of EFH. EFH is defined in the Magnuson-Stevens Act as "*those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.*"

14 The Sustainable Fisheries Act amended the Magnuson Stevens Act in 1998, adding new emphasis on achieving MSY, reducing bycatch and essential fish habitat (EFH) impacts, and reducing impacts on communities and safety of human life at sea.

Pursuant to the Magnuson-Stevens Act and the EFH regulations, the Councils submitted fishery management plan amendments and associated Environmental Assessments (EAs), as required under the National Environmental Policy Act (NEPA), to NMFS for Secretarial review. NMFS approved or partially approved all the EFH fishery management plan amendments in accordance with section 304(a) of the Magnuson-Stevens Act. Subsequently, a coalition of seven environmental groups and two fishermen's associations brought suit challenging NMFS' approval of certain EFH amendments prepared by the Gulf of Mexico, Caribbean, New England, North Pacific, and Pacific Fishery Management Councils (American Oceans Campaign et. al. v. Daley et al., Civil Action No. 99-982(GK)). The suit specifically contested the adequacy of the evaluations of fishing gear impacts on EFH in the fishery management plan amendments, and the analyses of environmental impacts in the EAs.

The U.S. District Court for the District of Columbia found that the agency's decisions on the subject EFH amendments were in accordance with the Magnuson-Stevens Act, but found that the EAs for the Councils' amendments were inadequate and in violation of NEPA. The court determined that the EAs prepared for the EFH provisions of the fishery management plans did not fully consider all relevant alternatives. The court specifically criticized several of the EAs for evaluating only two options for the EFH amendments: either approval of the amendment or status quo. Additionally, the decision noted that the descriptions and analyses of the environmental impacts of the proposed actions and alternatives were vague or not fully explained. The court ordered NMFS to complete a new and thorough NEPA analysis for each EFH amendment named in the suit. This Environmental Impact Statement (EIS) responds, in part (see above), to the court's directive to NMFS to complete new NEPA analyses for the Scallop Fishery Management Plan. Although the plaintiffs' complaint focused on whether NMFS had adequately evaluated the effects of fishing on EFH, NMFS decided to complete new EISs to evaluate all of the EFH components of the applicable fishery management plans. Accordingly, this EIS reevaluates the impacts of amending the Scallop fishery management plans to include the EFH provisions required by the Magnuson-Stevens Act. The EIS analyzes alternatives for the EFH FMP amendments, including the alternative that was adopted by the Council and approved by NMFS in 1999 and other alternatives.

Minor changes in the optimum scallop area rotation system could achieve these plan objectives through area specific seasons, habitat protection areas coordinated with other plans that govern other mobile bottom gear fishing, improving the efficiency of fishing, potential bycatch TACs that could induce the scallop vessels to avoid bycatch, and other measures. Amendment 10 proposes gear changes that would make fishing gear more size and species selective. It proposes changing the management of scallop fishing by vessels with a general category scallop permit or fishing for scallops while not on a day-at-sea to reduce the risk of overfishing from a growing, open-access fleet. Finally, Amendment 10 proposes to change the fishing year and the framework adjustment cycle to make management more efficient – timed to use the research and industry scallop surveys when the data become available and implement adjustments in the shortest possible time.

The spatial resource management alternatives in Amendment 10 are intended to augment and compliment, rather than supplant the existing conservation regulations of the FMP. Instead of annual day-at-sea allocations for vessels to fish anywhere in the EEZ, Amendment 10 proposes to spatially allocate this fishing effort via area-specific day-at-sea or trip allocations. This change would create a more optimal distribution of fishing effort, postponing mortality on small scallops and improving yield, and reducing total fishing time to achieve the fishing mortality targets. Therefore, spatial management would focus fishing effort on larger, more valuable scallops in area where the effort is more efficient.

Other measures, such as increasing the ring size to 4-inches, may also improve efficiency thereby reducing fishing time and possibly bycatch and habitat impacts[15].

The spatial effort (area specific) allocations require some compromises, however. Previously, the FMP's conservation measures were designed to achieve conservation objectives, but also maintain flexibility in the historically mobile fishery. The ability for fishermen to decide where and when to fish has been one of the hallmarks of independence that fishermen value. Amendment 10 would limit, yet preserve this flexibility by allocating fishing rights by area and possibly allow fishermen to trade area-specific allocations among themselves on a one-for-one basis.

Amendment 10 is needed because new science indicates that higher scallop yield can be achieved with less impact on the marine environment. Administrative and enforcement costs may increase, but this increase could be more than offset by the tangible and intangible benefits accruing from a healthier marine environment and scallop resource. The Magnuson Act requires the Council to amend its FMPs from time to time, when the best available science indicates that the FMP is not achieving its objectives.

In the 1996 reauthorization of the Magnuson-Stevens Act, Congress recognized that one of the greatest long-term threats to the viability of commercial and recreational fisheries is the continuing loss of marine, estuarine, and other aquatic habitats. To ensure habitat considerations receive increased attention for the conservation and management of fishery resources, the amended Magnuson-Stevens Act included new EFH requirements, and each fishery management plan must now include specific EFH provisions. Section 303(a)(7) of the Magnuson-Stevens Act requires that each FMP describe and identify EFH for the fishery based on the guidelines established by the Secretary (50 CFR part 600, Subpart J), minimize to the extent practicable adverse effects on EFH caused by fishing, and identify other actions to encourage the conservation and enhancement of EFH. The description an identification of EFH is applied as included in Amendment 9 to the Scallop FMP of 1998.

4.1 Goals of Amendment 10

The Council adopted the following three goals to be the focus of efforts to revise the FMP and improve scallop management.

A. To revise the FMP and improve the management of the resource

The Magnuson Act requires the Council to review its plans from time to time and to amend them if new regulations might improve the plan's ability to meet its objectives.

B. To update the analysis of cumulative impacts of the FMP on the human environment

NEPA requires the NMFS to review its fishery management plans and prepare a Supplemental Environmental Impact Statement on the cumulative impacts of the FMP, considering a broad range of reasonable alternatives that could reduce adverse impacts.

15 The impacts will also depend on the redistribution of fishing effort which may have positive or negative bycatch and habitat implications. These effects are analyzed more thoroughly in Sections 8.3 an 8.5.

C. To re-evaluate the Essential Fish Habitat (EFH) components of the Atlantic Sea Scallop FMP and minimize adverse effects on EFH

In compliance with a recent court order, the Council is considering new alternatives to minimize adverse effects on essential fish habitat (EFH). New evaluations of how scallop EFH is defined is being considered separately from Amendment 10.

4.2 Objectives of Amendment 10

The Council also identified 12 management problems that should be addressed, either directly or indirectly by measures proposed in the amendment. These scallop management problems were:

1. The scallop yield is below its maximum potential. Reasons for this include small scallops being vulnerable to fishing and non-catch mortality, large scallops being inaccessible to the fishery, and scallops being harvested during less favorable times of year.
2. Full-time scallop vessels are underutilized because they are limited to fishing 120 out of 365 days per year. Although this is presently sufficient for most vessels to be profitable, it potentially raises problems for retaining qualified crew, efficient use of capital, and effects on other fisheries from scallop vessels fishing for scallops and other species while not on a day-at-sea.
3. Unused fishing effort that is allocated to permit-holders is a potential threat to scallop management and other fishery resources
4. Scallop vessels using trawls target and catch smaller scallops than vessels using dredges.
5. Vessels with general category scallop permits have been prevented from fishing within closed areas that re-open to scallop fishing and may not benefit from area closures or other management that improves yield.
6. Finfish bycatch can be too high, relative to the objectives for other FMPs, preventing the scallop fishery from achieving optimum yield.
7. Sensitive habitat in some areas is adversely affected by scallop fishing
8. The fishing year and the management process is out of sync with annual surveys that produce data for stock assessment
9. Present scallop management is complicated by the mixture of scallop sizes in previously closed areas and the variability of the resource. Other factors need to be considered anew for each framework, increasing the complexity and effort needed to alter fishery regulations.
   The current framework adjustment process is time-consuming and prevents the Council from making progress on amendments
10. The impacts of scallop fishing and methods to reduce these impacts on Essential Fish Habitat need more consideration and analysis
11. Obtaining an Experimental Fishing Permits for scallop research is complicated and should be streamlined.
12. Data collection and research is inadequate to monitor the effects of management actions on the fishery and the resource. Sea sampling on scallop vessels in unrestricted areas is too spotty to provide adequate statistics.

4.2.1 Primary objectives

Focusing on the amendment goals and the above problems, the Council identified nine primary objectives in January 2001. These primary objectives were intended to be addressed directly by one or more sets of management alternatives which would be identified in the draft amendment (see Section

5.3). Some of the alternatives might also address one or more of the primary objectives through secondary effects, spelled out in the amendment.

1. Improve yield and rebuilding potential by reducing mortality on small scallops

Fishing mortality on smaller scallops prevents the fishery from obtaining optimum yield, because too many scallops are caught before reaching optimum size. While Amendments 4 and 7 successfully improved size selection by the fishery and improved yield, more gains are possible through area rotation and possibly other management measures. During the early 1990's, the fishery focused on 3 year old scallops and few 4 year old scallops were found in the population. Now the fishery is targeting 4 and 5 year old scallops, and few 3 year old scallops are retained and landed. Area rotation promises to postpone mortality for about 3 years for areas with abundant year classes to allow the scallops to reach an optimum size for maximizing yield, at about 7 to 8 years old.

2. Reduce reliance on day-at-sea allocations to control fishing mortality, either by area-based management, by output controls, and/or gear restrictions. Improve the ability of the FMP to meet mortality targets and achieve optimum yield by increasing the proportion of scallop fishing that falls within controlled access programs.

Day-at-sea allocations, crew limits, and gear restrictions have effectively lowered fishing mortality, but during times of low productivity, it becomes increasingly difficult to reduce day-at-sea allocations below current levels. In addition, day-at-sea allocations can sometimes be an imprecise way of controlling fishing mortality, due to uncertainties in the number of vessels that will fish, the number of days they actually use, and the amount of fishing time expended per day. Other limits on fishing could reduce the risk associated with this uncertainty.

Also, during the 1990's, the amount of landings from scallop vessels not on a day-at-sea was negligible. As the limited access day-at-sea allocations were lowered and the resource rebuilt, there were more concerns over this source of fishing mortality with few regulations. The uncertainty associated with this lightly regulated source of mortality could be lowered by accounting for this source of mortality before making limited access day-at-sea allocations or by increasing the day-at-sea regulations to encompass more vessels that target sea scallops.

3. Modify the framework adjustment process and change the fishing year to shorten the time between the availability of data (surveys) and annual adjustments via the framework procedure

Presently, the Council begins preparing the Scallop SAFE Report in June and presents it to the Council in late August or early September. This report includes information from the previous fishing year and most recent survey, initiating the annual framework adjustment process. Due to the timing of the fishing year, the survey information in the report is over a year old, when delivered to the Council as the basis for initiating the annual framework adjustment.

Between the initial and final framework meetings, the Council begins analyzing alternatives for adjusting the plan's management measures. Late during this period, the preliminary annual survey results become available from the annual resource survey in August, making proper analysis difficult under very short time constraints. Final, audited survey results often do not become available until after the Council makes decisions at the final framework meeting in November, assuming that a proposed rule can be bypassed by the framework adjustment process. Publication of a propose rule and a 30-day comment period advances the framework schedule even earlier, making it even more difficult and unlikely that the prior year's survey information can be incorporated into the analysis for the next year's management regulations.

Since the annual survey must be conducted about the same time of the year to ensure the integrity of the time series and logistics prevent scheduling the survey at another time of year, moving the fishing year by a few months would alleviate this problem and allow the annual adjustments to rely on more current survey information.

4. Reduce and/or minimize bycatch mortality and habitat impacts

The Sustainable Fisheries Act requires the Council to consider alternatives for minimizing bycatch mortality and habitat impacts. Since these impacts are recognized as problems that result from scallop fishing, Amendment 10 should re-evaluate the effect of current regulations to minimize these impacts and consider practical ways for reducing them.

5. Re-evaluate and balance the mortality associated with equal effort allocations to fishing sectors using different gears

Beginning with Amendment 4 in 1993, the Council recognized that trawls and dredges have different size selection characteristics, arising from the way the gear operates and from the way it is used in the fishery. These selectivity characteristics contribute to varying amounts of scallop mortality per day-at-sea, one of the major controls on fishing mortality. Research has been conducted to identify methods to improve the size selection of scallop trawls, but no workable methods have been found. Therefore, to reduce the uncertainty in controlling fishing mortality allocations and improve yield from the fishery, the Council should evaluate alternatives to discourage fishing with methods or gears having poorer size selection characteristics.

6. Develop a program for vessels with general category scallop permits that occasionally target sea scallops to continue this practice with restrictions on participation or the amount of scallops that these vessels may harvest.

Scallop fishing by vessels under general category rules have become more prevalent and at least temporarily began comprising a greater proportion of total sea scallop fishing mortality. Any fishing vessel may obtain a general category scallop permit and there are over 2,200 permits already issued. Although most vessels with general category permits use them to allow landings of normal scallop bycatch, any of them may begin targeting sea scallops if landing 400 lbs. of scallop meats is more profitable than using the time to fish for other species. As opportunities in other fisheries decline and/or scallop biomass in accessible areas improves, there is a potential for the amount of scallop mortality from this lightly regulated fishery to increase. Furthermore, the amount of monitoring on this component of the fishery is less than for landings by vessels with limited access scallop permits. Under these rules, limited access scallop vessels may also target sea scallops while not on a day-at-sea, thus also contributing to the uncertainty for the day-at-sea allocations to achieve the plan's mortality targets.

7. **To continue controlled access to groundfish closed areas, consistent with groundfish rebuilding and habitat protection objectives in the context of area rotation management.**

Presently, nearly 80% of the biomass for scallops on Georges Bank (50% for both Georges Bank and Mid-Atlantic scallops) is found within the Georges Bank groundfish closed areas. The scallops in most of these areas are furthermore older than optimal age for maximizing yield and represent a significant loss in benefits if they cannot be fished. Allowing scallop fishing in these areas could reduce the effects of scallop fishing elsewhere and significantly improve yield per recruit. Without access to these scallops, it also makes it much more difficult to initiate area rotation with closures without substantial financial hardship on the fishing industry. The amendment should consider alternatives that identify acceptable ways of fishing the scallops in the groundfish closed areas, without causing unacceptable bycatch mortality and habitat impacts.

8. **Develop a streamlined program to allow researchers to obtain an Experimental Fishery Permit to collect scallop fishery and resource data.**

Obtaining an Experimental Fishery Permit to conduct scallop and scallop-related research is very cumbersome and time-consuming, sometimes requiring the preparation of an Environmental Assessment or Environmental Impact Statement (EIS) by the research applicant. Sometimes the research has no more effects than commercial fishing for scallops, but the research (potentially identifying ways to fish with fewer impacts) is often inhibited by this cumbersome process. The amendment should consider alternatives for allowing certain types of scallop and scallop-related research, conducted under the analysis provided in the plan's EIS.

9. **Improve data collection and research on the scallop resource and fishery through a set-aside program to provide funding through industry participation.**

The TAC set-aside program for funding scallop trip sea sampling and for conducting scallop research has been successful, but limited to the controlled access areas in Framework Adjustments 11, 13, 14, and 15. The amendment should consider alternatives for extending these programs for scallop fishing throughout the resource, increasing the benefits from these successful programs.

4.2.2 Secondary objectives

The Council also identified 10 additional secondary objectives that it would like to address through incidental effects of the management alternatives in the draft amendment. These may be achieved through a combination of effects or in the first case below, are necessary procedures to achieve the primary objectives described above. Many of these objectives also address issues identified in the 10 National Standards in the Magnuson-Stevens Act.

1. **Re-evaluate and possibly modify the overfishing definition reference points (targets and thresholds for fishing mortality and stock biomass) to be consistent with new management policies (i.e. area rotation and/or gear modifications)**

2. **Improve scallop spawning potential, considering sources of variation such as oceanographic factors and man-made effects**
3. **Improve total productivity for all related species in the fishery**
4. **Maximize the social and economic benefits to the industry and the nation**
5. **Minimize adverse impacts on the industry while rebuilding the resource**
6. **Maximize industry flexibility to adjust to resource variation**
7. **Minimize regulatory complexity and cost to reduce administrative costs and improve enforcement**
8. **Reduce and minimize uncertainty about future regulations**
9. **Minimize adverse impacts on communities, ensuring fair and equitable access to the scallop fishery**
10. **Improve safety at sea**

5.0 DESCRIPTION OF MANAGEMENT ALTERNATIVES AND RATIONALE (Amendment, EIS, RFA)

5.1 Summary of Proposed Action and Initial Allocations

This section describes the final alternative approved by the Council at the August 13-14 and September 16-17, 2003 meetings and is the proposed action for Final Amendment 10. Based public comments and the DSEIS analysis as well as scientific advice since public hearings, the Council selected alternatives from among the preferred and non-preferred alternatives, sometimes choosing or revising the specifications and establishing the way an alternative should be implemented to improve the FMP's ability to meet its objectives.

Where it makes sense to do so, the sections below may refer to existing text in other sections that describe the alternatives, but in other cases it is necessary to describe the final alternative completely, incorporating all final revisions in the descriptions. To avoid confusion, the "preferred" labels for alternatives in Section 5.5 of the draft amendment were removed in the final document (see Section 5.3), since the Council sometimes selected a non-preferred alternative or revised the preferred alternative based on the comments and additional scientific advice. Thus, the final alternatives and proposed action described in this section are based on either a preferred or non-preferred alternative in Section 5.3, but modest differences from an alternative in the draft amendment will be present, reflecting the final Council decisions. The final alternatives described below furthermore identify specifications that were included as a range of choices in the draft documents.

Also, to be clear, the Council approved continuing to use the status quo overfishing definition to determine when a stock is overfished or overfishing is occurring, but moved the minimum biomass threshold from $\frac{1}{4}B_{MSY}$ to $\frac{1}{2}B_{MSY}$. Perhaps a little confusing, the title of the disapproved overfishing definition alternative is the "Proposed Overfishing Definition", because it was originally proposed by the PDT for consideration in Amendment 10 and has no other name. Only the status quo overfishing definition is being proposed in the final Amendment 10 alternative, with a slight modification of the minimum biomass threshold to improve compliance with the National Standard 1 guidelines.

Sections 5.2 and 5.3 of the DSEIS described the combination of the preferred alternatives and the potential initial area management beginning in 2004. As a result of the Council's decisions based on updated data that have come in since the DSEIS and based on public comment, this section describes the final alternative (some of which include formerly non-preferred alternatives) and initial allocations/specifications, replacing Sections 5.2 and 5.3 in the DSEIS. To review the discussion of the combined description of the DSEIS preferred alternatives and predicted initial area rotation in 2004, please refer to the draft document.

5.1.1 Overfishing Definition (Status quo)

The final alternative will use the status quo overfishing definition as described and justified in Amendment 7 to the FMP, except that the minimum biomass threshold will be raised from $\frac{1}{4}B_{max}$ to $\frac{1}{2}B_{max}$ and the data used to specify the biomass target, B_{max}, will be the mean stratified number of recruits from the 1982 to 2002 annual scallop surveys. Also, to clarify the potential ambiguity in the Amendment 7 language, for the purposes of biomass status determination (i.e. whether a stock is overfished), the FMP considers the sea scallops in federal and state waters to be a continuous stock for the purposes of management. Status determination of overfishing (i.e. whether the level of fishing is exceeding the maximum fishing mortality threshold) will also be made on a resource wide basis, because the FMP manages effort on a region-wide basis.

Unlike the way that the minimum biomass threshold was developed in Amendment 7, the new minimum biomass threshold will be used to determine when a scallop stock is overfished, i.e. at unacceptably low biomass, which would require the development of a new rebuilding program should a stock again become overfished. In the absence of other adjustments or annual fishing mortality specifications that rebuild the stock, the maximum fishing mortality threshold during rebuilding will be the one described by the control rule for the status quo overfishing definition, identified in Amendment 7.

Consistent with the status quo overfishing definition and applying risk averse management principals in the National Standard 1 guidelines and managing the fishery as a unit, optimum yield is the annual amount of scallop biomass that may be landed to achieve the mortality target for the combined stocks. Total biomass and fishing mortality for the entire resource area, including scallops in closed areas, will be used for status determination with respect to the overfishing definition reference points. The value for the annual fishing mortality target is 80% of F_{max}. Day-at-sea and other allocations will be set to achieve this constant annual mortality target, unless the stock is overfished and being managed according to a rebuilding program. Specific management areas, e.g. controlled access areas, may have TACs based on fishing mortality rates that are above F_{max}, however, provided that the resource wide average does not exceed F_{max}. The Council may however set other annual allocations below that which would cause overfishing to occur, in order to meet other plan objectives, stabilize yield or day-at-sea allocations, and/or maximize net benefits.

The Council may adjust the values of the biomass and fishing mortality targets and thresholds by framework or amendment, based on updated analysis or upon recommendation of the Stock Assessment Workshop.

The status quo overfishing definition, as revised by Amendment 10 will read:

"If stock biomass is equal or greater than B_{max} as measured by the resource survey weight per tow index (currently estimated at 5.60 kg/tow for scallops in the Georges Bank and Mid-Atlantic resource areas), overfishing occurs when fishing mortality exceeds F_{max}, currently estimated as 0.24. If the total stock biomass is below B_{max}, overfishing occurs when fishing mortality exceeds the level that has a 50 percent probability to rebuild stock biomass to B_{max} in 10 years. A scallop stock is in an overfished condition when stock biomass is below ½B_{max} and in that case overfishing occurs when fishing mortality is above a level expected to rebuild in five years, or above zero when the stock is below ¼B_{max}"

These reference points form the basis for the Amendment 7 control rule shown in Figure 4:

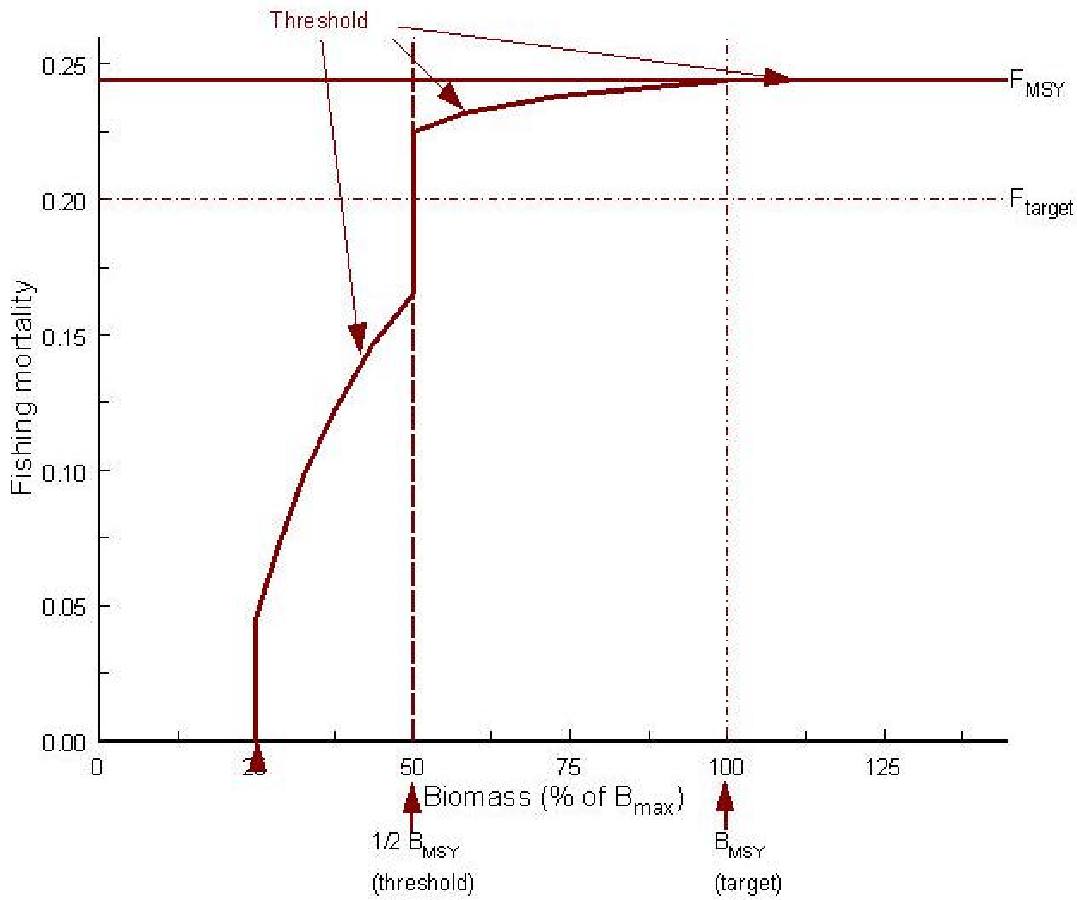


Figure 4. Existing overfishing definition control rule for sea scallops. Calculated threshold fishing mortality rates assume that the intrinsic rate of population growth is two times the value of F_{max}, then estimated to be F=0.24.

Specifications:

Based on scientific recommendations of SAW 32 (NEFSC 2001b) and updated stratified mean recruitment indices for 1982-2002, the biomass and fishing mortality targets and thresholds in the table below will be used as the basis for setting allocations and making status determinations. The biomass target and threshold for the Gulf of Maine is unknown because there is no annual survey and insufficient data to determine a value.

Table 7. Revised specifications (values) for overfishing definition targets and thresholds by stock.

<table>
<tr><th>Stock</th><th>Mid-Atlantic & Georges Bank</th><th>Gulf of Maine</th></tr>
<tr><td>Biomass target (B_{max}, kg/tow)</td><td>5.60</td><td>Unknown</td></tr>
<tr><td>Minimum biomass threshold (kg/tow)</td><td>2.80</td><td>Unknown</td></tr>
<tr><td>Fishing mortality threshold (F_{max})</td><td colspan="2">0.24</td></tr>
<tr><td>Fishing mortality target</td><td colspan="2">0.20</td></tr>
</table>

Rationale and explanation:

The status quo overfishing definition includes specifications for thresholds and targets for biomass and fishing mortality. A minimum biomass threshold will protect the scallop resource from low biomass that could affect spawning potential and the capacity of the resource to produce MSY. A maximum fishing mortality threshold protects the resource from an unsustainable rate of fishing that could deplete the resource.

Target biomass and a target fishing mortality rate are also included to simultaneously achieve MSY and apply risk adverse management to avoid overfishing while achieving a yield that is very close to MSY. The Council believes that management targets set to achieve a fishing mortality rate of 80% of F_{max} will achieve this goal. Future yield, however, will depend on where, when, and how the management targets are set, and achieving optimum yield may require specification of annual management targets that deviate from F_{max} applied to the entire resource.

At the present time, regional differences in size selectivity of the fishery and scallop growth or natural mortality are insufficient to define separate fishing mortality targets and thresholds. The NMFS therefore recommends that a common value for a fishing mortality target and threshold apply over all areas.

Using the 1982 – 2002 recruitment index time series, the values of Bmax for the Georges Bank and Mid-Atlantic regions area also similar, where they were once thought to vary by a factor of two (Georges Bank = 8.2 kg/tow; Mid-Atlantic = 4.1 kg/tow). While area-specific measures may be required to balance effort and achieve optimum yield, the NMFS recommends that one value is appropriate for determining when the scallop resource is overfished.

The fishing mortality reference points are also appropriate for Gulf of Maine scallops because although local difference in growth rates of Gulf of Maine scallops occur, they are not sufficient to justify applying a different fishing mortality target and threshold. Surveys in the Gulf of Maine, however, have been insufficient to enable estimation of separate biological reference points for the Gulf of Maine.

Overfishing occurs when fishing mortality exceeds the fishing mortality threshold. The threshold is F_{max} when biomass is above B_{max} and declines to zero as the stock approaches 25 percent of B_{max} (Figure 4). Between ¼B_{max} and B_{max}, the fishing mortality threshold was determined from the calculated rate of logistic biomass growth, assuming that the intrinsic rate of population growth is two times the value of F_{max} and F_{max} is a valid proxy for F_{MSY}. When biomass is between ½B_{max} and B_{max}, the threshold is based on a ten-year rebuilding calculation. A more risk-adverse strategy is employed in the current overfishing definition when biomass is lower, between ¼B_{max} and ½B_{max} a more aggressive five-year rebuilding calculation is employed. The target fishing mortality rate is 80% of the threshold value.

B_{max}, or the biomass target is calculated by multiplying the median recruitment by the estimated biomass per recruit when fished at F_{max}. Using the PDT's selectivity curve for 4" rings, the biomass per recruit is estimated to be 85.66 g/scallop for Georges Bank and 89.3 g/scallop for the Mid-Atlantic region. The 1982 – 2002 median recruits per tow is 64.0 scallops per tow for Georges Bank and 62.5 scallops per tow for the Mid-Atlantic region. Since the scallop resource area for Georges Bank comprises 46.6 of the total scallop resource area for both regions, the area-weighted product of the biomass per recruit and median number of scallops per tow give a B_{max} value of 5.60 kg/tow, which will be used as the biomass target until updated with new information. The minimum biomass threshold is ½ of this value, or 2.80 kg/tow.

Both B_{max} and F_{max} apply to all areas, regardless of their status (i.e. open or closed). Thus, it is possible to increase biomass or reduce mortality by closing more of the scallop resource area, as has occurred since 1994. Greater survival in the closed areas will increase biomass as scallops there grow and reduce mortality, if fishing mortality does not increase an equal amount in the remaining open areas. B_{max} cannot be calculated for scallops in the Gulf of Maine using this method, because there is no survey.

The maximum fishing mortality threshold and target are constant, i.e. they apply in all stock areas (including the Gulf of Maine) regardless of the age structure of the stock and its recent management history. Even if the majority of the resource had been subject to several years of closure and scallops were larger than optimum (i.e. natural mortality was removing more biomass than growth was adding), the resource-wide fishing mortality rate could not exceed F_{max}, even temporarily when it would improve long-term yield.

See Section 6.1.1 for a summary of how the status quo overfishing definition meets the criteria and guidance for National Standard 1.

5.1.2 Area-Specific Limited Access Days-At-Sea And Trip Allocations

Amendment 10 will continue to allocate annual days-at-sea to limited access scallop vessels and allow other vessels to target scallops with a 400 lb. scallop possession limit under general category rules. Vessels with limited access scallop permits will be authorized to target sea scallops with a legal scallop dredge or trawl, with time at sea counted against an annual day-at-sea (DAS) allocation. Up to now, the DAS allocations were made for three classes of permits (full-time, part-time, and occasional) and vessels could target sea scallops while on a DAS anywhere that was not already closed. A modification to this system was introduced by Framework Adjustment 11 in 1999 to allow limited access scallop vessels special access, where they were charged a fixed 10 days to land 10,000 lbs. of sea scallops[16]. The advantage of this change was that the vessels were expected to catch and land the 10,000 lbs. in much fewer than 10 days and this would help to reduce fishing effort on smaller scallops found elsewhere. Unfortunately, the benefits of this program, which were initially very successful, were mitigated by vessels not fishing in the re-opened controlled access areas and using those days to fish in the general, open areas.

Amendment 10 takes this program one step further and makes separate DAS allocations for open and controlled access areas, each tracked and monitored separately by VMS and by declared controlled access area trips. It retains the scallop possession limit for controlled access areas and like earlier programs, vessels will be charged a fixed number of days for each controlled access trip. The difference in the new allocation system is that vessels may not use controlled access days to fish in open fishing areas, and vice versa. Like the existing program, limited access vessels will be assigned a maximum number of trips in each controlled access area that may be taken, thus ensuring that the controlled access TACs and fishing mortality targets will not be exceeded.

Since some limited access vessels will not be able or inclined to fish in distant controlled access areas. It is therefore necessary to accommodate the existing fishing practices by allowing limited access vessels to exchange controlled access trips with another limited access scallop vessel that would prefer to fish in an area closest to its port. A vessel from Gloucester, MA or New Bedford, MA, for example, would be able to trade a Hudson Canyon Area trips with a vessel from Point Pleasant, NJ or Seaford, VA in exchange for the same number of trips to fish in Closed Area I.

[16] The 10,000 lb. scallop possession limit was gradually increased in Framework Adjustments 13, 14, and 15 to match the higher catch rates for the rebuilding scallop resource.

5.1.2.1 Annual allocations

The final alternative is area-specific day and trip allocations, a non-preferred alternative described in Section 5.3.3.1. Amendment 10 also applies a DAS tradeoff with a scallop possession limit for trip allocations for fishing in controlled access areas.

Annual day-at-sea allocations will be set to achieve a fishing mortality target of F = 0.20 or any other level that the Council determines will produce optimum yield and does not cause or risk overfishing. Day-at-sea allocations and use will be made separately and monitored for open and controlled access areas. Vessels may not use controlled access area days to fish in open areas, and vice versa.

The day-at-sea allocations for fishing in open areas (excluding controlled access areas) will be based on the allowable day-at-sea use, as adjusted for the number of active permits (i.e. those using days in the previous fishing year) and the percent of allocated days actually used by active permits. Part-time vessels will receive 40% of the number of full-time days allocated, while occasional vessels will receive $1/12^{th}$ of the number of full-time day-at-sea allocations, both rounded up to the nearest whole number of days. Vessels may also use their carry over days (up to 10 unused days may be carried over from the previous fishing year) to fish in the open fishing areas (but not in controlled access areas). When calculating open area DAS allocations, the allowable DAS use will be reduced by three percent to accommodate the set-asides in Section 5.1.8, for carrying out sea sampling, cooperative industry surveys, and scallop research.

The day-at-sea allocations for controlled access areas will be made by calculating the product of the total number of trips that are allocated to each area and the number of days charged for each controlled access trip. With five trips and a 12 DAS tradeoff, for example, a full-time vessel would receive 60 controlled access days. These days may be used in any controlled access area, provided the vessel has sufficient number of unused trips to fish in the area being fished. When calculating controlled access trip allocations, the TACs will be reduced by three percent to accommodate the set-asides in Section 5.1.8, for carrying out sea sampling, cooperative industry surveys, and scallop research. Except for sea sampling, the data monitoring and research conducted using funds generated from allowing controlled access possession limit exceptions need not be conducted within that or other controlled access areas, although it may be convenient or more cost-effective in doing so.

Part-time and occasional vessels will receive controlled access day-at-sea allocations that are equal to 40% and 1/12 of the number of full-time controlled access days-at-sea, rounded down to the next block of trips, but may be no less than one controlled access trip DAS charge. Using the above example, a part-time vessel would receive 24 controlled access days, equivalent to two controlled access trips, while an occasional vessel would receive 12 controlled access days, equivalent to one controlled access trip.

The number of controlled access trips in each area for a full-time vessel will be computed from a TAC that is equivalent to the annual fishing mortality target chosen for each controlled access management area, divided by the chosen scallop possession limit on controlled access trips and distributed among the number of active full-time, part-time, and occasional scallop permits, using the allocation method described above for allocating controlled access days. This calculation defines the maximum number of controlled access trips that can be taken for each controlled access management area, subject to the number of controlled access days available for full-time, part-time, and occasional vessels.

The sum of the maximum number of trips per vessel for each controlled access area is equal to the number of controlled access trips that full-time vessels will receive. The number of trips for part-time and occasional vessels will be 40% and 1/12th of the number of full-time controlled access trips, but may be no less than one trip if full-time vessels receive a controlled access trip allocation. Part-time and occasional vessels may fish the controlled access trips in any combination among the controlled access areas, up to the maximum number of trips per vessel assigned to the area by the above method.

The Regional Administrator should apply sanctions, when they are used to reduce the annual DAS allocations as a penalty for past law violations or other reasons, on a case-by-case basis. The Regional Administrator may reduce the open area DAS allocations, the controlled access DAS allocations, or both to account for the number of sanctioned DAS.

To achieve the annual resource-wide fishing mortality target requires more open-area DAS without access than with access, because without access a greater share of the resource would have zero fishing mortality and it would take more effort in the remaining open areas to take the same number of scallops without access. With access, the fishing mortality is spread across a broader range and it takes fewer days in the open areas to achieve the fishing mortality target.

Amendment 10 by itself does not allow access to the Georges Bank groundfish closed areas, which would be allowed under a joint Framework 16 for the Scallop FMP and Framework 39 for the Multispecies FMP, the latter that dictates what gear may be used in the Georges Bank groundfish areas and would set parameters to minimize catches and discarding of regulated multispecies. Therefore, standing alone, Amendment 10 should allocate 62 full-time open area days-at-sea on March 1, 2004 without access (see table below), then reduce the open area DAS allocations to 42 full-time open area DAS when Framework 16/39 is implemented during the fishing year.

Such a strategy would cause havoc in the fishery and scallop markets, causing economic disruptions and potentially compromising safety at sea. Fishing vessels would respond by using as many of the open area DAS as possible before the DAS were reduced during the fishing year, causing a derby style fishery to develop.

To avoid this situation, Amendment 10 will allocate 42 full-time open area DAS and 48 full-time Hudson Canyon Area DAS on March 1, 2004. If Framework 16/39 is approved and allows rotation access to the Framework 13 portions of the Georges Bank groundfish areas, NMFS would allocate the remaining 36 controlled access DAS (and three additional trips) when Framework 16/39 is implemented. Framework Adjustment 16 may re-estimate the TACs and associated DAS/trip allocations based on new information from 2003 surveys, when the data become available for analysis.

In case Framework 16/39 is not approved or does not allow access to the Georges Bank groundfish areas, the full-time open area DAS allocations will increase by 20 DAS to 62 on August 15, 2004 to be used through the remainder of the 2004 fishing year. Part-time and occasional DAS allocations would be adjusted in the same manner, proportionally to their allocation relative to full-time DAS allocations and the above procedures, as shown in the table below.

Specifications: Annual specification estimates for 2004 and 2005-2007 are shown in Table 8, following the procedure described above. Initial allocations for 2006 and future years would continue as shown for 2005, but any allocations would be re-evaluated and potentially adjusted by framework action.

On March 1, 2004, full-time limited access scallop vessels will receive 42 open area days, plus 4 trips and 48 DAS to use in controlled access areas. At that time, only the Hudson Canyon Area would be open for fishing and limited access vessels could take up to 4 trips there during the 2004 fishing year.

Part-time scallop vessels will receive 17 open area DAS, plus one trip and 12 DAS to use in controlled access areas. Occasional vessels will receive 4 open area DAS, plus one trip and 12 DAS to use in controlled access areas.

If Framework Adjustment 16/39 is approved and implemented to allow access to Georges Bank groundfish closed areas in 2004, the controlled access full-time allocations will increase in 2004 to 7 trips and 84 DAS and controlled access part-time allocations will increase in 2004 to 2 trips and 24 DAS. Occasional controlled access allocations would remain constant since one trip is more than 1/12th of a full-time allocation, but like full-time and part-time vessels, occasional vessels could use the one trip allocation in all re-opened controlled access areas that are available at the time of their use. In other words, before Framework 16/39 implementation, occasional vessels could fish the trip in the Hudson Canyon Area only. After Framework 16/39 implementation, occasional vessels could use the trip in the Hudson Canyon Area, Nantucket Lightship Area, or Closed Area I, whenever they are open for scallop fishing.

If Framework Adjustment 16/39 is disapproved or fails to allow Georges Bank area access, then on August 15, 2004, the full-time open area DAS allocation would increase to 62 DAS, the part-time open area DAS allocation would increase to 25 DAS, and the occasional open area DAS allocation would increase to 5 DAS.

Rationale and explanation: The allocation mechanism that assigns area-specific days and trips improves the ability of the FMP to achieve its objectives and prevent overfishing. Allocations of controlled access trips and days that cannot be used to fish in non-controlled access open fishing areas reduces the potential for overexploitation of scallops in open areas, thereby increasing yield-per-recruit and total yield.

Vessels may carry over up to 10 unused days from the previous year to fish in open non-controlled access areas to reduce risk and improve safety that may otherwise be compromised when vessels try to finish out an annual allocation at the end of the year. By prohibiting these days from being used in controlled access areas, the amendment improves the ability of the FMP to control mortality in controlled access areas without a hard TAC and without requiring real-time monitoring of landings to close the fishery.

DAS tradeoffs with a scallop possession limit for controlled access areas allows the FMP to allocate more DAS that it would without the tradeoff, but also has a benefit of reducing the incentive to fish as if it were a derby-style fishery. With projected catch rates around 2,400 to 2,800 lb./day, vessels will catch their scallop possession limit in much less time than they would be charged for the trip when the DAS tradeoff is based on a lower value, e.g. 1,500 lb./day. Thus when fishing in controlled access areas, there is no cost to the vessel to fish in less productive zones that have lower finfish bycatch or on smoother bottom to reduce gear hang-ups or wear. Secondly, it removes the incentive to deck load scallops and fish as hard as possible to maximize the catch per day, while fishing in a controlled access area where the gear's catch rates are expected to exceed the crew's shucking capacity.

The Council examined the performance over DAS tradeoffs ranging from 8 to 15 days, with a trip possession limit equivalent to 1,500 lb./day. In the short term (2004-2007), a 12 DAS tradeoff with an 18,000 pound scallop possession limit appears to be best, because:

1. Other than the effect of rounding and allocating trip-equivalent blocks of DAS and scallop lbs., it does not matter biologically which choice is made. Total bottom contact time is nearly the same in all scenarios – influenced mainly by the projected LPUE.

2. The allocated days (after considering the effect of the DAS tradeoff) is highest for this option, 84 days (seven trips) in 2004, versus 70 days (seven trips) in 2004 with a 10 DAS/15,000 lb. tradeoff.

3. There will be no hard scallop TAC for controlled access areas with area-specific day-at-sea allocations, according to the alternative selected by the Council.

4. Rounding up has the potential for significant overruns of the TACs, so without a hard TAC, simple rounding makes the best sense and allows combined controlled access landings of be very close to the TAC.

5. The analysis of the proportion of TAC landed, shows that in some years there could be slight overages assuming that all allocated trips are taken and they land 100% of the scallop possession limit. Even with the broken trip procedure and one-to-one trading this is unlikely, so overages of a maximum 12% (see graph below), should be acceptable.

Table 8. Initial allocations of area-specific days-at-sea and trips by management area for 2004-2005 and estimated DAS to achieve fishing mortality target in 2006. The allocations for individual areas represent the maximum number of trips and days that can be taken in each area by a limited access vessel, unless authorized to do so through an approved trip/day-at-sea exchange with another limited access vessel. Controlled access DAS allocations and charges assume a 12 DAS/18,000 lb. tradeoff.

Management area	Possession limit & DAS charge	Permit	Trip allocation			Day-at-sea allocation		
			2004	2005	2006 (default)	2004	2005	2006 (default)
Open fishing areas (excluding controlled access areas; begins on Aug. 15, 2004 if Framework Adjustment 16/39 does not allow Georges Bank groundfish area access) (Gulf of Maine, Georges Bank, Mid-Atlantic)	Does not apply	Full-time	Does not apply			62	117	152
		Part-time				25	47	61
		Occasional				5	10	13
Controlled access areas combined (Hudson Canyon Area allocation, begins March 1, 2004)	18,000 for 12 DAS	Full-time	4	3	0	48	36	0
		Part-time	1	1	0	12	12	0
		Occasional	1	1	0	12	12	0
Open fishing areas (excluding controlled access areas; begins March 1, 2004) (Gulf of Maine, Georges Bank, Mid-Atlantic)	Does not apply	Full-time	Does not apply			42	40	67
		Part-time				17	16	27
		Occasional				4	3	6
Controlled access areas combined (implemented via FW 16)	18,000 for 12 DAS	Full-time	7	7	4	84	84	48
		Part-time	2	2	1	24	24	12
		Occasional	1	1	1	12	12	12
Maximum trip and day-at-sea allocations by controlled access area								
Hudson Canyon Area (begins March 1, 2004)	18,000 for 12 DAS	All	4	3	Does not apply	48	36	Does not apply
Nantucket Lightship Area (implemented via FW 16)	18,000 for 12 DAS	All	2	Closed	Closed	24	Closed	Closed
Closed Area I (implemented via FW 16)	18,000 for 12 DAS	All	1	Closed	Closed	12	Closed	Closed
Closed Area II (implemented via FW 16)	18,000 for 12 DAS	All	Closed	4	4	Closed	48	48

6. The 12 DAS/18,000 lb. choice allows the greatest proportion (98%) of the TAC to be landed.

7. Total net revenues per vessel are the highest for this choice, about $333,202 dollars (see Figure 142), after deducting fishing costs for each trip length estimated from controlled access LPUEs. This value is sensitive to trip length and the percent of TAC potentially landed.

8. Short-term market effects from landing a large amount of large scallops are less than with higher scallop possession limits that were considered.

9. An 18,000 lb. possession limit will be taken in 6-8 days, depending on area, in 2004; 7-9 days in 2005, and about 8 days in 2006. Thus, the scallop possession limit could be caught by the average trip in less than 12 days for all years. This is about the same as the trip length for vessels making controlled access trips into the Hudson Canyon Area during 2001 and 2002.

5.1.2.2 One to one exchanges of controlled access trip and DAS allocations

Open area days-at-sea and controlled access area trips and days-at-sea will be allocated for the fishing year to use for scallop DAS trips beginning March 1 (or the start of the fishing year if the date later changes). Vessels will be able to re-balance their controlled access trips to fish more economically (or for any reason) by exchanging trips and days with another limited access scallop vessel having controlled access area allocations.

Limited access vessels can exchange controlled access trips with one or more other limited access vessels within the first three months of the fishing year, using a method developed and authorized by the Northeast Regional Office of the NMFS. This could involve joint submission of the exchange by a legal document that NMFS develops and authorizes for this use. NMFS may instead use any other means it deems appropriate for administration of the exchanges. Vessels, however, may not make use of the authorized controlled access exchange until at least 15 days from the time the documents are submitted and not before NMFS approves and authorizes the exchange. Additional exchanges will be authorized or approved for exchanges received by the Regional Office after three calendar months into the fishing year. Trip exchanges may be made between any limited access permit categories, or between any limited access vessels, whether or not they are authorized to use trawls or dredges only. Controlled access trips may also be exchanged between vessels having the same ownership, but must use this exchange process. Limited access exchanges between permit categories are permissible.

Exception: Amendment 10 by itself does not allow access to the Georges Bank groundfish areas, which may become available for scallop fishing during the 2004 fishing year and if so, limited access scallop vessels would receive additional controlled access allocations (see section above). Since the controlled access allocations for Georges Bank areas will not be available until later in the fishing year, limited access vessels will have a three-month window to execute trip exchanges after the implementation of the final rules for Framework 16/39.

Although the above allocation method allocates controlled access days and trips in a combined block, these exchanges would enable a vessel to fish for more trips in one controlled access area than the initial allocation, in exchange for reducing the number of authorized trips in another controlled access area. The following table provides an example of how an exchange would work:

Table 9. Example one-to-one exchange of controlled access trips, showing the application of day-at-sea allocations and charges. This example assumes a 12 DAS tradeoff.

	Management area	Vessel A		Vessel B	
		Trips	DAS	Trips	DAS
Before exchange	Open area allocation	Does not apply	72	Does not apply	72
	Controlled access area allocation	6	72	6	72
	Area 1, trips authorized	4	48 days to be charged	4	48 days to be charged
	Area 2, trips authorized	2	24 days to be charged	2	24 days to be charged
		Vessel A Exchanges two trips from area 1 to fish two more in area 2		Vessel B Exchanges two trips from area 2 to fish two more in area 1	
After exchange	Open area allocation	Does not apply	72	Does not apply	72
	Controlled access area allocation	6	72	6	72
	Area 1, trips authorized	2	24 days to be charged	6	72 days to be charged
	Area 2, trips authorized	4	48 days to be charged	0	0 days to be charged

Rationale: The DAS allocation and monitoring in the previous section prevents a vessel from using its controlled access days to fish in open areas elsewhere, as has been allowed until now. It could be inconvenient and costly for a scallop vessel to fish in a very distant controlled access area, which it might be forced to do if the days cannot be applied elsewhere.

Although quantitative data are unavailable, this management measure will reduce the adverse economic and community impacts of area-specific day-at-sea allocations, which otherwise might prevent a vessel from using its controlled access DAS and/or force the vessel to land scallops at distant and unfamiliar ports. It furthermore could improve safety of human life at sea, by allowing vessels to fish closer to port on familiar fishing grounds, and improve the ability of the FMP to achieve OY.

Administrative and enforcement costs associated with the exchange of controlled access trip authorizations should be relatively modest, when compared with the potential improvement in controlled access allocation programs and reduced economic costs to the industry.

5.1.2.3 Carry over days

Vessels may carry over up to 10 unused open-area days-at-sea from the previous fishing year and use them to fish in open, non-controlled access areas in the current year. Controlled access days may not be carried forward into the next fishing year, even when applied to the same area.

Rationale: Originally this measure was intended to address the potential requirement for limited access scallop vessels to use abnormally short trips at the end of the year to use their available day-at-sea allocations, which would otherwise be lost. Doing so, also improves safety by reducing the likelihood that a vessel would have to make a trip at the end of a fishing year during inclement weather or under unsafe conditions.

The current allowance has proven satisfactory for the purposes it was intended to serve and has caused minimal increases in uncertainty for estimating day-at-sea allocations that would prevent overfishing. With 2003 DAS allocations, the potential effect is 8.33 percent, compared to the 20% difference between the target and threshold fishing mortality rates. Secondly, a potential increase in carry over days was proposed to mitigate the business risk associated with proposed changes in the fishing year. Since Amendment 10 will not change the fishing year, increases in carry over day limits are unnecessary.

5.1.2.4 Broken trip exemption

Vessels returning from a controlled access area trip with less than the scallop possession limit, due to an emergency, poor weather, or any other reason deemed appropriate by the captain will have the automatic DAS charge reduced, based on the amount of scallops landed. To terminate a trip and have a reduced day-at-sea charge, the Captain must notify NMFS of his intent to terminate the trip before landing; and report the reason for the termination, the hail weight of the scallop catch onboard the vessel, and the intended time and location of offloading and landing. In addition, vessel owners or captains must submit an application to receive credit for a broken trip adjustment, showing the actual amount of scallops landed, the date sailed, and the date when the vessel returned to a port (i.e. no longer on a DAS). This application must be received and acknowledged by the NMFS Law Enforcement Division before the broken trip may be retaken. Since controlled access DAS and trips cannot be carried over to the next fishing year, all broken trip applications expire at the end of the fishing year.

Vessels retuning from a controlled access area trip and having no scallops onboard to land will be charged two days-at-sea. Otherwise the vessel meeting the above conditions would be charged a minimum of 2 days-at-sea plus one day-at-sea for each 10 percent of the scallop possession limit onboard the vessel (i.e. landed).

Actual time will be charged against a vessel's annual day-at-sea allocation for trips that are longer than the DAS charges associated with the amount of scallop landings, unless a special exemption is granted by the Regional Administrator for extenuating circumstances that require the vessel to be towed to port by another vessel, to remain on station to assist in an official USCG search and rescue, or to aid another vessel in distress. Examples of the default broken trip day-at-sea charges are given in the table below:

Vessels that qualify for a broken trip day-at-sea adjustment will also be allowed to re-take the same trip later within the fishing year, the replacement trip having a possession limit that is reduced to account for remaining time from the original trip. The day-at-sea charge for this trip will be the remaining days-at-sea for that trip and the possession limit will be prorated at a 1,500 per day-at-sea equivalent. For example, a vessel charged two days for a broken trip could continue the trip later in the fishing year, but would be able to land 15,000 lbs. and would be charged 10 DAS. A vessel charged four days for a broken trip could continue that trip later in the fishing year, but would be able to land 12,000 lbs. of scallops (see table below). Adjustments for two or more broken trips from the same area may be combined in a "make-up" trip, provided that the scallop possession limit does not exceed 18,000 lbs.

After adjustments, more than one broken trip may be combined into one controlled access trip, as long as the total does not exceed the maximum scallop possession limit for controlled access trips for the area being fished, presently 18,000 lbs. of scallop meats for all controlled access areas.

Table 10. Schedule of day-at-sea charges for trips terminated early by limited access scallop making controlled access trips. This is an example day-at-sea charge schedule if the scallop possession limit is 18,000 pounds and the re-opened area day-at-sea tradeoff is 12 days.

Proportion of scallop landings to the scallop possession limit	*Example hail weight of sea scallops (meat weight, pounds)*	*Minimum day-at-sea charge17*	*Trip continuation*
	18,000 pound possession limit	12 day-at-sea tradeoff	
0 percent	Zero	2 days-at-sea	10 days; 15,000 lbs.
More than 0 to 10 percent	1 to 1,800	3 days-at-sea	9 days; 13,500 lbs.
More than 10 percent to 20 percent	1,801 to 3,600	4 days-at-sea	8 days; 12,000 lbs.
More than 20 percent to 30 percent	3,601 to 5,400	5 days-at-sea	7 days; 10,500 lbs.
More than 30 percent to 40 percent	5,401 to 7,200	6 days-at-sea	6 days; 9,000 lbs.
More than 40 percent to 50 percent	7,201 to 9,000	7 days-at-sea	5 days; 7,500 lbs.
More than 50 percent to 60 percent	9,001 to 10,800	8 days-at-sea	4 days; 6,000 lbs.
More than 60 percent to 70 percent	10,801 to 12,600	9 days-at-sea	3 days; 4,500 lbs.
More than 70 percent to 80 percent	12,601 to 14,400	10 days-at-sea	2 days; 3,000 lbs.
More than 80 percent	Over 14,400	11 days-at-sea	1 day; 1,500 lbs.

Rationale: Although Amendment 10 will increase the likelihood that vessels will take controlled access trips, since they cannot apply those days to fishing trips elsewhere, the above broken trip procedure is needed to reduce fishing costs and encourage landings from controlled access trips where scallops are generally larger, which in turn may reduce the incentive to fish all of the open area allocated days.

A secondary effect would be to improve safety. In some cases, fishermen would be less inclined to keep fishing in the face of bad weather if they knew that they wouldn't loose the full controlled access day-at-sea charge if they came home early. At present, fishermen are unsure of whether they would be granted an adjustment and could be less prudent in bad weather because of this risk of not landing sufficient scallops to make a 10 day-at-sea charge (for example) a profitable venture.

Built into this procedure, there are three provisions which will prevent abuse of the system that might occur if there are loopholes which provide an advantage to fishermen. First is that any vessel that terminates a trip will automatically be charged two days-at-sea. A day-at-sea is worth over $6000 for a vessel that fishes 120 days and stocks $750,000 per year. Second, actual time at sea will be charged even with no scallop landings or a small amount, unless there are extenuating circumstances explained above that require the vessel to remain at sea. This would prevent vessels from catching large amounts of scallops in controlled access areas and despite a prohibition, transferring portions of the catch to other vessels. While this problem might not be a factor under normal circumstances, the broken trip procedure could open a new incentive to transfer catches to reduce the DAS charge for controlled access trips, unless the vessel would be charged for actual time at sea when landing small amounts of scallops.

In Framework Adjustment 14, the day-at-sea adjustment for broken trips became a non-preferred alternative because of law enforcement concerns. Although vessels would be required to hail the catch and report the intended time of landing, law enforcement interests thought that this program could create opportunities for abuse. A second factor in the decision was that NMFS believes that an existing program

17 Actual time at sea will be charged against the vessel's annual day-at-sea allocation for trips longer than these amounts, unless a special exemption is granted by the Regional Administrator.

performed satisfactorily and reduced the risk vessels face when fishing in the Hudson Canyon and VA/NC Areas. Under the existing program, vessels can apply for an adjustment to the day-at-sea charge for broken trips. NMFS has granted or denied adjustments on a case-by-case basis for vessels that claim a medical emergency, equipment failure, bad weather, or other legitimate reason to return early to port.

The amount of fishing activity in the Hudson Canyon and VA/NC Areas in 2001 was however significantly below desired amounts and only about ½ of the TAC was landed. Even fewer controlled access trips for the Hudson Canyon Area were taken in 2002, too. Part of the reason for the sub-optimal amount of fishing effort (and corresponding mortality reduction in other scallop fishing areas) is because catch rates outside of the Hudson Canyon and VA/NC Areas was around 1,800 pounds or more per day, reducing the attractiveness of fishing in the Hudson Canyon and VA/NC Areas with an 18,000 pound possession limit and a 10 day-at-sea tradeoff.

5.1.3 Area Rotation

Amendment 10 introduces a new form of management to the Sea Scallop FMP – area rotation. The concept in its simplest form is that areas that circumscribe beds of small sea scallops close before the scallops begin experiencing fishing mortality (from either non-catch mortality from gear damage, discarding, or landing) and then the areas re-open for fishing when the scallops are larger, boosting meat yield and yield-per-recruit.

Applying this simple concept is considerably more difficult, requiring consideration of the smallest practical areas to close, how long to close them, and how hard they should be fished when re-opened.

Except for the groundfish closed areas on Georges Bank (where scallops are large due to a prolonged closure to enhance groundfish rebuilding) and the Hudson Canyon Area (which was closed and re-opened on an ad hoc area rotation basis), a flexible-boundary area rotation system (described below) will apply.

5.1.3.1 General area rotation policies

Unlike the current management measures, area rotation will introduce a systematic structure that determines where commercial vessels may fish for scallops and for how long. Area rotation also establishes a planned set of criteria or guidelines that would regularly close areas to fishing when small scallops are more abundant than large scallops, due to abundant new recruitment, due to the effects of fishing, or both. Framework adjustments will consider areas for closure when the expected increase in exploitable biomass in the absence of fishing mortality exceeds 30% per year, and re-open to fishing when the annual increase in the absence of fishing mortality is less than 15% per year. These criteria define times when stock structure is composed of young, fast-growing scallops or older, slower growing scallops, respectively.

Three types of areas will be established under the area rotation management system: Closed rotation area, re-opened rotation area, open fishing areas. The general area rotation rules for these area classifications are described in Table 11.

Table 11. General management structure for area rotation management.

Area type	Criteria for rotation area management consideration	General management rules	Who may fish
Closed rotation	Rate of biomass growth exceeds 30% per year if closed.	• No scallop fishing allowed • Scallop limited access and general category vessels may transit closed rotation areas provided fishing gear is properly stowed. • Scallop bycatch must be returned intact to the water in the general location of capture.	• Any vessel may fish with gear other than a scallop dredge or scallop trawl • Zero scallop possession limit
Re-opened controlled access	A previously closed rotation area where the rate of biomass growth is less than 15% per year if closure continues. Status expires when time averaged mortality increases to average the resource-wide target, i.e. as defined by the Council by setting the annual mortality targets for a re-opened area.	• Fishing mortality target set by framework adjustment subject to guidelines determined by time averaging since the beginning of the most recent closure. • Maximum number of limited access trips will be determined from permit activity, scallop possession limits, and TACs associated with the time-average annual fishing mortality target. • Transfers of scallops at sea would be prohibited	• Limited access vessels may fish for scallops only on authorized trips. • Vessels with general category permits will be allowed to target scallops or retain scallop incidental catch, with a 400 lb. scallop possession limit in accordance with general category rules.
Open	Scallop resource does not meet criteria to be classified as a closed rotation or re-opened controlled access area	• Limited access vessels may target scallops on an open area day-at-sea • General category vessels may target sea scallops with dredges or trawls under existing rules. • Transfers of scallops at sea would be prohibited	All vessels may fish for scallops and other species under applicable rules.

Area rotation also allows for differences in annual fishing mortality targets to catch scallops at a higher than normal rate, precisely (used in a relative sense) when the scallops are at an optimum size. This optimum is defined by a biomass growth rate that declines as scallops age and falls below losses due to natural mortality. Interestingly, it also is defined by a gear efficiency vector with scallop size (see comparison of 3 ½ and 4-inch rings in Section 8.2.8), reducing the tow time (and environmental impacts) needed to catch scallops that maximize yield (appropriately reduced to account for risks due to uncertainty and to achieve economic and social objectives). Thus when scallops are abundant and near the optimum size, fishing mortality should be higher at that time, than it would be if fished continuously the appropriate level that would otherwise achieve maximum yield-per-recruit.

One way to account for temporary changes in annual fishing mortality is by using time averaged fishing mortality, such that the average for an area since the beginning of the last closure will be equal to the resource-wide fishing mortality target (80% of F_{max}, estimated to be F=0.20). To do this, framework adjustments should set either the length of time when a rotation area is deemed to be "re-opened, controlled access", or set the annual fishing mortality target for recently re-opened areas should in advance within the framework adjustment that establishes and implements controlled access for a re-opened rotation management area. The Council will decide this issue based on resource conditions and projected results when considering re-opening a rotation closure by framework adjustment. Nonetheless the potential choices and approach are described below. The choices may also be affected by length of closure and whether other new controlled access re-openings are foreseeable in the near future when a framework adjustment is made.

For example, after a closure period of three years and a planned re-open period of another three years, the time-averaged fishing mortality target is 0.4 [i.e. 0.2 times 6 years divided by 3 years (the total period as a re-opened area)]. A useful variation on this calculation (and one that is risk adverse and reduces variability in landings) is to catch scallops at less than 0.4 in the first re-opened year, at 0.4 in the second year, and higher than 0.4 in the third (and last) re-opened year. The first year might be fished at a rate of 80% of the time averaged target (or F=0.32), the second year at 100% (F=0.40), and the third year at 120% (F=0.48; see Table 12).

In the example below, whether or not the annual fishing mortality target increases with time, the time-averaged fishing mortality declines to the norm in the seventh year (i.e. F=0.20). Also, in the seventh year (or whenever the time averaged fishing mortality target increases to the stock-wide target), the fishing area becomes reclassified as an "open" fishing area under general scallop fishing rules and under most of the strategies below, there would be no area specific limits or a hard TAC.

Variations on the above example include the length of the closure, the length of the recently re-opened period, and the "ramping" strategy applied to the annual mortality targets in the re-opened areas. The following tables show how this would work:

Table 12. Example of ramped fishing mortality targets for re-opened areas, compared to mortality targets with no rotation and simple rotation with constant fishing mortality targets when re-opened. See Sections **8.2.1** and for analysis of impacts.

YEAR	Year N	1	2	3	4	5	6	7 to N	1	All
No rotation	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Status	**Open**	**Closed**	**Closed**	**Closed**	**Re-opened**	**Re-opened**	**Re-opened**	**Open**	**Closed**	**Average**
Simple rotation	0.20	0.00	0.00	0.00	0.40	0.40	0.40	0.20	0.00	0.20
Ramped rotation	0.20	0.00	0.00	0.00	0.32	0.40	0.48	0.20	0.00	0.20

Table 13. Management policies and fishing mortality targets for rotation areas.

Area type	Rotational management policy	Annual fishing mortality target and TAC
Closed rotation	Temporarily closed to scallop fishing	Set to zero
Re-opened, controlled access	• Area specific day-at-sea allocations and trips with possession limits and day-at-sea tradeoffs • Target TAC applies and trip allocations based on the number of trips with a possession limit calculated to achieve the target. A DAS tradeoff of 12 days will apply for each controlled access trip, no matter the actual trip length unless the trip qualifies for the broken trip adjustment exemption (Section 5.1.2.4). DAS charges will count against a combined pool of controlled access DAS allocations. • Trip allocations for part-time and occasional limited access vessels are 40% and 1/12th of the number of full-time trips that can be allocated, rounded down to the nearest whole number, but may be no less than one trip if controlled access areas are available. • Areas re-open to fishing at the beginning of the fishing year (Section 5.3.9.4), unless there is a seasonal closure to avoid unacceptably high bycatch of finfish or turtles.	Set by framework action to achieve the target mortality that the Council sets, consistent with time average guidelines, possibly following a ramped strategy to achieve optimum yield from the scallops in the re-opened area.
Open	• Open to scallop fishing under general rules • DAS allocations are determined from the target TACs consistent with the fishing mortality target at right, divided by the expected catch per DAS.	Equals a value such that the resource-wide average fishing mortality is expected to be 80% of F_{max}.

5.1.3.2 Adaptive closures and re-openings, with adaptive boundaries identified by survey when the areas are closed

The fully adaptive strategy will estimate whether various configurations of potential areas meet closure and re-opening criteria. Ten-minute squares (Map 3), each about 75 nm^2, will be the basis for evaluation of contiguous blocks that may close to postpone mortality on small scallops. A ten-minute square is considerably smaller than the annual biomass estimates from the existing resource survey will allow. Instead, a procedure utilizing an industry supported survey described in Section 5.1.8.2 would provide a detailed assessment of candidate rotational management areas.

The boundaries of the rotational management areas would be established by future framework adjustment, based on the distribution and abundance of scallops at size. The guidelines described below would keep the size of the areas large enough and regular in shape to be effective, while allowing a degree of flexibility to define closed rotation areas.

Like other area rotation alternatives, the decision about whether an area should close or re-open to fishing would depend on its expected potential biomass growth rate if closed, following pre-defined criteria. Areas will be considered for closure when the annual increase in scallop biomass is estimated to exceed 30% in the absence of fishing and would be considered for re-opening when the scallop biomass increase declines to below 15 percent per year in the absence of fishing. No additional closures would be considered if said closure would result in more than 25 percent of the exploitable scallop biomass to reside within closed rotation areas when a new area is considered.

5.1.3.2.1 Closure shaping rules

The following rules describe the Council intent and outlook for managing area rotation by this system, rather than as strict, invariable rules as written in the DSEIS. The rules below are intended as guidance on how and when rotation closures should be considered for implementation, but do not bind NMFS or the Council to close all areas that meet these criteria. Similarly, NMFS and the Council may deviate from these guidelines for re-opening and managing controlled access areas to achieve optimum yield or achieve plan objectives, in response to changing resource conditions or regulatory environments.

Boundaries and distribution of rotational closures

Scallop management regions would be divided into "blocks", each approximately 75 square nautical miles in area, by the existing grid of latitude and longitude lines at 10-minute intervals. [generally west of 72°30'W], the blocks spanning the depth range [ranging from 15 to 45 fathoms] are grouped into east-west "strips", each 10 nautical miles wide, north-south. The blocks would be grouped into five "regions":

- Gulf of Maine – [all blocks north of 42°20'N].
- Georges Bank – [all blocks south of 42°20'N and east of 68°30'W].
- South Channel – [all blocks south of 42°20'N, west of 68°30'W and east of 72°30'W].
- Hudson Canyon – [all blocks west of 72°30'W and north of 38°30'N].
- Southern – [all blocks south of 38°30'N]

Within these regions, the following rules would apply to determine the number and configuration of areas that would be closed to scallop fishing until the potential biomass growth rate declined below the minimum threshold, reclassifying by framework action the area as "re-opened, controlled access".

Number of Closures

Unless the combination of all other closed areas in a region exceeds the maximum acceptable closure extent, there will be one and no more than one scallop rotational closure in each region at any time, except the Gulf of Maine region. In that region, there may be either zero or one scallop rotational closure at any time. Areas indefinitely closed to scalloping (to minimize bycatch or habitat impacts, or for other reasons) will not be considered "rotational closures" for this purpose. If areas are temporarily closed to scalloping by management measures outside of this scallop rotation system, those areas may be (but need not be) considered to fulfill this requirement for having a rotational closure in each region.

Minimum Closure Sizes

Closures may be larger than but may not be smaller than:

- Georges Bank region: 9 blocks arranged in a 3x3 square.
- Hudson Canyon and Southern regions: 3 adjacent strips.
- Gulf of Maine and South Channel regions: Any 6 contiguous blocks, where blocks are considered to be contiguous if it is possible to pass from one to any of the others by only crossing the boundaries of abutting blocks within the six.

Where a closure spans the boundaries of two or more regions, it shall be at least as large as the minimum size for any of the regions concerned. In the Hudson Canyon and Southern regions, strips may only be closed or re-opened as whole units.

Maximum Closure Extent

Closures in each of the five regions may not close more than 25 percent of the exploitable scallop biomass when new closures are considered. In no case will areas be closed under this rotational system if doing so would result in the total area closed to scalloping (including all closed areas, not simply rotational closures) exceeding 50% of the productive blocks in a region. For this purpose, the sum of the total blocks and that of those in closures will be weighted by the relative productivities for the ten-minute squares in a region (Map 2). Blocks that are cut by the boundaries of federal waters or by the boundaries of closed areas will be weighted pro rata to their included area. Similarly, no areas will be closed under this system if doing so would result in 75% or more of the scallop biomass in a region (as estimated by the best scientific estimates available) being in areas closed to scalloping.

If some blocks in a region are subject to seasonal closures to scalloping, the above requirement must be met at some point during the year. In addition, no areas will be closed under this rotational system if doing so would result in the total area closed to scalloping (including all closed areas, not simply rotational closures) at any point during the year exceeding 75% of the productive blocks in a region, with the weighted sum calculated as above. Similarly, no areas will be closed under this system if doing so would result in 90% or more of the scallop biomass in a region being in areas closed to scalloping at any point during the year.

Boundaries

Straight lines will form all boundaries of rotational closures. The internal angles between such lines will never be greater than 180°, except that 270° internal angles may be used when the boundary lines that meet at such an angle both extend for at least 21 nautical miles. Where possible, the boundaries will follow the edges of blocks (north-south and east-west boundaries). However, where a rectangular closure would enclose one or more corner blocks that would not themselves merit closure, the Council may select a diagonal boundary aligned from one corner of a block to one corner of another. Long-term closures abutting a rotational closure will be considered when applying this rule.

<u>Basic guidance for closures</u>

Subject to the above guidelines, the areas to be included in each year's closures shall be selected so as to include as many as possible of the blocks for which the annual potential increase has been estimated to be above 30% in the absence of fishing, plus as many as possible of those blocks closed in the previous year for which the annual potential increase has been estimated as 15% or more, while incorporating as few other blocks as possible.

When it is not possible to include all of the blocks for which the annual potential increase exceeds the relevant levels, preference may be given to closing those with higher values of the product of current biomass and annual potential increase.

Low-Biomass Blocks

Blocks with scallop biomasses currently estimated as less than 400 tons of meats in the block will be treated as having zero annual potential increase when applying the basic rule. They may be included in rotational closures, however, when necessary to satisfy the requirements of the invariable rules.

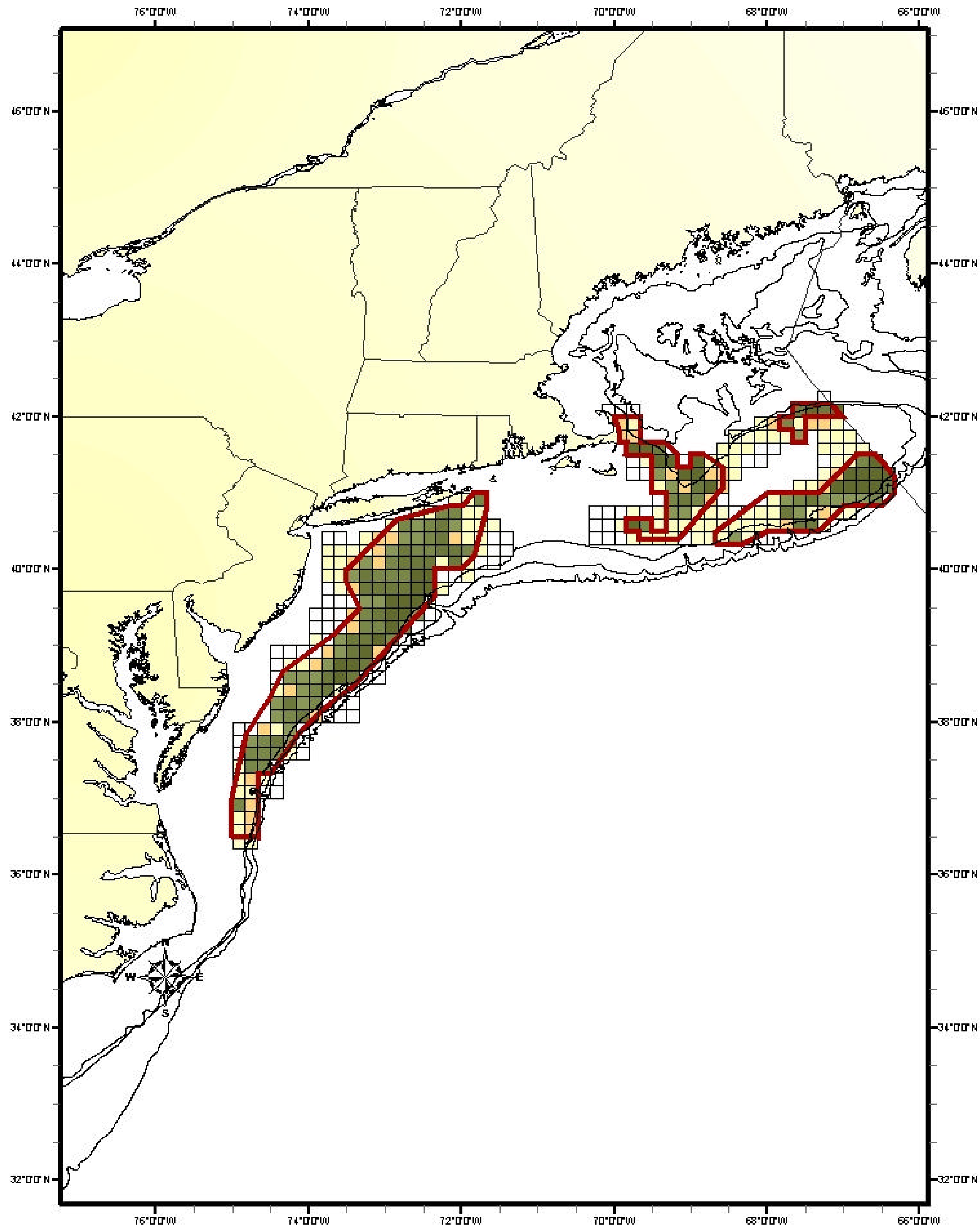
Closure Expansion

Blocks abutting a block in either the Georges Bank or South Channel regions that itself meets the annual potential increase requirements of the basic rule may be included in a closure if the directions of water movement are such that dispersal of scallops into the additional block from a closure is probable. Other blocks will only be added to closures when essential to meet the requirements of the invariable rules.

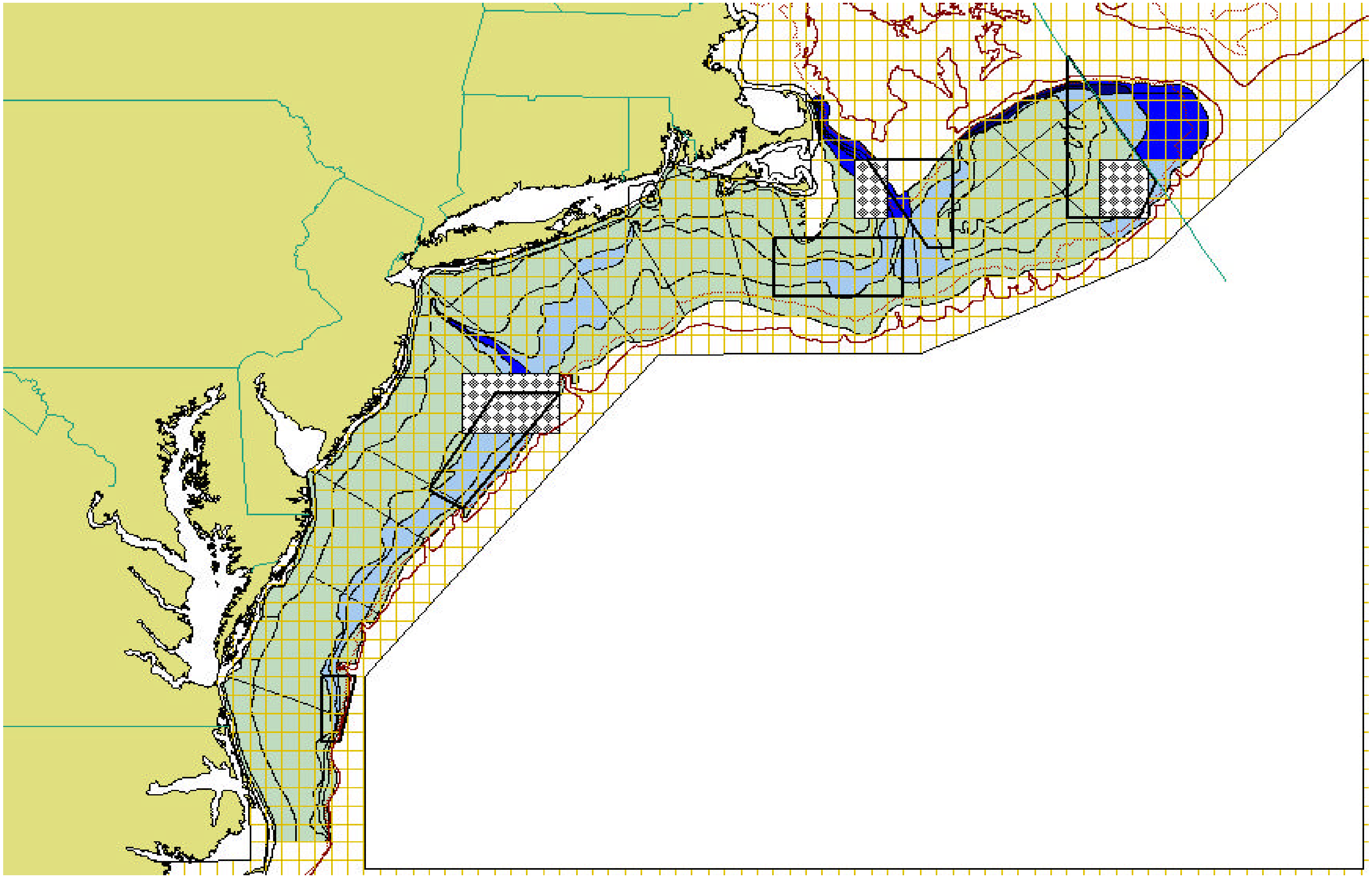
Overall Guidance

Except where required to meet the minimum of one closure per region, each rotational closure must, as a whole unit, meet the requirements of the basic rule. For that purpose, the biomass-weighted average of the annual potential increases of the blocks included in the closure (with any part blocks further weighted by the proportion of their areas in the closure) must equal or exceed a biomass-weighted average of the 30% target for those blocks not currently closed and 15% for those under rotational closure in the previous year. Any long-term closures will be excluded from these calculations.

The average scallop biomass in the blocks included in the closure (with any part blocks weighted by the proportion of their areas in the closure and excluding any long-term closures) must exceed 400 tons of meats per block. If no closure in a region (except for the Gulf of Maine region) can meet these requirements, the minimum-sized closure which would enclose the largest sum, across its included blocks, of the product of biomass and annual potential increase for each block shall be selected for rotational closure.



Map 2. Map of estimated scallop productivity by rotation management area, distributed by average recruitment by ten-minute square in the 1982 – 2000 scallop survey. Darker shades (green) represent higher productivity levels. The polygons encircle areas of high productivity.



Map 3. Basemap for area rotation with adaptively managed boundaries, showing potential minimum size and example configurations of closures (hatched) to protect concentrations of small scallops. Other closures may also occur at any time subject to the above invariable rules.

5.1.3.2.2 Closure Process

Rotation area closures will be implemented by ad hoc or standard framework adjustments, utilizing the slate of framework measures that exist in the FMP as amended by Section 5.1.9.

Identification of appropriate closure areas would be based on either a combination of NMFS Survey and industry-based surveys or industry-based surveys alone. NMFS surveys are not designed to identify resource conditions at the level of precision on which this alternative is based. Therefore, if NMFS surveys are used, it could be used to identify broad areas which would need to be refined by further industry-based surveys, implemented via the measures described in Section 5.1.8.2. Alternatively, industry may identify areas during fishing activities and the Council may initiate a framework adjustment which will analyze and consider taking action to close new areas for rotation. In such cases, it will be crucial that NMFS establishes the program in Section 5.1.8.2 so that it is ready for use when the need arises.

5.1.3.2.3 Monitoring and Re-Opening

1. All closed blocks will be surveyed annually by a commercial scallop vessel with a NMFS survey dredge to determine current biomass, size composition and growth rates. These surveys will also extend over all blocks immediately adjacent to a closed one. They will also cover all blocks currently subject to re-opening TACs.
2. NMFS receives the data and calculates the "annual potential increase" of the scallops in each closed rotation area.
3. Block closures re-open on when appropriate and defined by framework adjustment or whenever the Council sets as a default opening date when the area closes, unless:

   a: The discovery of additional seed of younger year-classes, during the period of a closure, requires extension of that closure,
   b: The shaping of new closures requires re-opening in advance of the expected year, or
   c: An early re-opening is made under an Emergency Action (e.g. if mass mortality of scallops in closure is suspected).

   No other alterations to the timing of re-opening may be made without a Plan Amendment.

4. For each re-opening, a TAC will be set, based on survey estimates (corrected for catchability) of harvestable biomass and, for most blocks, a target fishing mortality rate calculated by applying time averaged mortality calculations. The biomass estimates will include scallops in all blocks immediately adjacent to the re-opening, provided that they will be open in the coming year. Such blocks will then be subject to the same TAC control as those in the re-opened area.
5. Based on the annual fishing mortality target for a re-opened area, a TAC will be calculated and the number of trips to allocate will be determined using a scallop possession limit which the Council will determine. Controlled access day-at-sea allocations will be calculated using a DAS/possession limit tradeoff that the Council establishes. Both controlled access trips and equivalent days will be allocated as one block, following the procedures described in Section 5.1.2.1. Each re-opened controlled access area will have a maximum number of trips that limited access vessels may take to that area, subject to one-to-one exchanges (Section 5.1.2.2), to avoid exceeding the areas TAC.

Rationale: Although this is the most complicated (and probably most costly to administer) area rotation alternative, it is intended to produce the highest benefits by protecting small scallops during their highest growth rates, and more accurately determine areas that should be closed. Improvements in yield and fishing efficiency, compared with fixed boundary area rotation alternatives, will result from temporal and geographic heterogeneities in age structure, growth, and recruitment that may not be captured by other alternatives.

The higher potential biomass growth rate criteria, compared to the other alternatives is believed to be warranted because the adaptive boundaries and frequent surveys will be able to earlier and better identify the concentrations of small scallops. As a result, the more dynamic and adaptive approach would better conserve smaller and faster growing scallops than an annual review process with fixed boundaries.

5.1.3.3 Rotation area management closures

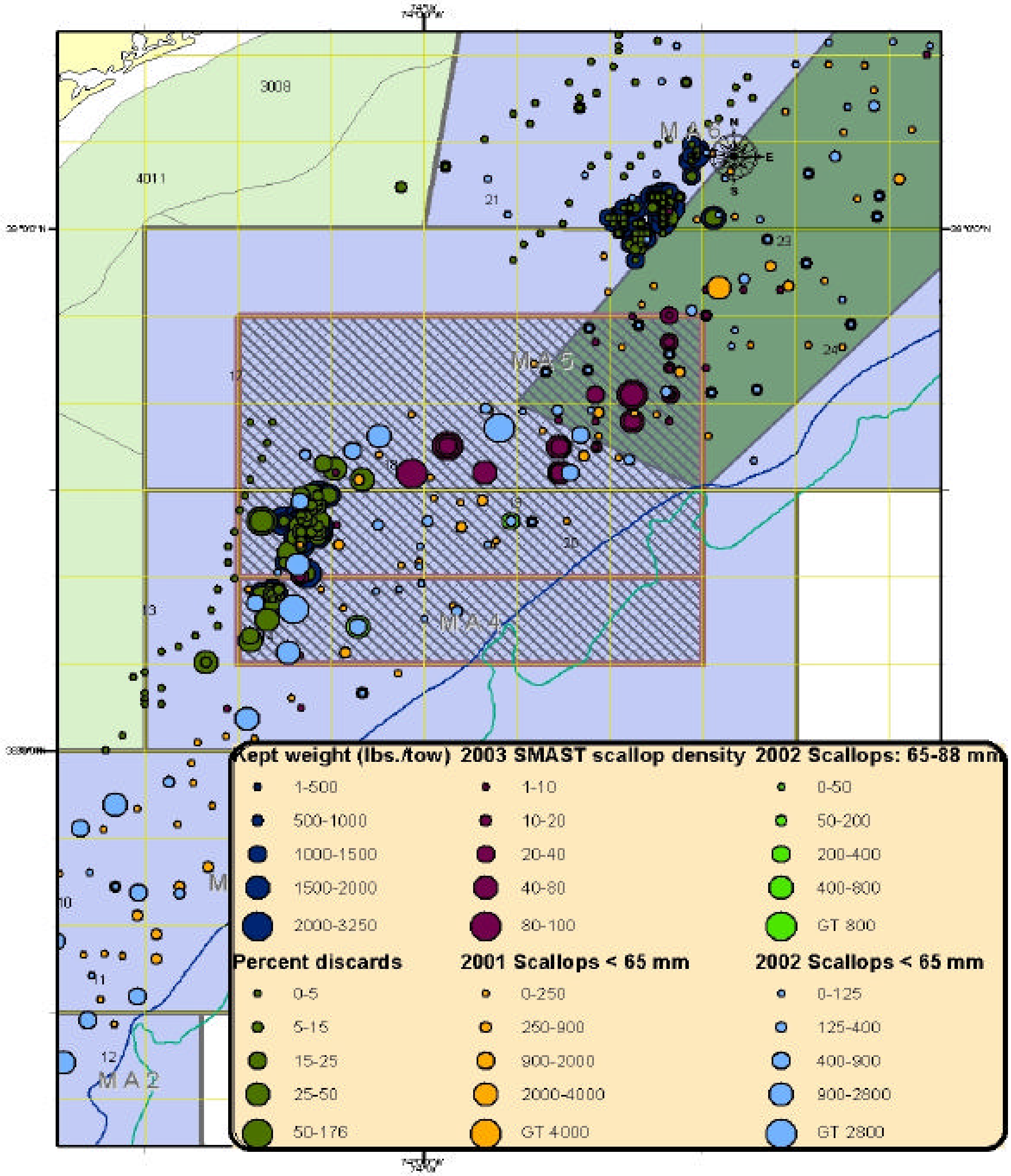
Using the principals of the rotation area management system described above, Amendment 10 will close an area in the Mid-Atlantic on March 1, 2004; encompassing beds where small scallops are abundant and prevalent. This area will closed for a default three years (re-opening on March 1, 2007), which the Council may extend or shorten by framework adjustment based on future conditions. The area, known locally as “the elephant trunk”, is composed of a rectangle of 15 ten-minute squares, shown in Map 4 having the coordinates in Table 14. This area overlaps areas that are open for scallop fishing in 2003 and part of the Hudson Canyon Area which is under controlled access limits. Both portions within the boundaries in the table below would close to scallop fishing and possession of sea scallops would be prohibited, unless fishing gear is properly stowed.

Table 14. Boundaries of “Elephant Trunk” closed rotation area.

Vertex	Latitude	Longitude
ET1	38°50’ N	74°20’ W
ET2	38°10’ N	74°20’ W
ET3	38°10’ N	73°30’ W
ET4	38°50’ N	73°30’ W

Rationale: The abundance of small scallops in this area appears to be substantially higher than other fishing areas and would benefit from a rotational closure. Large beds of small scallops were apparent within the closure area in the 2002 and 2003 R/V Albatross annual scallop survey and in the 2003 SMAST survey. Elevated scallop discard rates in this area were also apparent in the 2003 sea sampling data base for scallop fishing trips.

A closure of this area could substantially improve yield from the fishery, potentially offering the benefits attributable to the Hudson Canyon Area and Georges Bank closed areas. The analysis of the small scallop distribution is given in Section 8.2.5 (data also displayed in the figure below) and the benefits of the closure when it would re-open are integrated into the projections in Section 8.2.1. Like other controlled access areas that came before it, re-opening the area to fishing when the scallops are much larger improves yield, reduces fishing costs, reduces bottom contact time, and potentially reduces finfish bycatch. Precise estimates of the benefits of the closure are difficult because the application of controlled access for this area (e.g. target fishing mortality rates, seasons, etc.) are uncertain.



Map 4. Mid-Atlantic rotation area management closure for 2004-2007, shown as being hatched. This area is shown in relationship to the distribution of small scallops in the 2002 R/V Albatross survey and the identified seed beds in the 2003 SMAST video survey. Also shown are the distribution of kept scallop catch rates and discard proportions from 2003 sea sampling data on observed scallop trips. Fixed boundary rotation management areas used to analyze and evaluate the effects of area rotation are shown in blue and the Hudson Canyon Area controlled access area is shown in dark green.

5.1.3.4 Controlled access

The approved controlled access alternative will continue out the controlled access program for the Hudson Canyon Area, following a gradual increase in annual fishing mortality targets as outlined in Section 5.1.3.1. Controlled access to the Georges Bank groundfish closed areas will be implemented by Framework Adjustments 16 (scallop) and 39 (multispecies) according to the mechanical rotation of these areas described by Section 5.1.3.4. The VA/NC Area will no longer exist as a special, distinct management area on March 1, 2004.

Future re-openings of rotation area management closures would be considered following the guidelines described in Section 5.1.3.2, using the allocation procedures in Section 5.1.2.1. The Council will choose the duration of the controlled access program and thus the time-averaged annual fishing mortality targets that apply to the areas, when implemented by framework adjustment.

Following a rotation area management closure, areas are expected to re-open under a controlled management program designed to maximize yield. For each re-opened area, the Council will set a target annual fishing mortality rate for individual areas and estimate a total allowable catch (TAC). Dividing the TAC by a scallop possession limit and the number of active limited access scallop permits[18] in the prior fishing year, the Council will determine the maximum number of trips that limited access scallop vessels may take in each controlled access area. The combined sum of these trips times the DAS tradeoff is equal to the number of controlled access days allocated to full-time vessels. Since part-time and occasional vessels will have a controlled access DAS allocation that is equivalent to 40% and 1/12th of a full-time allocation, rounded down to the nearest multiple of trips,

Specifications: All controlled access trips will have a 18,000 lb. scallop possession limit and would accrue 12 DAS to be charged against the vessel's annual controlled access DAS allocation, no matter the actual length of the trip unless it qualified for a broken trip exemption. Controlled access day-at-sea and trip allocations, and the maximum number of trips that a vessel may take in each controlled access area are shown in Table 8.

The Hudson Canyon Area (Map 5) will continue under the controlled access program for the 2004 and 2005 fishing years, then become a regular, open fishing area unless the controlled access program is continued or the area is closed later under the rotation area management guidelines in Section 5.1.3.1. The target fishing mortality rate for the Hudson Canyon Area is F=0.40 in 2004 and F=0.48 in 2005, following the time-averaged mortality guidance in Section 5.1.3.1.

Amendment 10 will not re-open the Georges Bank groundfish closed areas to controlled scallop access, but Framework Adjustment 16 to the Scallop FMP and Framework Adjustment 39 to the Multispecies FMP (planned for approval in early 2004 and implementation by summer of 2004) is expected to consider additional measures to minimize groundfish bycatch and allow access. Should the Council and NMFS approve Framework Adjustment 16 (and its Multispecies companion Framework Adjustment 39), controlled access for these areas would occur according to the provisions in access alternative 1 (Section 5.3.2.8).

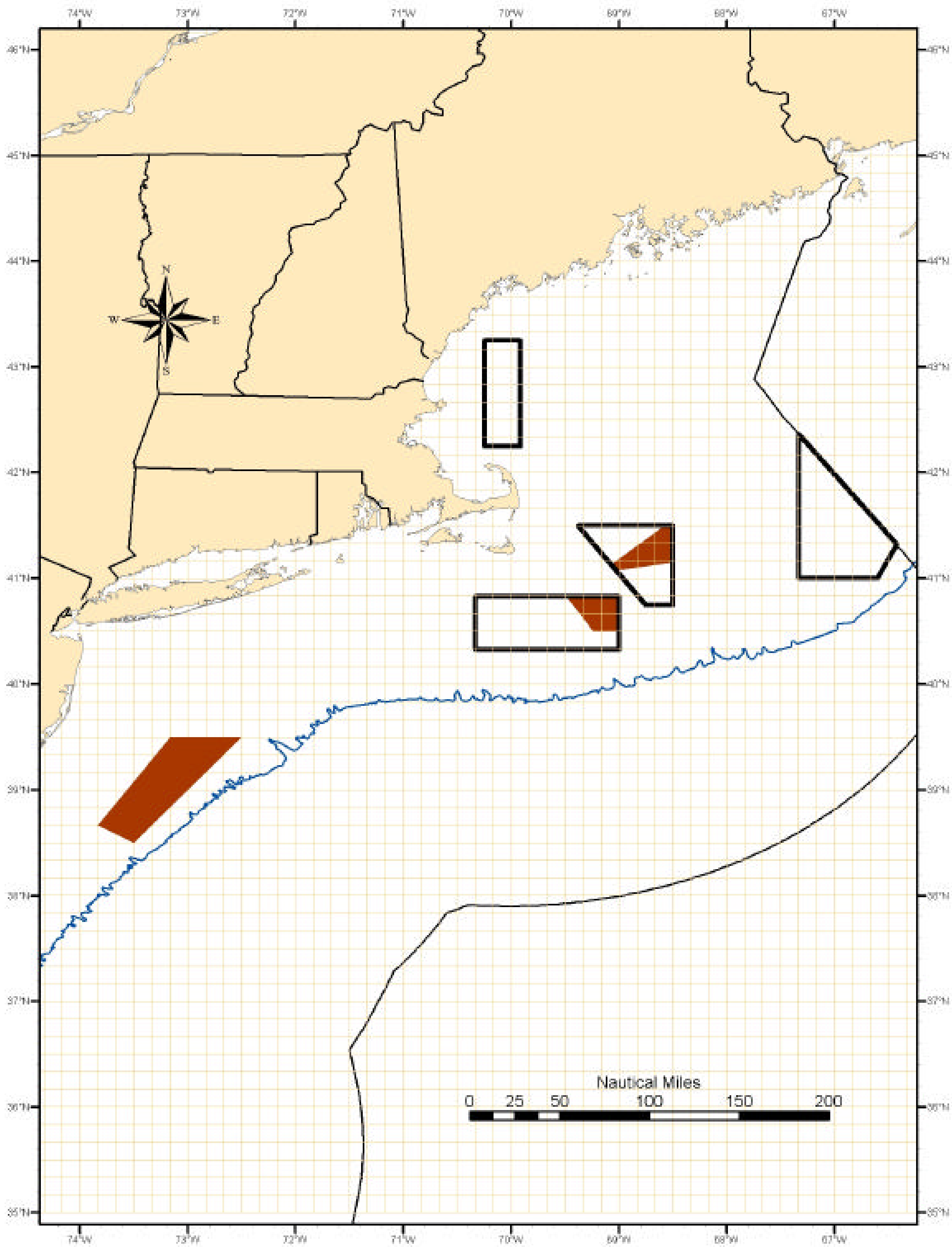
Although Framework Adjustment 39 may limit the duration of the controlled access openings, Amendment 10 specifies the order of mechanical rotation of the controlled access to the groundfish closed areas. During the 2004 fishing year, the portions of Closed Area I and the Nantucket Lightship Area that were opened in 2000 (Framework Adjustment 13) to scallop fishing (see Map 5) would open for

[18] An active permit is considered to be one that used one or more DAS in the prior fishing year.

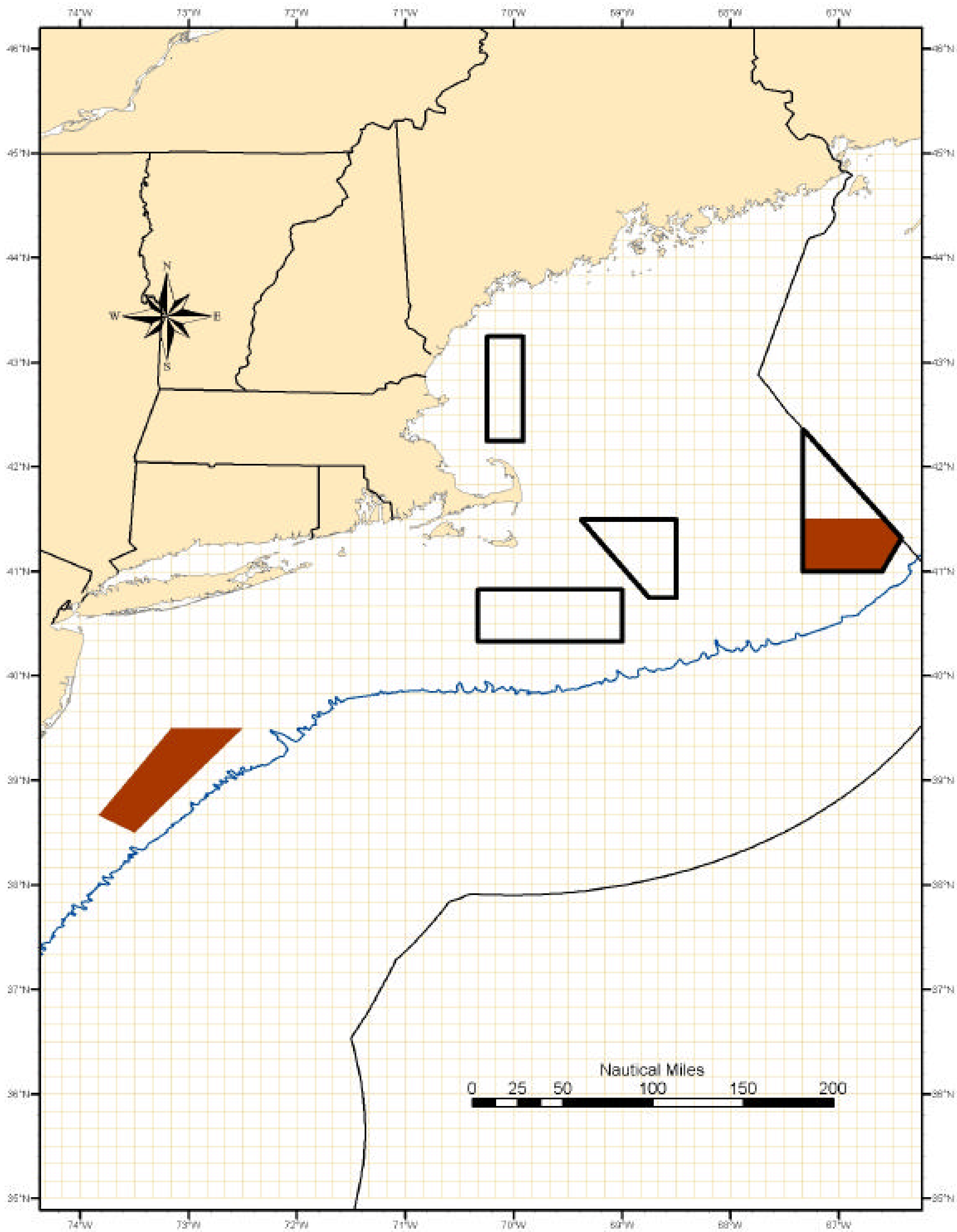
controlled access, with a fishing mortality target of F=0.40. In 2005-2007, the southern part of Closed Area II (Map 6) would open for controlled access with a fishing mortality target of F=0.20.

Table 8 shows the maximum number of trips and total, combined controlled access trip and day-at-sea allocations that would apply, subject to approval of Framework Adjustment 16/39. Framework Adjustment 16 would implement these allocations, subject to the groundfish bycatch limits and associated rules in Framework Adjustment 16 to minimize bycatch.

Rationale and explanation: This Hudson Canyon Area management program was described in Section 5.3 of the DSEIS and available for public comment. Proposed management alternatives for controlled access for the Georges Bank groundfish closed areas were described in Section 5.3.2.8. These controlled access management measures are needed to achieve OY, minimize bycatch and habitat impacts, and prevent derby-style fishing that might otherwise occur if these areas are re-opened with the limits that generally apply to limited access and general category vessels. The normal general category possession limit will apply for vessels operating or fishing in re-opened controlled access scallop areas to enable their participation in and benefit from re-opened areas where they were prohibited from fishing during a rotation area management closure. The need for a special VA/NC Area management area no longer exists because the scallop population there do not exhibit characteristics of a re-opened controlled access area.



Map 5. Controlled access areas (shaded polygons) for the 2004 fishing year. The target fishing mortality rate will be 0.40 for all areas. The existing groundfish closed areas and a grid of ten-minute squares are shown for comparison.



Map 6. Controlled access areas (shaded polygons) for the 2005 fishing year. The target fishing mortality rate will be 0.48 for the Hudson Canyon Area and 0.20 for Closed Area I South. The existing groundfish closed areas and a grid of ten-minute squares are shown for comparison. For 2006 and 2007, only Closed Area II South will be open under controlled access rules and the Hudson Canyon Area will be subject to the general scallop fishing rules.

5.1.4 Gear Restrictions

5.1.4.1 Minimum ring size

Beginning September 1, 2004, scallop dredges onboard vessels having limited access and general category scallop permits must have rings throughout the chain bag that are no less than 4-inches in diameter. Beginning March 1, 2004, all scallop dredges onboard vessels on a Hudson Canyon Area controlled access trip must have rings throughout the chain bag that are no less than 4-inches in diameter.

Monitoring compliance with the 4-inch minimum ring size requirement will follow existing procedures. Vessels fishing under an exempted state fishery are not subject to this requirement, unless required to do so by the state exemption provisions.

Rationale: This is the alternative originally described in Section 5.3.2.9, a preferred alternative in the DSEIS, applied to the entire resource. Increasing the ring size to 4-inches will improve size selectivity of scallop dredges, increasing yield-per-recruit and reducing the potential for scallop vessels to target smaller scallops. Experiments indicate that catches of 70-110 mm scallops are reduced and catches of larger scallops increase. Where scallops larger than 110 mm are available to the fishery, research has shown that a dredge with 4-inch rings catches more scallops per hour and reduces finfish and invertebrate bycatch (See Section 8.2.8). Vessels that are shucking capacity limit due to the crew size limits and shucking at sea requirements will therefore fish less time per DAS. As an added benefit, the use of dredges with 4-inch rings will reduce bottom contact time by 5-15 percent, since the dredge will catch scallops more quickly. Reducing bottom contact time will reduce finfish bycatch, reduce non-catch mortality of scallops that dredges encounter but do not retain, and could help to minimize EFH impacts. Since scallop populations have rebuilt to the biomass target and larger scallops are much more abundant throughout the resource than they have been in the past, requiring a minimum 4-inch ring size in all areas is appropriate.

Delayed implementation for six months until September 1, 2004 will allow manufacturers and gear suppliers to ramp up production to supply the fleet with new gear. Also scallop vessels will be able to use existing gear for a phase-in period, replacing the old gear with the new rings as it wears. Many scallop vessels replace dredge chain bags once or twice per year due to wear. On the other hand, 4-inch rings are available in the market, just not in quantities that can supply the entire fleet at the same time. The conditions in the Hudson Canyon Area are close to those that would benefit most from the 4-inch rings, where large scallops are abundant, but there is a mix of small to intermediate sizes as well. Vessels that cannot obtain 4-inch rings will be able to postpone Hudson Canyon Area controlled access trips, but may continue to use the 3½ rings elsewhere until September 1, 2004.

5.1.4.2 Twine top mesh

Beginning March 1, 2004, scallop dredges onboard vessels having limited access and general category scallop permits must have twine tops with mesh no less than 10-inches, diamond or square mesh. Scallop vessels may not have twine tops with less than 10-inch mesh onboard.

Monitoring compliance with the 10-inch minimum mesh requirement will follow existing procedures. Vessels fishing under an exempted state fishery are not subject to this requirement, unless required to do so by the state exemption provisions.

Rationale: This is the alternative in Section 5.3.5.3, a non-preferred alternative in the DSEIS, to minimize finfish bycatch. Increasing the minimum twine top mesh has proven successful for reducing finfish bycatch of many species when used in the controlled access areas since 1999. When applied in all areas (see note below about rebuilding and expanding scallop age structure), the 10-inch mesh will allow greater escapement of many species and help to minimize bycatch. Many small finfish and animals will benefit from escaping the dredge through the twine top.

Few problems associated with scallop loss have been reported, especially where large scallops are available and relatively abundant. Since scallop populations have rebuilt to the biomass target and larger scallops are much more abundant throughout the resource than they have been in the past, requiring a 10-inch minimum mesh in all areas is now appropriate.

Scallop vessels on controlled access trips have had to use 10-inch mesh twine tops since 1999, so the gear is readily available and can be easily adopted. A new twine top is relatively inexpensive, is frequently replaced due to wear, and can be installed in a dredge in less than an hour.

Although Section 5.3.5.3 in the DSEIS indicated that a six-month implementation delay would occur, the Council decided to require 10-inch twine top minimum mesh immediately when Amendment 10 is implemented. The alternative was changed to help address some of the concerns expressed by public comments concerning scallop fishery bycatch. The Council felt that the benefits of quicker implementation of larger twine top mesh requirements outweighed the cost, because vessels frequently replace twine tops due to customary wear, because of the relatively low cost ($300 – 500, plus about an hour or two to replace them), and because of the ready availability of twine tops from suppliers due to existing requirements to use them in the Hudson Canyon and VA/NC Areas.

5.1.5 Permit Restrictions

Except for vessels fishing on a multispecies or monkfish day-at-sea or fishing for scallops under a state-exemption program, vessels holding a limited access scallop permit may possess no more than 40 lbs. (18.14 kg) of shucked scallops or 5 US bu. (176.2 L) of unshucked scallops while not on a scallop DAS.

Vessels without limited access scallop permits may hold a general category scallop permit, which authorizes the vessel to possess and land on a trip up to 400 lbs. (181.44 kg) of shucked scallops or 50 US bu. (17.62 hl) of unshucked scallops, with no more than one trip per calendar day. This limit will apply to vessels holding general category scallop permits and vessels fishing under a Multispecies or Monkfish DAS in all open scallop fishing areas and re-opened, controlled access areas (including those re-opened for species other than scallops), unless the vessel is operating in a state-exempted fishery which authorizes the vessel to possess a different amount of scallops.. This measure does not supercede the groundfish gear regulations and a specific gear exemption may be required for vessels with general category permits to fish for scallops, using dredges or small mesh gear.

Rationale: The Council selected the alternative in Section 5.3.6.3, a non-preferred alternative in the DSEIS. Although some vessels with limited access scallop permits targeted scallops under general category rules while not on a scallop DAS, it was a loophole that has the potential for increasing mortality on sea scallops and exceeding the fishing mortality threshold. In addition, it would rob days from other limited access scallop permit holders if this source of fishing mortality is taken into account for setting allocations to meet annual mortality targets.

Other than requiring that limited access scallop vessels land a certain amount of other species while not fishing on a scallop DAS, the only practicable means for preventing limited access scallop vessels from targeting scallops under general category rules is to remove that authorization and its associated scallop possession limit. In some cases, scallop fishing gear (especially scallop trawls) is used to target other species and may be practicably indistinguishable for purposes of enforcement. Prohibiting the use of scallop fishing gear by limited access vessels when not on a DAS is therefore not practicable.

Some vessels with limited access scallop permits used this loophole to supplement their crew's income and keep their crew actively fishing for scallops. Other vessels took some time off, maintained their vessels, or fished for other species when they had no scallop DAS available. Nonetheless, no other FMP allows vessels with limited access permits to commercially fish for the plan's regulated species while not on a DAS.

Under area rotation, vessels with general category permits would be prohibited from possessing sea scallops in a closed rotation area. Allowing them to target and retain sea scallops in a re-opened, controlled access area would enable the vessels to recover the benefits that were gained as a result of the short-term costs of a rotation closure. Although there is a potential for vessels with general category permits to exceed the possession limit and/or transfer scallops within an area with a limited access scallop possession limit, the Council finds that the existing requirements for reporting and the enforcement capabilities are adequate to avoid this problem. The benefits of requiring VMS onboard general category scallop vessels that fish in controlled access areas do not justify the costs of requiring the vessel to install and continuously use VMS equipment.

5.1.6 Measures To Minimize Impacts On Essential Fish Habitat

5.1.6.1 Habitat Alternative 2 - Benefits of other Amendment 10 measures

This alternative identifies and assesses the incidental habitat benefits that are attributed to non-habitat-specific management measures in Amendment 10, and relies on these benefits to comply with the EFH provisions of the Magnuson-Stevens Act. There are several measures that are "carry-over" measures that have been in place for sometime which have benefited EFH, as well as new measures that will have additional habitat benefits. New measures adopted by the Council in the final alternative that are expected to have positive habitat benefits include:

- Days-at-sea limits in open access areas
- Gear modification (4-inch rings in scallop dredges)
- Promoting habitat research with funding through scallop set-asides
- Rotational Area Management

Resource management measures with positive habitat impacts that are incorporated into an open access strategy that will be implemented in subsequent framework adjustments include days-at-sea tradeoffs and trip adjustments for broken trips in limited access areas (Table 1). A "carry-over" management measure that has positive habitat impacts is crew limits. Rotational area management may or may not benefit habitat, depending on which areas are opened or closed to scallop gear and how much bottom fishing with other gears takes place in these areas, however the overall effect of this management strategy is expected to be beneficial for habitat. Most of these measures effectively minimize bottom contact time by scallop gear. These effects and the potential distribution of fishing effort relative to the metrics that the Council uses to assess adverse EFH impacts are analyzed and assessed in Sections 8.5.4 and 8.5.6.4

Rationale: The Council selected Habitat Alternative 2 in Section 5.3.4.2, a preferred alternative in the DSEIS, as part of the suite of measures implemented to reduce the impacts of fishing on EFH, to the extent practicable. The Council discussed the practicability of the alternatives to minimize adverse effects of fishing on EFH and concluded that Habitat Alternative 2 (Section 5.3.4.2), which relies on the habitat benefits derived from the other Amendment 10 measures, meets the SFA mandate and is practicable. It is important to note, that Amendment 10 implements the foundation of a rotational area management strategy, but does not actually open specific areas for access. Therefore, the habitat benefits of a rotational area management strategy, which includes DAS limits and DAS tradeoffs, will not be realized until subsequent framework actions are adopted which implement the access program and specify which areas will be included in it. Management measures that will benefit habitat and do not rely on access are DAS limits, crew limits, 4-inch dredge rings, and TAC set-asides for habitat research. The Council discussion of the habitat benefits of this alternative (with and without access) is described below and summarized in Table 15.

Under a controlled access program with rotation of closed areas, DAS and swept area are projected to decline, and this is expected to have positive benefits on EFH. In this analysis, swept area is an estimate of how much bottom area is swept by scallop gear, assuming no overlap of individual dredge tows. According to Section 8.2.2.3.4, under the proposed action, the swept area is expected to reduce significantly in FY2004 with or without access to the closed areas. Furthermore, for FY 2005-2007 with access to the closed areas, swept area is expected to decline significantly as well. Without access, swept area is projected to increase by 60% in 2005-2007.

The final alternative in Amendment 10 is expected to reduce overall area swept, particularly in the Mid-Atlantic region (see Section 8.2.2.3.4). While effort is expected to stay relatively the same on Georges Bank, substantial catches from the Nantucket Lightship and Closed Area I are expected, so high daily catch limits in combination with the crew shucking capacity will keep area swept levels down. The habitat evaluation of rotational area management in terms of how effort is expected to shift over different sediment types and EFH is summarized in Section 8.5.7.2.1.2. It is difficult to describe the specific impacts of area rotation on EFH because the impacts will vary depending on the type and vulnerability of habitat types present in the area, its size, the intensity of scallop fishing prior to closure, recovery times for critical habitat features, duration of closure, etc. Thus, each framework action that implements access to specific closed areas, will have a complete habitat evaluation and assessment of impacts. However, the general impacts of a rotational area management strategy are assessed in this document.

DAS tradeoffs associated with participation in access programs will benefit EFH in terms of reduced bottom contact time. If catch levels are high in a re-opened access area, as they are expected to be, then the amount of time a vessel needs to catch the trip limit is expected to be much less than the amount of time that vessel is charged to participate in an access program. For example, if it takes a vessel only four days to harvest the trip limit for an access trip, but that vessel is charged ten days to access the area, then the remaining six days are not used to fish, a positive impact on habitat inside and outside the area.

There are additional measures implemented in Amendment 10 which will benefit essential fish habitat that do not rely on a rotational area management program. According to the gear effects workshop, there are three management strategies that have been identified as beneficial for habitat: effort reductions, gear modifications, and closed areas. A new measure implemented in Amendment 10 is requiring vessels to use four-inch rings, which will slightly increase dredge efficiency for larger scallops, thus reduce bottom contact time in recently-opened areas where large scallops are abundant. However, it is possible that this measure will reduce catch rates and increase bottom time in areas where medium-small sized scallops are prevalent. Ten-inch twine tops will reduce by-catch, but have no direct habitat effects. Limiting the number of crew that can be on a scallop vessel is an effort control measure that will benefit EFH. This measure has been implemented since Amendment 4 in 1994, and in areas where scallop density is high, this measure has successfully limited effort and the amount of time scallop gear is on the bottom. DAS limits is another effort control strategy that has direct benefits on habitat. By reducing the amount of days individual vessels can fish, effort is reduced, thus bottom contact time is reduced which has beneficial impacts on EFH. Lastly, habitat research funded with scallop TAC set asides could indirectly benefit habitat. The following table summarizes the habitat benefits from proposed scallop management measures in Amendment 10 (both new and carry-over measures), and explains how these measures could affect habitat.

Table 15. Characterization and summary of positive impacts of Amendment 10 management measures on EFH.

Management Measure	Carry-over or New measure	Impact on Habitat	Explanation
Status quo overfishing definition	Carry-over	– w/o access + with access	Use of SQ definition will increase scallop fishing effort in open access areas, which could lead to resource depletion, reduced catch rates and increase in bottom time, but not if fleet has access to closed areas; with access, total bottom time will probably decrease because of high catch rates in closed areas.
Rotational Area Management (RAM)	New	+	Specific impacts of area rotation will vary depending on the type and vulnerability of habitat types present in the area, its size, the intensity of scallop fishing prior to closure, recovery times for critical habitat features, duration of closure, etc., but overall, RAM is expected to have positive effects on habitat because effort on gravelly sand sediment types is expected to decline. However, negative impacts may also occur because more effort is expected to shift to areas with more EFH for juvenile species with vulnerable EFH. Therefore, there may be both positive and negative cumulative impacts on EFH from RAM.. In general, swept area is expected to decline in most of the projected scenarios (especially in the Mid-Atlantic region), which could have positive impacts on EFH.
Access to Georges Bank closed areas	Depends if access plan is implemented	+ and -	Amendment 10 does not provide access to the GB closed areas, but it does implement a long-term strategy of access that will be implemented though subsequent frameworks. Access to Georges Bank has localized negative impacts on the EFH within the closures, but overall access programs have reduced bottom contact time and may have reduced fishing effort in areas with "sensitive" habitat in areas outside access programs, which would benefit EFH.
DAS Limits	New	+	The total DAS allocation in open areas is significantly less than the Status quo DAS allocation. Less DAS translates into less fishing effort, so positive for EFH.

Management Measure	Carry-over or New measure	Impact on Habitat	Explanation
DAS Tradeoffs	Depends if access plan is implemented	+	Positive impact on EFH from this measure, if bottom contact time is reduced and vessels are shifted into areas that are more appropriate/efficient for harvesting scallops
Broken trip DAS and trip adjustments	Depends if access plan is implemented	+	Could reduce effort in controlled access areas. Under a broken trip adjustment, vessels will actually loose some controlled access DAS allocations as part of the penalty. They would not be able to finish the trip, unless they had sufficient days remaining.
Crew Limits	Carry-over	+	If harvest levels are high, particularly in the access areas, then the capacity of each vessel is limited to how fast the crew can shuck. This measure is not a new restriction under A10, but will continue to have indirect benefits on EFH as long as catch limits are high.
Four inch rings and 10 inch twine tops	New	+	Four inch rings will slightly increase dredge efficiency for larger scallops, thus reducing bottom contact time in recently-opened areas where large scallops are abundant, but will reduce catch rates and increase bottom time in areas where medium-small sized scallops are prevalent. Ten-inch twine tops will reduce by-catch, but have no direct habitat effects.
Reduced possession limit for limited access vessels fishing outside of scallop DAS	New	+	Vessels with limited access permits are currently allowed to possess and land up to 400 lbs per trip of shucked scallop meats when not required to use allocated DAS; this measure will reduce possession limit to 40 lbs/trip) and reduce fishing effort by vessels that have been targeting scallops under the higher general category possession limit. Scallops harvested under this provision cannot be sold.
2% set-aside from TAC and/or DAS allocations to fund scallop and habitat research and surveys	New	+	Could indirectly benefit habitat when habitat research is funded and provides better information for future management decisions.

5.1.6.2 Habitat Alternative 6 - Habitat Closures Consistent With The Framework Adjustment 13 Scallop Closed Areas Access Program

Year-round groundfish closed areas (Western Gulf of Maine, Closed Area I, Closed Area II and the Nantucket Lightship Area) during 1998 - 2003 are considered by the Sea Scallop FMP as habitat closures except for areas opened under the Scallop Framework Adjustment 13 controlled access. Amendment 10 and the Sea Scallop FMP will implement this habitat closure by prohibiting fishing with scallop dredges and trawls, the type of fishing regulated by this FMP.

Figure 5 shows the coordinates and a map of the habitat closures. See Sections 8.5.4.6 and 8.5.6.4.6 for the analysis of the management measure (Habitat Alternative #6 is the same in both Scallop Amendment 10 and Multispecies Amendment 13 except that Alternative 6 in Amendment 10 is closed only to scallop dredge gear based on the Council's final decision).

Rationale: Critical and sensitive habitats occur within these area boundaries and protection of these areas from fishing with scallop gear will allow continued habitat recovery in these areas, particularly when other bottom tending mobile gear are prohibited to promote groundfish rebuilding and to protect groundfish spawning activities. Under the present management circumstances, selection of these closures for habitat protection carries little cost as long as the groundfish closed areas apply to scallop fishing. If other areas are later identified to be better areas for habitat protection by closure to various types of fishing gear, the costs of the habitat closures under this alternative would be much higher and subject to re-evaluation by the Council.

In terms of EFH protection, the percent of total vulnerable EFH in Alternative 6 ranks higher than most of the other alternatives, excluding habitat alternatives 7 and 9. However, because this area is larger than most of the other alternatives (except for habitat alternatives 7 and 9), when the EFH values are scaled for area, this alternative ranks lower than most. It is less "effective" than alternatives 3, 4, 8, and 5a-c in terms of EFH value per nautical mile. Alternative 6 contains high amounts of biomass for three bottom-feeding trophic guilds which is an important indication of what species live in this area, and how many. For example, more benthivore biomass (species that eat from the ocean bottom) is contained in Alternative 6 than any of the other alternatives, except for habitat alternatives 7 and 9. In terms of the sediment composition, over 60% of the area in this closure alternative is composed of sandy bottom. And although habitat alternative 6 is a small part of the total area under management, 2.3% of the proposed habitat closed area is made up of gravel and comprises a significant portion (17%) of the total amount of gravel sediment substrates in the Northwest Atlantic Analysis Area.

The Council selected Habitat Alternative 6 in Amendment 10 for the following reasons:

- Because these areas had already been defined and used as closed areas, this alternative would minimize any re-distribution of impacts which would help gain widespread acceptability among stakeholders.

- Closing areas within the boundaries of existing groundfish closed area would help build on the habitat protection benefits that had been provided to date by the these areas by clarifying and elevating the intent of the closures to protect essential fish habitat (habitat closures).

- While the closures include some productive scallop fishing areas and areas of relatively low habitat value (e.g. high energy sandy environments), these closures also protect a substantial amount of complex bottom in the Gulf of Maine (WGOM closure) and George's Bank (Closed Area II north of the 72°30' N latitude and the northern and southern thirds of Closed Area I). This is accomplished by converting a large portion of the current year round groundfish closed areas into modified Level 3 habitat closures (closed indefinitely to scallop dredge gear).

- Uncertainty over the efficacy of closing large areas, given the uncertainties about benefits v. costs, optimal location of areas, distribution of impacts, and the difficulty of re-opening the areas if they are not optimal. The Council is initiating action on an omnibus habitat amendment that will strive to integrate habitat protection across all plans and to explore other approaches using new data to develop better habitat alternatives.

- Closing any additional areas could be costly and imprudent, until the Council takes action under Amendment 13 to the Northeast Multispecies FMP. Additionally, the Council believes that Amendment 10 and Amendment 13 will implement measures to meet plan objectives, rebuild fishery stocks, while meeting the Council's obligations to minimize adverse effects of fishing in the short term.

- Reducing day-at-sea use by 25% from 2002 and 2003 levels in Scallop Amendment 10 will minimize habitat impacts, which will be bolstered by the crew limits while fishing in re-opened scallop rotation areas. These scallop management measures are expected to minimize bottom contact time and projection analyses (Section 8.2.1) show that redistribution of intensive fishing effort in sensitive areas (measured by the EFH metrics analysis) is not significant. As such, other measures besides closed habitat areas implemented in Amendment 10 will help reduce the impacts of fishing on EFH.

- Enforcement and compliance will be supported by the coincidental boundaries of this alternative with the existing groundfish closure boundaries.

The Council did not select other habitat closure alternatives for the following reasons:

- Alternative 3 includes the closure of the Great South Channel, which is impracticable due to the dramatic social and economic impacts. Further, the equity of impacts is uneven and is focused mainly in the New Bedford, MA port.

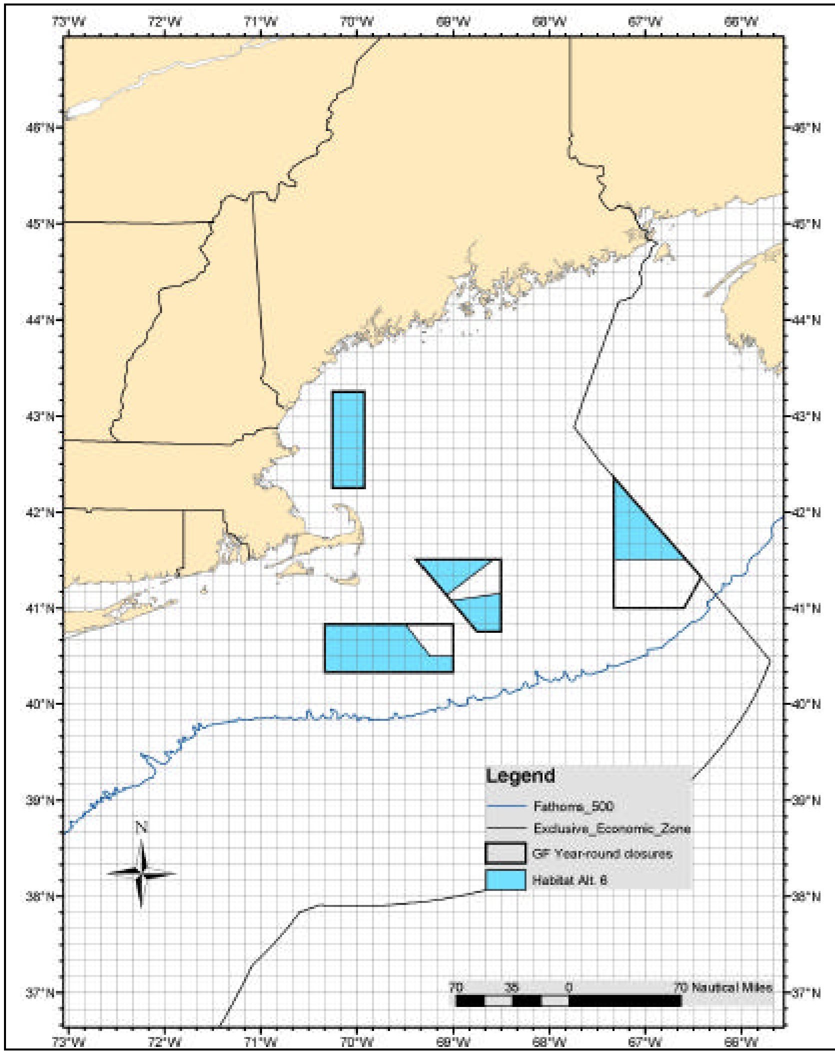
- Alternative 4 was deemed impracticable because it is inconsistent with the rotational management areas as they overlap the boundaries of Alternative 4. The Council expressed concern of implementing an area-based rotational management scheme with these areas closed as habitat closures.

- Alternative 5 was thought to be impracticable due to the inequity of social and economic impacts in the ports of Provincetown, MA, Chatham, MA, and Gloucester,MA.

- Alternative 7 is impracticable because it includes a tremendous amount of the EEZ, which is largely comprised of sandy sediment. These areas do not experience scallop dredging and don't warrant protection.

- Alternative 8 is impracticable due to the concern with implementing either of these closure alternatives only to scallop gear was noted. The Council acknowledges that closing these areas to scallop dredging will lead to some habitat benefit. However, since otter trawling will still be able to occur in this area, the habitat benefit will be greatly reduced.

- Alternative 9 was not practicable because it included the Framework 13 Access Areas as habitat closures. The Council believes that not allowing access to these areas is be impracticable due to the high costs that are associated with lack of access to scallops, compared to the benefits that might accrue from closing the parts of the groundfish closed areas that had been previously open for scallop fishing.



		LONGITUDE		LATITUDE	
	Point #	deg	min	deg	min
CAI	1	69	1.2	41	4.5
	2	68	30	41	9
	3	68	30	40	45
	4	68	45	40	45
	5	69	23	41	30
	6	68	35	41	30
	7	69	4.3	41	8
CAII	1	67	20	42	22
	2	66	34.8	41	30
	3	67	20	41	30
Nantucket Lightship	1	69	0	40	20
	2	69	0	40	30
	3	69	14.5	40	30
	4	69	29.5	40	50
	5	70	20	40	20
	6	72	20	40	50
WGOM	1	69	55	42	15
	2	69	55	43	15
	3	70	15	43	15
	4	70	15	42	15

Figure 5. Map and Coordinates for Habitat Alternative 6 (current groundfish closed areas included for reference)

5.1.6.3 Minimum ring size

This is a scallop management measure, described in Section 5.1.4.1 which will have benefits that arise from reducing total bottom contact time by improving dredge efficiency for catching large scallops.

Rationale: The Council selected Habitat Alternative 11 in Section 5.3.4.11, a non-preferred alternative in the DSEIS.

Scallop research conducted by Dr. DuPaul of the Va. Inst. of Marine Science indicates that gear efficiency for a dredge outfitted with 4" rings increases by 10-15 percent for scallops over 110 mm. Particularly in areas having predominately large scallops, like a re-opened controlled access scallop rotation area, this measure will decrease bottom contact time to take the same number of scallops and achieve the fishing mortality targets. This result can help reduce habitat impacts, particularly when it reduces the 'footprint' of the fishing activity by reducing effort in areas that are fished infrequently. With vessel DAS at a premium, scallop fishing vessels are unlikely to spend time targeting smaller scallops in marginal areas with a dredge that is designed to allow more escapement of smaller scallops. Since the distributional effects of this measure are difficult to quantify, it could reduce fishing in areas that are infrequently fished or it could simply reduce fishing intensity in areas that would continue be dredged. In the latter case, the habitat benefits would be lower than if the measure eliminated fishing in some areas that are infrequently fished.

The second impact of increasing dredge ring size to 4 inches is the effect this will have on fishing patterns in general and swept area in particular. Four-inch dredge rings appear to be more efficient harvesters of larger (110+ mm) scallops, and long-term projections indicate that the effect will be to also improve scallop yield by about 4 to 5%. As a result of the combined effect of improving scallop yield (i.e. the fleet catching larger sea scallops) and dredge efficiency for large scallops, long-term projection indicate an reduction in area swept by 14% (Table 16).

Table 16. Long-term non-rotation projections of scallop biomass, yield, and area swept, 3.5 inch vs. 4 inch dredge rings.

Fishing mortality	Ring size (inches)	Average scallop biomass (g/tow)	Average Catch (mt)	Average landings per DAS	Average DAS use	Total area swept (nm^2)
F=0.2	3.5	13732	14945	2314	14559	2334
F=0.2	4	14237	15561	2397	14267	1996

Initially, the 4 inch dredge ring could lead to an unquantifiable increase in swept area in open scallop management areas (as contrasted with re-opened controlled access areas) as scallop vessels attempt to compensate for reduced catches of small (90-95 mm) scallops which will escape through the larger rings. The short-term effect is expected to last for one year, the time it takes for scallops of this size to grow large enough to be retained by the dredge. As the average size of scallops throughout the range of the fishery increases, the area swept will decrease. However, depending on the management alternatives selected in future framework adjustments, the potential exists that scallop vessels will continue to fish, albeit with reduced efficiency, on beds of smaller scallops. This could lead to an overall increase in swept area and bottom contact time for the fishery.

In addition to this effect, the comparative gear research conducted by Dr. DuPaul shows that a dredge outfitted with 4" rings catches considerably fewer finfish and benthic invertebrates (sponges, crabs, starfish, etc.) than a dredge outfitted with 3½" rings. While benthic species still exhibit non-catch mortality when passing through the dredge and escaping through or between the rings, disturbance and mortality associated with gear retrieval (caused by temperature changes in the water column) and the sorting process on deck (caused by desiccation, crushing, and temperature change) will be reduced. Reduced damage and mortality of bottom dwelling species enhances biodiversity and reduces the impact of dredging on benthic community structure. The magnitude of this bycatch reduction has not been studied and cannot be quantified at this time.

5.1.6.4 Habitat research funded through scallop TAC set-aside

This measure will improve data and information that could reduce habitat impacts and enhance recovery from adverse impacts. The program is incorporated and derive its funds from the scallop research program described in Section 5.1.8.3.

Rationale: The Council selected Habitat Alternative 12 in Section 5.3.4.12, a non-preferred alternative in the DSEIS.

Scientists conducting habitat research related to the effects of scallop fishing could apply for funding through the research TAC/day-at-sea set aside. Research is needed to quantify or evaluate the long-term effects of scallop fishing on the essential fish habitat and to estimate habitat recovery rates. Some of the funds from a TAC set-aside would promote such research. Up to 2% of the TAC set-aside would be used to conduct both scallop and habitat-related scallop research, including cooperative industry surveys to monitor the resource and rotation area management.

This alternative will broaden the range of research types that could be funded through the scallop research set aside. Research funded through this mechanism could identify fishing gear or methods that have fewer habitat impacts, or might be useful to identify ways that fishing is managed to minimize related habitat impacts. While there may be some benefit to habitat through the research itself, and research may result in additional bottom contact time for fishing gears, these alternatives address only mechanisms for enabling research. Under this program, however, funds and a research mechanism could become available to advance habitat research if it relates to scallop fishery management.

Research conducted under this alternative would directly benefit the habitats of the region. There are large gaps in the understanding of fishery impacts on EFH, and much research is needed. Valuable research that is currently being conducted would also likely benefit from additional funding. This alternative does not quantify the funds available specifically for habitat research. Priorities and funding will be managed by the Council in cooperation with the Scallop and Habitat Oversight Committees, according to the priorities identified in this document (Section 5.1.8.3) and as modified by future framework adjustments.

5.1.7 Proactive Protected Species Program

The Council passed a motion at its November 2001 meeting that established steps to be taken to address protected species issues in the scallop fishery. This alternative is proposed to address the majority of the recommendations set out at that meeting. It provides a mechanism to close areas through a framework adjustment to reduce the risk of encounters between turtles (as well as other protected species) and fishing gear used in the scallop fishery, and the necessary data collection and analyses needed to address the Council's recommendations. It also provides suggestions for gear research to determine how sea turtles are caught and how to reduce the potential for those captures.

Management Measures – Framework adjustments for controlled access re-openings (see Section 5.1.9) would allow area re-openings to be timed in a manner to minimize the interactions between scallop gear and protected species found in the action area, particularly sea turtles. This measure could be applied to the Mid-Atlantic region during the sea turtle concentration period from June to November and be modified as resource conditions or fishery operations change.

This section provides for closures of areas or modifications to gear or fishing operations to protect sea turtles and any other protected species through a framework adjustment to the FMP. Further discussion in future framework documents would address the specific problem and fully describe the timing, duration and other requirements associated with the action, as well as provide the appropriate analyses and background information:

- Data Collection and Analyses – More sea sampling will help identify where and when interactions with sea turtles occur, and the increase in the frequency of trips with an observer aboard will improve the estimates. The expanded and enhanced observer program for scallop fishing through a one-percent set-aside program is described in Section 5.1.8.1.

- Gear Research – Research priorities for identifying how turtles are caught by scallop fishing gear and for identifying means to reduce interactions and mortality are incorporated into the scallop research program, described in Section 5.1.8.3.

Rationale: In response to reports of sea turtle takes in the sea scallop fishery, NMFS reinitiated consultation under section 7 of the ESA on December 21, 2001. NMFS completed a Biological Opinion (BO) for the scallop fishery as a whole, including the measures included in Framework 15, on February 24, 2003. The BO concluded that the continued implementation of the scallop fishery and the proposed activity may adversely affect but is not likely to jeopardize the continued existence of loggerhead, Kemp's ridley, green, and leatherback sea turtles. No designated critical habitat was likely to be affected by the fishery. In the BO, NMFS provided an incidental take statement allowing the annual take of 88 loggerhead (up to 25 lethal), 7 Kemp's ridley (2 lethal), and 1 green (lethal or non-lethal) sea turtles in the sea scallop dredge fishery. In addition, the incidental take statement allows the lethal or non-lethal observed annual take of one loggerhead, Kemp's ridley, green, or leatherback sea turtles in the scallop trawl fishery.

The BO completed by NMFS acknowledges that there is insufficient information to determine the full scope of sea turtle and scallop fishery gear interactions because of an overall lack of sufficient data and understanding of the interactions. NMFS is continuing to monitor the observed takes of sea turtles in this fishery and evaluate the potential impact of these interactions, which will require extrapolations of observed sea turtle takes within and outside of the Hudson Canyon and VA/NC Areas. Lacking this information, the Council does not have the benefit of more complete observer data to determine how to best mitigate these takes prior to submitting the draft phase of Amendment 10. Further Council action without such information and careful consideration of all relevant factors could displace fishing effort into areas of higher turtle bycatch than currently exists. The Council, therefore, is currently proposing broad measures for use in future actions that would contribute toward the protection turtles and other protected species. This alternative, however, provides a framework mechanism to mitigate takes of turtles in the scallop fishery and recommends enhanced observer coverage to collect the appropriate protected species data to better identify the nature and scope of this problem. Further research to provide longer-term solutions is also recommended.

5.1.8 Data Collection, Monitoring, And Scallop Research

5.1.8.1 Sea sampling

Vessels with sea scallop fishing permits may be required by the Regional Administrator to carry onboard an observer, whose costs will be born by the vessel. To defray the costs of carrying an observer [from partial up to full compensation of the observer cost], the Regional Administrator will also authorize the vessel to land more scallops or fish more DAS than it would otherwise be authorized to do. In controlled access areas where a scallop possession limit applies, the Regional Administrator will authorize the vessel to land more than the scallop possession limit that applies to the area where the trip takes place. In open fishing areas where there is no possession limit, the Regional Administrator will apply a constant adjustment factor that applies to each DAS on an observed trip, taking into account the average open area catch per day expected from open fishing areas and the effect that the amount has on sampling frequency. The adjustment will either reduce the amount of DAS charged for the trip or the vessel's annual DAS allocation. The table below gives an example of the controlled access possession limit and open area DAS adjustments that might be applied:

Table 17. Example controlled access possession limit and open area DAS adjustments needed to fully compensate for the cost of the observer. This example does not take into account the vessel's lay system or the costs for the extra time and effort needed to process the scallops.

	Controlled access areas	Open areas
Observer cost ($/day)	800	800
Scallop possession limit	18,000	Does not apply
Expected LPUE (lbs./day)	2,400	1,800
Price per pound	$4.25	$3.25
Expected trip length	7.5	14.0
Landings needed to fully compensate observer cost from vessel share (lbs. of meats)	1,412	3,446
DAS equivalent adjustment (days-at-sea)	Does not apply	1.9
Possession limit equivalent adjustment (lbs. of meats)	19,412	Does not apply

The Regional Administrator will determine the number of sea sampled trips and distribution by gear and area, taking into account the desired level of sea sampling needed to estimate bycatch with an accuracy appropriate to the scallop at which the bycatch information will affect management decisions. As such, it would be appropriate for sea sampling intensity to favor areas of higher than average groundfish and turtle bycatch.

One percent of the controlled area TACs and one percent of the allowable open area days used will be deducted before calculating the controlled access trip and open area DAS allocations. This deduction will provide funding for vessels carrying observers and authorized to partially or completely recover the associated costs through scallop landings, while meeting the FMP's mortality targets. The purpose of the set-aside is to pay for the daily cost of observers (including fixed and variable costs for salary, administration, training, etc.), data entry, auditing, and analysis.

Specifications: Amendment 10 establishes a one percent set aside to provide some funding to increase Sea Sampling Observer Program sampling frequency on vessels targeting sea scallops with dredges or trawls. Unlike the existing controlled access set aside, Amendment 10 expands this program to the entire fishery, applied to both controlled access areas (that have a target TAC, Section 8.2.4.1) and regular open scallop fishing areas (that have an annual target DAS use, Section 8.2.4.2).

Controlled access areas in 2004 and 2005 include only the Hudson Canyon Area, unless Framework Adjustment 16/39 (a planned framework adjustment to follow on the heels of Amendment 10) allows access to the Georges Bank groundfish closed areas during 2004 – 2007. The TAC set asides under both conditions are shown in Table 18, using the current target TAC estimates derived from 2002 survey data. The TAC set asides are of course higher with access than without, due to the additional TACs associated with the access to the groundfish closed areas in 2004 – 2007. Without access to the groundfish closed areas, the TAC set aside for controlled access areas would be zero in 2006 and 2007 if and when the Hudson Canyon Area converts to a regular open scallop fishing area. When this happens, the associated TAC set-aside would transfer from the TAC set aside from controlled access areas to a one-percent DAS set aside for regular open scallop fishing areas (see below).

Table 18. Controlled access TAC set-aside for observers.

Fishing year	Georges Bank area access	One percent TAC set-aside (total observer landing allowance)		Estimated ex-vessel value of landings
		Pounds	Metric tons	
2004	With	304,899	138	$ 1,301,491
	Without	187,900	85.2	$ 802,069
2005	With	354,106	160.6	$ 1,564,105
	Without	149,562	67.8	$ 660,621
2006	With	191,141	86.7	$ 876,836
	Without[19]	0	0	$ 0
2007	With	177,031	80.3	$ 934,700
	Without	0	0	$ 0

Like the TAC set aside, one percent of the target DAS use for regular open scallop fishing areas was set aside to provide funds for placing observers on scallop vessels fishing in open fishing areas. This adjustment effects the annual DAS allocations for limited access scallop vessels, which leaves a pool of DAS that can be re-allocated to vessels carrying observers without exceeding the annual fishing mortality target for the scallop resource. A 350 DAS set-aside reduces a limited access vessel's annual DAS allocation by approximately one day.

Table 19 shows the amount of DAS that were set aside from the projected DAS use before calculating full-time, part-time, and occasional DAS allocations, with and without access to the Georges Bank areas. The set-aside is higher in the open areas without access, because the target DAS use in the open areas increases to achieve the stock-wide fishing mortality target when more closed areas apply. Using the economics model price equation and predicted average scallop price per pound, Table 19 also gives an approximate value associated with the set-aside DAS. The value estimates assume that landings will be generated from the extra DAS allocations for vessels carrying observers, and those catches on those days-at-sea will be the same as the expected LPUE and be of the same average size as those estimated for regular, open scallop fishing areas. Actual value will vary depending on the utilization of rebated DAS, the size of the scallops, where the vessel fishes, and when the landings occur.

[19] Assumes that the Hudson Canyon Area converts to a regular open fishing area, as scheduled in Amendment 10.

Table 19. Open area DAS set-aside for observers.

Fishing year	Georges Bank area access	One percent of target DAS use	Estimated ex-vessel value of landings
2004	With	117	$ 693,893
	Without[20]	171	$ 1,010,345
2005	With	111	$ 548,624
	Without	304	$ 799,921
2006	With	187	$ 768,509
	Without	376	$ 755,915
2007	With	207	$ 875,261
	Without	359	$ 806,660

An estimate of the total value of the controlled access set-aside is also shown in Table 18 and Table 19, by applying the estimated average annual price per pound from a price equation used for estimating net economic benefits (Section 8.7.3.2). The scallop prices vary by year and by whether or not there is access to the groundfish closed areas because of the predicted response of scallop prices to domestic landings. The actual results may vary because scallop prices are sensitive to landings by grade or count, not just the average size used in the price equation. The seasonal timing of landings that differ from the assumptions in the projection model will also have an impact.

Nonetheless, the estimated value of the TAC and DAS set asides provide an approximation of the number of observer days that could be funded by the set-aside, once the daily observer cost is determined. The remaining observer costs associated with the total number of observer days needed to achieve a target sampling frequency would be borne by the vessels carrying observers.

Like the controlled access area TACs, the TAC set asides are targets, not a hard number that would close the fishery due to a lack of funding for observers. They are intended to provide guidance for how many trips can be observed with these funds and for setting the scallop possession limit allowance for vessels carrying observers. NMFS will set the scallop possession limit allowance for observed trips using this information and monitor the landings that exceed 18,000 lbs. per trip for observed trips. Substantial overruns of the TAC set aside could increase fishing mortality above the intended targets. Theoretically, landings that exceed the target set asides could cause overfishing, but the amounts, even if double the set-aside is a small proportion of the total catch.

The Regional Administrator will take into account the amount of funds generated by the set-asides and a reasonable compensation to scallop vessels carrying observers, to maximize the observer sampling frequency without placing an undue burden and hardship on vessels selected to carry observers. An analysis of this tradeoff is provided in Section 8.2.4, for the 2004 – 2007 fishing years with and without access. These analyses will be considered when setting a scallop possession limit allowance for controlled access areas and a DAS adjustment factor for regular open scallop fishing areas.

Rationale: The Council selected the alternative in Section 5.3.7.1, a preferred alternative in the DSEIS, applying the set aside and adjustment mechanism to the area-specific allocation system in Section 5.1.2. Increased observer coverage is needed to improve the estimated amount of finfish bycatch in order to better comply with National Standard 9, and to determine the level of sea turtle takes in the scallop fishery. Because the increase in observers would be costly and may not be entirely within the capabilities of NMFS to pay for such increases, the TAC and/or DAS set-asides would allow compensation to vessel

[20] After 8/15/03 if the default DAS allocations go into place.

owners and crews which have paid for observers. This program has proven to be successful in limited applications under the Georges Bank Closed Area Exemption Programs in 1999 and 2000 and under the Mid-Atlantic Area Access Program implemented in 2001, 2002.

As in previous fishing years and controlled access programs, a set-aside was deducted from the controlled access area TACs, before determining how many trips to an area could be allocated to limited access scallop vessels. Theoretically the reduction in the TACs by the set-aside would cause fewer controlled access trips to be allocated. In some cases, the Council also applied a set-aside that added to the TAC, to provide adequate funding. With a hard TAC that applied in previous fishing years, the sampling frequency might decline because less trips might be observed when the TAC set aside ran out, or in the extreme case, the Regional Administrator could shut the access program down because observers could not be place on vessels due to insufficient funds being left to do so. Fortunately, it never came to this.

With a target, rather than hard, TAC, the link between the set-aside and the number of allocated trips or the season isn't as direct. A slight one or two percent reduction in the TAC does not in reality change the number of trips allocated, because of the coarse allocation mechanism that allocates a whole number of trips equally to all limited access vessels (subject to policies on part-time and occasional allocations). Thus the sampling frequency and vessel compensation for observed trips should be based on the TAC set aside, and care should be taken to ensure that the scallop possession limit observer allowance does not substantially exceed the amounts specified.

5.1.8.2 Cooperative industry surveys

NMFS will initiate a cooperative industry scallop survey, primarily designed to assist in estimating the distribution and biomass of scallops in specific areas, as needed to provide information for rotation area management. Vessel compensation and direct administrative costs of this survey are to be recaptured from a two percent set aside to fund research and resource monitoring. Two percent of the controlled area TACs and two percent of the allowable open area days used will be deducted before calculating the controlled access trip and open area DAS allocations. The Regional Administrator will authorize vessels that participate in the cooperative surveys to make compensation trips to defray the costs of the vessel's participation. The Regional Administrator will specify whether and for how long a vessel may fish in a controlled access area or open area to recoup the costs, based on the expected scallop catch per day and price per pound. A compensation trip is one in which the Regional Administrator authorizes the vessel to fish for scallops while not on the DAS clock or one in which the vessel is authorized to land more than a scallop possession limit that applies to a controlled access area. Resource surveys under this program shall be deemed scientific research under the Magnuson Act. Surveys and compensation trips that do not adversely affect the environment beyond those associated with a scallop DAS will not require an experimental fishing permit.

Cooperative surveys may target areas reported to have high concentrations of small scallops to determine the potential boundaries of a rotation management area closure, and/or to more accurately determine the biomass of a closed rotation management area about to re-open. The latter case may be anticipated, but small scallops may appear suddenly and an ad hoc survey may be needed. As such, the Regional Administrator is encouraged to develop administrative procedures for conducting an ad hoc resource survey using industry vessels and pre-arrange participation in such a survey, should the need arise.

Scientific personnel on industry vessels may be NMFS employees, state employees, or university employees. The added costs of these scientific personnel for their time aboard survey vessels and/or preparing the data for analysis may be recovered from scallop compensation trips by charging the vessel that participated in the survey and recovered survey costs via compensation trips.

Rationale: This is the alternative included in Section 5.3.7.8, a preferred alternative in the DSEIS. Industry-funded and supported resource surveys are needed to increase the sampling intensity and support area rotation, especially if many small areas need to be evaluated to close or open rotation management areas.

5.1.8.3 Scallop research

The scallop research program, formerly funded by TAC set-asides in controlled access areas, will continue using the existing administrative procedures and the funding will be expanded to a two-percent set aside of controlled access TACs and open area DAS for all areas. Before allocating controlled access trips and open area days, two percent will be deducted from the controlled access TACs and allowable open area day-at-sea use to calculate annual allocations. Because this SEIS analyzes the effects of achieving OY for the scallop fishery, research and compensation trips that do not adversely affect the environment beyond those on a scallop DAS will not be required to prepare an EA or EIS to conduct the research, unless required to do so for special, unique reasons identified by the Regional Administrator.

Whether funded by the set aside or by other sources, this section describes the type of research that may be conducted under an Experimental Fishing Permit, without preparing an Environmental Assessment (EA) or Environmental Impact Statement (EIS). To qualify for this exemption from the normal application procedures, the research must not cause mortality or impacts that differ from that created by normal scallop fishing on a day-at-sea (Section 5.3.8.2.2). Research projects that are not conducted on a day-at-sea (an allocated day or a set-aside day), in areas that are otherwise closed to scallop fishing, or using gear that is otherwise prohibited while fishing for sea scallops would be required to follow the normal application procedures (Section 5.3.8.3).

Nothing in the alternatives in this section is intended to supercede the requirements of the Magnuson-Stevens Act provisions with respect to experimental (exempted) fishing activity. Rather, the alternatives in this section are intended to incorporate the requirements of the Magnuson-Stevens Act provisions into the Amendment 10 process or into future specification or framework processes in order to facilitate future research. Based on the analysis contained herein and associated with a customary scallop fishing day, the applicant may be relieved of preparing an EA or EIS for a research application. If the research is deemed to have greater impacts, however, these procedures may require the applicant to prepare an EA or EIS to be authorized to conduct the research.

Types of research activities that would automatically be considered as analyzed by the SEIS are:

- Research that causes negligible mortality and disturbance of the sea floor, such as video surveys.
- Research that uses unmodified commercial fishing gear or commercial fishing gear that causes less mortality or disturbance of the sea floor, such as:
  - Paired tow comparisons using gear that complies with existing fishing regulations.
  - Resource surveys with unmodified commercial dredges or trawls.
  - Tagging of animals caught by gear that complies with existing fishing regulations.
- Observation of discard mortality during regular commercial fishing.
- Retention of catches that exceed a possession limit, unless it exceeds the amount associated with a TAC or DAS set aside.

Not included is research that:

- o Uses commercial fishing gear that does not comply with existing regulations
- o Requires fishing in closed areas
- o Requires fishing on a day that exempt from the DAS regulations, except as provided for in a TAC or DAS set aside program.
- o Uses liners or other gear that increases retention of scallops or non-target species, unless accounted for by a TAC or DAS adjustment under a set aside program.

The Regional Administrator will authorize vessels that participate in research programs funded by the set-aside to make compensation trips to defray the costs of the vessel's participation. The Regional Administrator will specify whether and for how long a vessel may fish in a controlled access area or open area to recoup the costs, based on the expected scallop catch per day and price per pound. A compensation trip is one in which the Regional Administrator authorizes the vessel to fish for scallops while not on the DAS clock or one in which the vessel is authorized to land more than a scallop possession limit that applies to a controlled access area.

Research conducted through the TAC set-aside should be related to information needed to make management decisions about scallop fishing, understanding and mitigating the fishery's environmental impacts, and the performance characteristics of potential new scallop fishing gear. Appropriate uses include those that identify and evaluate effects of the fishery on the environment, ways to reduce or mitigate those effects, and the recovery potential of habitat, flora, and fauna to potential conservation management measures or changes in the way fishing is conducted.

Important research issues are listed below and may be modified or prioritized by framework adjustment or plan amendment:

- ❑ Cooperative industry surveys to determine small sea scallop distribution and the biomass of exploitable size scallops in closed rotation management areas
- ❑ Video and/or photo transects of the bottom within Closed Area II and the Nantucket Lightship area in areas both subject to scallop fishing and not subject to scallop fishing, before and after scallop fishing commences
- ❑ Intensive sampling on both sides of the boundary of Closed Area II and the Nantucket Lightship area this year and in subsequent years to gauge the effects of fishing on the resource
- ❑ Special sampling stations be used during this summer's scallop survey, selected to represent areas both opened to scallop fishing and not opened to scallop fishing
- ❑ Development of higher resolution benthic/sediment mapping of Mid-Atlantic and New England areas
- ❑ Identification and description of biogenic structure and biological communities associated with different physical habitat types
- ❑ Development of high-resolution sediment mapping in the Gulf of Maine and Georges Bank, using Canadian sea scallop industry mapping effort as an example process.
- ❑ Identification of nursery and over-wintering habitats for species that are vulnerable to habitat alteration by scallop fishing.
- ❑ Any other habitat information that may be possible to collect.
- ❑ Evaluation of the co-distribution of sea turtles and scallop effort to identify time/area 'hot spots'
- ❑ Identification of the mechanisms that cause scallop fishing gear to threaten sea turtles during all phases of operation (towing on bottom, retrieving gear to surface, and towing at surface);
- ❑ Developing scallop dredge and trawl operations that would reduce or eliminate the threat of sea turtle capture;
- ❑ Developing appropriate escape gear or techniques that may be used without unacceptable reduction in scallop retention; and

- Comparing the turtle capture rates of similar gear in other fisheries such as the Mid-Atlantic summer flounder trawl fishery.
- Research on scallop biology and scallop fishery social science, including identifying ways to improve benefits to the fishery and to the nation
- Research on habitat effects from scallop fishing and identification of practicable methods to minimize or mitigate those impacts

Specifications: A two percent set aside will be deducted from the target TACs for controlled access areas and DAS use for regular, open scallop fishing areas to provide a pool of funds for qualified researchers to conduct studies on the scallop resource, the scallop fishery, and on scallop-related habitat. Scallop related habitat research includes but is not limited to investigations on the effect of scallop fishing on various marine habitats and EFH, discovering how scallop gear or fishing methods may be modified to reduce adverse impacts, discovering effective management strategies to minimize adverse effects on marine habitats and EFH, and evaluating the recovery potential of habitat adversely impacted by scallop fishing. The funds from the research set-aside are also intended to be used for cooperative industry scallop surveys, conducted to support scallop area rotation or scallop management (Section 5.1.8.2).

Table 20 estimates the total amount of scallop landings from controlled access areas that vessels will be able to land on compensation trips, i.e. trips taken by a vessel to compensate for their costs to participate in specific, approved research and/or to pay for the research expenses of the project. The Regional Administrator will authorize the participating vessel to land more than the scallop possession limit on controlled access area trips or may authorize the vessel to take additional trips to the controlled access areas specifically to land and generate revenue from its scallop research allowance. Research may be conducted on the compensation trip, or the compensation trip may be taken at another time, depending on whether or not it is practicable to catch and process scallops on the same trip that research is being conducted. Scallop and scallop-related habitat research may be conducted within or outside of the controlled access area boundaries, using funds generated by catching scallops from the controlled access area TAC set aside. Catches that count against the controlled access area TAC set aside must come from within the controlled access areas while they are otherwise open for scallop fishing.

Table 20. Controlled access TAC set-aside for scallop and scallop-related habitat research.

Fishing year	Georges Bank area access	Two percent TAC set-aside (total observer landing allowance)		Estimated ex-vessel value of landings
		Pounds	Metric tons	
2004	With	609,798	276.6	$ 2,602,982
	Without	375,800	170.5	$ 1,604,137
2005	With	708,213	321.2	$ 3,128,210
	Without	299,123	135.7	$ 1,321,241
2006	With	382,281	173.4	$ 1,753,672
	Without[21]	0	0	$ 0
2007	With	354,062	160.6	$ 1,869,399
	Without	0	0	$ 0

Table 21 shows the amount of DAS use set aside from the target before estimating the limited access DAS allocations for regular, open scallop fishing areas. These set-asides will be established and monitored as a ceiling on the amount of fishing time that vessels may utilize to compensate them for participation in research or scallop surveys, or to pay for the costs of the research and/or survey.

[21] Assumes that the Hudson Canyon Area converts to a regular open fishing area, as scheduled in Amendment 10.

These set aside DAS would be used to allow authorized limited access scallop vessels to fish for scallops under applicable limited access rules, without having the fishing time count against the vessel's annual DAS allocation. Revenue from these "off the clock" trips would be used to compensate the vessel for participating in scallop research or cooperative scallop surveys.

The research or surveys may be conducted on the same trip that is used to catch the scallops for compensation if it is practical to do so. Or, the research or surveys may be conducted at another time. Scallop and scallop-related habitat research may be conducted in open fishing areas, inside of the controlled access area boundaries, or in closed areas, using funds generated by catching scallops from the open area DAS set aside, but scallop catches made by using DAS set asides must come from regular open scallop fishing areas.

Table 21. Open area DAS set-aside for scallop and scallop-related habitat research.

Fishing year	Georges Bank area access	Two percent of target DAS use	Estimated ex-vessel value of landings
2004	With	233	$ 1,387,785
	Without[22]	343	$ 2,020,690
2005	With	607	$ 1,599,843
	Without	223	$ 1,097,248
2006	With	752	$ 1,511,830
	Without	373	$ 1,537,018
2007	With	719	$ 1,613,320
	Without	415	$ 1,750,521

The estimated annual ex-vessel value of the compensation trips is provided in Table 20 and Table 21 with and without access to the Georges Bank groundfish closed areas. In both the TAC and DAS set asides, the price equation and estimated annual scallop prices (Section 8.7.3.2) were applied to the estimated landings. For the DAS set aside, the estimated annual LPUE was assumed for each DAS. The scallop prices vary by year and by whether or not there is access to the groundfish closed areas because of the predicted response of scallop prices to domestic landings. The actual results may vary because scallop prices are sensitive to landings by grade or count, not just the average size used in the price equation. The seasonal timing of landings that differ from the assumptions in the projection model will also have an impact.

Rationale: Many times, management is compromised by a lack of information or adequate research. While in existence for controlled access programs beginning in 1999, the program has provided much information about resource distribution, habitat distribution and fishery effects, ways to reduce bycatch, and ways to improve size selection and gear efficiency. The last resulted in the implementation of 4-inch minimum ring size in this amendment. Much of the work, however, has been conducted in closed or controlled access areas where compensation trips were convenient and cost effective. Expansion of this program is expected to enhance the information and research that future management actions can rely. At MSY with existing scallop prices, a two-percent set aside will generate nearly $3 million of scallop landings on compensation trips for scallop and habitat research.

Impacts of experimental fishing that are no greater than those expected on a standard commercial fishing trip can be estimated, anticipated, and evaluated in the Amendment 10 DSEIS. The various

[22] Associate with the default DAS allocations that would go into effect on 8/15/03 if Framework Adjustment 16/39 does not allow access to the Georges Bank groundfish closed areas.

effects of this character of experimental fishing programs would furthermore be accounted for in the mortality controls on the commercial fishery. Experimental fishing proposals that exceeded this level would be difficult to anticipate and hard to analyze in advance, without knowing the details of the proposed experimental fishing activity.

5.1.9 Framework Adjustment Process

The Council will prepare a Stock Assessment and Fishery Evaluation (SAFE) Report on a bi-annual basis, beginning with 2005, providing the information and analysis needed to evaluate potential management adjustments. Based on this information and analysis, the Council will initiate a standard framework adjustment to set DAS allocations, TACs, scallop possession limits, or adjust other measures to achieve plan objectives and limit fishing mortality**.** The preparation of this document will start early enough (approximately May or early June), to provide the Council and NMFS the ability to develop, review, and prepare management measures with sufficient time to implement the measures for the following fishing year.

In the SAFE Report, the Scallop PDT will review and evaluate the existing management measures to determine if the measures are achieving the FMP objectives and optimum yield from the scallop resource as a whole. In doing so, the PDT will consider the effects of any closed areas, either temporary, indefinite, or permanent, on the ability of the FMP to achieve optimum yield and prevent overfishing on a continuing basis, as required by National Standard 1 of the Magnuson Stevens Act. If the existing management measures are deemed insufficient to achieve FMP objectives and/or are not expected to achieve optimum yield and prevent overfishing on a continuing basis, the PDT shall recommend to the Council appropriate measures and alternatives that will meet FMP objectives, achieve optimum yield, and prevent overfishing on a continuing basis.

When making the above status determination, the PDT will calculate the stock biomass and fishing mortality to compare with the minimum biomass and maximum fishing mortality thresholds, by combining all scallops in the stock area, including but not limited to scallops located in open fishing areas, controlled access areas, scallop closed areas, groundfish closed areas, and habitat closed areas. To the extent possible, all removals from the resource should be considered, including landings, discards, and non-catch mortality from directed scallop fishing by limited access vessels, directed scallop fishing by general category vessels, and vessels that catch scallops incidentally in other fisheries.

In order to assure that optimum yield is achieved, on a continuing basis, the PDT will develop, and modify as appropriate, the suite of management measures required to achieve optimum yield-per-recruit from the exploitable components of the resource (e.g. those components available for harvest in the upcoming fishing years), taking into account at least the following factors:

- Differential fishing mortality rates for the various spatial components of the resource
- Overall yields from the portions of the scallop resource available to the fishery
- Outlook for phasing in and out closed and controlled access areas according to the area rotation strategy
- Potential adverse impacts on EFH.

To prevent overfishing of the available biomass of scallops and ensure that optimum yield is achieved on a continuing basis, the Council will consider at the first framework meeting the management options (including DAS adjustments, area closures, gear restrictions, or other measures) recommended by the PDT. The PDT, Oversight Committee, and Council may develop or adjust measures based on, but not limited to, the following categories:

- Modification of the overfishing definition
- Adjustments to the area rotation program
- DAS allocation adjustments, including their area-specific distribution
- Gear restrictions

The Council must select one of the PDT recommendations or a substitute developed by the Scallop Oversight Committee or the Council that will achieve optimum yield and prevent overfishing on a continuing basis. If the Council fails to act or does not adopt a suitable alternative, the Regional Administrator may select an alternative developed and recommended by the PDT and shall proceed with a proposed rule, as described in the framework process regulations for the FMP.

The framework will set specifications and allocations for the following two fishing years, but the Council may initiate an ad hoc framework adjustment to change management measures at any time before the next regularly-scheduled framework adjustment. One area that ad hoc in-season or annual framework adjustments may be needed are for rotation closures when small scallops appear in sufficient concentrations to justify a new closure, and in controlled access re-openings when those openings do not coincide with the bi-annual adjustment and when they cannot be anticipated by the previous framework adjustment. If for some reason, the Council fails to initiate and approve a standard framework adjustment, the specifications from the then current fishing year will remain in force, unless NMFS initiates secretarial action to change them.

In addition to the frameworkable measures in the current FMP, the Council may adjust the following measures by framework action:

- Size and configuration of rotation management areas
- Controlled access seasons to minimize bycatch and maximize yield
- Area-specific day-at-sea or trip allocations
- Amount and duration of TAC specifications following re-opening
- Limits on number of closures
- TAC or day-at-sea set asides for funding research, for funding research
- Priorities for scallop-related research that is funded by a set aside from scallop management allocations.
- Finfish TACs for controlled access areas
- Finfish possession limits
- Sea sampling frequency
- Area-specific gear limits and specifications

Framework provision #18 (“Closed areas to lessen the amount of DAS reductions”) is removed from the list of frameworkable items, since it has been included into the area rotation framework and the DAS allocations will be consistent with area rotation strategies of achieve optimum yield.

Rationale: The Council selected the alternative in Section 5.3.9.3, a preferred alternative in the DSEIS. A bi-annual adjustment is possible because of improving analysis and data over the last several years. Also, having rebuilt scallop biomass to near target levels makes annual adjustments to prevent overfishing unnecessarily – there is less risk associated with short-term increases in mortality.

This change would allow the Council and NMFS time to administer a more complicated area rotation management system, as well as time to develop future plan amendments when needed. An environmental assessment (EA) would normally be associated with this action, but a DSEIS may be prepared with an expansion in the normal framework adjustment process time line to accommodate the more in-depth analysis.

The longer framework adjustment cycle could reduce administrative costs arising from frequent extensive analysis, review, and approval currently associated with framework adjustments. The longer cycle would be adequate to manage the scallop resource and fishery.

5.2 No Action and Status quo

Some of the alternative sections in Section 5.3 contain unique status quo or no action alternatives that are also described within each section. For example, for management measures to minimize the adverse effects of fishing on EFH, a status quo/no action alternative is presented which would implement no further EFH measures. These are presented so that each set of alternatives can be considered separate from area rotation and area management and other alternatives to improve scallop yield. Otherwise, the entire set of alternatives within Amendment 10 would have to be adopted or not, eliminating flexibility in the Council and Agency's choice and decision making.. Throughout all the alternatives described in Section 5.3, a status quo alternative is described relative to the issue being addressed by the set of alternatives (e.g. area rotation, effort allocation, minimizing habitat impacts, data collection and monitoring, etc.).

The status quo describes what would transpire if Amendment 10 was not adopted and future annual framework actions were approved to meet the Amendment 7 plan objectives. This outcome includes adjustments to the annual day-at-sea allocations to meet the fishing mortality target (F=0.2) in Amendment 7 as well as the possibility of future access to areas now closed areas under controlled conditions or the possibility of new scallop closures on an ad hoc basis. Although the impact on habitat (including the effect of the year-round groundfish closed areas) was analyzed in the Omnibus EFH Amendment 9, no areas would close to scallop fishing for the purposes of protecting habitat, with the exception of the present HAPC for cod on Georges Bank.

Where there is a difference between the current management rules and those that would transpire under the status quo, an additional No Action alternative is also described below. For example, the No Action alternative includes the current Amendment 7 schedule of day-at-sea allocations and no access to the Georges Bank groundfish closed areas. The controlled access program for the Hudson Canyon and VA/NC Areas would furthermore would cease when the Framework Adjustment 15 action expires on February 28, 2004. No action would mean that the Hudson Canyon and VA/NC Areas would be treated as normal, open scallop fishing area under nominal Amendment 7 regulations. On the other hand, No Action would also mean that scallop fishing would not occur under any circumstances in the Georges Bank groundfish closed areas, until the Northeast Multispecies FMP re-opened the areas to "gears capable of catching groundfish". Therefore under the No Action alternative, habitat in the existing groundfish closures would not be affected by scallop fishing, similar to Habitat Alternative 1 (Section 5.3.4.1).

Thus, a 120 full-time day-at-sea allocation with continued controlled access to the Hudson Canyon and VA/NC Areas does not meet the standard of being either the status quo or no action. A status quo day-at-sea allocation appears to exceed the maximum fishing mortality threshold in the present overfishing definition and would be an unlikely outcome of status quo management. Nevertheless, in some analyses of scallop management, a scenario assuming the 2002 day-at-sea allocation and use has been included for comparison.

5.3 Preferred and Non-preferred Alternatives

One major purpose of Amendment 10 is to introduce new management to the fishery that benefits from the heterogeneities in the resource and the environment – improving the effectiveness of management to maximize benefits while reducing environmental effects from traditional scallop fishing.

This section describes the preferred and non-preferred alternatives that the Council considered in Amendment 10. Although the Council sometimes selected non-preferred alternatives or modified alternatives based on public comment and supplementary analysis, the content of this section was not changed (except for a few minor corrections and removal of "preferred" for the title of alternatives) to retain the original description of the alternative and rationale before the public and Council at the DSEIS stage. The Council's rationale for the final alternatives and proposed action, as well as an undated description of alternatives that were modified based on public comment and supplemental analysis is given in Section 5.1.

The alternatives are grouped by their primary intent, but may have important and secondary effects that achieves or helps achieve other objectives. Raising the minimum ring size, for example, reduces mortality on small scallops and improves yield, but also improves gear efficiency for larger scallops. It therefore takes less towing time to capture an equal number of large scallops. Similarly, area rotation improves the distribution of effort, favoring more productive areas for scallops and at times reducing the amount of tow time to capture an equal amount of scallops.

Both increases in ring size and area rotation improve yield, but also reduce tow time which can reduce bycatch and habitat effects for the target scallop fishing mortality rate. For simplicity, the alternatives are described once in the following sections, but where these multiple effects are thought to be important, the alternative is listed in each appropriate section.

Status quo and no action alternatives: In each of the following sections, a status quo alternative and possibly a no action alternative is included and analyzed in Section 5.3. In some cases, there is no difference between the status quo and a no action alternative, and only a no action alternative is described. In other cases, there are important differences between the status quo and no action, where both are described. The following convention was followed in the document to identify the status quo and/or a no action alternative.

The status quo is interpreted as what management actions would transpire to meet the Amendment 7 mortality objectives, considering the status of the resource relative to the Amendment 7 overfishing definition. The status quo is interpreted as to what would be the likely result for area access policies, including treatment of the Hudson Canyon Area as a re-opened area and presuming no access to the Georges Bank groundfish closures. The status quo alternative is not interpreted to mean the current management status under conditions that prevailed in 2001 and 2002, i.e. **the status quo is not interpreted as a 120 full-time day-at-sea allocation** because it may not achieve the Amendment 7 mortality target.

The no action alternative, on the other hand, is interpreted as what management actions would transpire in the absence of any change in regulations, thus the no action alternative applies to all of the sections below. As such, the day-at-sea allocations after 2002 would revert to the published Amendment 7 day-at-sea schedule and the Hudson Canyon and VA/NC Areas would open to regular scallop fishing. These events would occur when no action is taken, because the two-year day-at-sea and area allocation provisions of Framework Adjustment 14 would expire.

Short term management actions: Because Amendment 10 introduces an adaptive management approach, it is difficult and unrealistic to specify management measures beyond the 2004 fishing year. In particular, the future day-at-sea allocations would depend on the status of the resource in various management areas, dictated by the most recent annual or enhanced industry survey. The allocations, TACs, and closures would depend on future events, primarily scallop recruitment which is highly variable and unpredictable on an annual or area-specific basis.

To the extent that current data allow, estimates of area-specific allocations or days-at-sea or trips with possession limits are supplied for 2003 and 2004. These and the specific areas that would be closed to fishing at that time depend in part on the 2002 annual survey results which will be conducted later this year.

The 2001 survey data is however useful and provides a satisfactory estimate of the management measures that are likely in 2003, because the results of the area rotation strategies and allocation mechanisms described below depend on the status of the resource. The status of the resource in 2003 is largely related to the projected age structure of the population in 2001 and the realized mortality rate in 2002, but may be affected by recruiting scallops first observed in the future 2002 survey. Although the 2002 recruitment could affect the 2003 projection, the scallop stocks have an age structure that reflects recent management decisions that led to large scallops in Closed Area I and the Nantucket Lightship Area, slightly smaller scallops in the Hudson Canyon Area, few scallops in the VBA, and smaller scallops in Closed Area II (due high mortality rates in 1999 and a large 2000 recruitment event) and in the Mid-Atlantic open areas (due to high fishing mortality for the past several years). The fishing fleet, however, have directed little effort in the open areas of Georges Bank (except for the area southeast of Chatham that had been proposed for closure in Framework Adjustment 14, but not implemented).

As a result of the above events and projected stock structure, the day-at-sea allocations in 2003 and potentially 2004 can be estimated fairly well and we can also estimate the probability that rotational management areas would close to fishing because it met closure criteria. There is very little short term differences between the area rotation alternatives in 2003 and 2004, because the results are dominated by the current resource condition and management controls. On the other hand, probable area closures in Amendment 10 might suddenly change after the 2002 scallop survey due to new recruitment.

5.3.1 Overfishing definition

The Council considered revising the overfishing definition to be more consistent with area rotation and the effect of long-term closures on scallop management. Both definitions use the same biological reference points, F_{max} and B_{max}. Fmax is currently estimated to be 0.24 and is used as a proxy for F_{MSY} which is unknown. Consistent with the National Standard 1 guidelines, F_{max} is used as a maximum fishing mortality threshold and the annual target is 80% of that value.

The biomass target is the biomass expected to occur based on equilibrium yield-per-recruit calculations when the stock is fished at F_{max}. The value of B_{max} estimated in Amendment 7 using 1982 to 1997 data was 8.16 g/tow for scallops on Georges Bank and 4.10 g/tow for scallops on the Mid-Atlantic shelf. Amendment 10 would update these targets using 1982 – 2002 recruitment data, revising the Georges Bank target to 5.30 kg/tow and the Mid-Atlantic target to 6.26 kg/tow.

5.3.1.1 Proposed

The proposed overfishing definition would set annual fishing mortality thresholds to achieve maximum yield-per-recruit from scallops that are or will potentially become available to fishing. These annual thresholds will vary according to the rotation area management situation at the time. The biomass target would continue to be defined as B_{max}, but the minimum biomass threshold would be revised to ½B_{max}. The details of the proposed overfishing definition are described in Section 3.4.1.

Rationale: A revision in the overfishing definition is needed to achieve optimum yield, establishing annual mortality targets that apply to areas that are presently or will become available for fishing. The revision is also necessary to allow fluctuations in the annual fishing mortality rate to achieve optimum yield from area rotation, consistent with the policy of achieving an optimum mortality rate for a cohort, averaged over time, which will maximize its yield-per-recruit. Moving the minimum biomass threshold from ¼B_{max} to ½B_{max} would improve consistency with the National Standard 1 guidelines, without forcing another round of rebuilding and causing economic disruptions.

5.3.1.2 Status quo

The existing overfishing definition would continue in force. The fishing mortality target would be a fixed parameter (80 percent of F_{max}) and would apply to the entire resource, regardless of whether the scallops contribute to yield. The minimum biomass threshold would remain at ¼B_{max}. The details of the status quo overfishing definition are given in Section 3.4.2.

Rationale: The status quo overfishing definition will achieve optimum yield if sufficient areas remain or become open to scallop fishing. Also the zero mortality in long-term closed areas23, while not affecting the harvest rate in open fishing areas, have conservation benefits and act as a source of spawning activity.

5.3.2 Alternatives to Improve Scallop Yield

One major purpose of Amendment 10 is to introduce new management to the fishery that benefits from the heterogeneities in the resource and the environment – improving the effectiveness of management to maximize benefits while reducing environmental effects from traditional scallop fishing. One way to do this is to manage the distribution and amount of fishing effort much better than has been possible under the existing management regulations.

Unlike the current management system that allocates days to vessels for fishing in any open area, scallop fishing effort can be identified with specific areas. Where the scallops are small or where the effects on habitat or bycatch are higher than in other areas, fishing effort can be reduced by strategically closing areas. In some cases, areas would close over a long term to protect important resources. In other cases, areas might close seasonally to avoid bycatch or over several years to allow growth of high abundances of small scallops. Other areas with large scallops, where gear efficiency is high, or where environmental impacts are low, fishing effort might be raised to be consistent with a **rotational management** approach.

Several types of rotational management approaches are presented below as alternatives, ranging from the simplest form of area rotation to more complex, adaptive strategies. The simplest form of area rotation only requires identification of discrete area boundaries and a regular schedule for rotation closures. The most complex strategy, allows for adaptive decisions for when to close an area, for when to re-open the area to fishing, and even the size and shape of areas that are closed and later could be fished under rules that deviate from the norm to maximize net benefits. These area rotation strategies are described in Sections 5.3.2.2 to 5.3.2.8, categorized as follows:

23 Long-term closures would not be available for future scallop fishing under area rotation policy. Examples of this are habitat closure areas, like ones described in Section 5.3.2.2.

1. Mechanical rotation with fixed area boundaries
2. Adaptive closures, for a fixed duration and with fixed area boundaries
3. Adaptive closures and re-openings, with fixed area boundaries
4. Adaptive closures and re-openings, with fixed boundaries and mortality targets or frequency of access that vary by area
5. Adaptive closures and re-openings, with adaptive boundaries identified by survey when the areas are closed
6. Georges Bank access to groundfish closed areas

Even without closures, fishing effort management by area could improve scallop yield and reduce habitat effects. Without restrictions on where vessels fish (other than the existing area closures to protect groundfish), the fishery has a history of targeting scallops long before they have reached optimum harvest size. Under certain conditions, it can be more lucrative for commercial fishing vessels to target the small scallops that are aggregated than dispersed large scallops. These short-term responses by fishermen can create a pattern of localized overfishing by increasing the mortality of small scallops that are caught before their contribution to landings is at its maximum. At the same time, larger scallops (assuming that they survived early targeting by the fishery) are not fished at appropriate levels and biomass is lost due to natural mortality.

Even though large scallops may be available elsewhere, the contagious distribution of scallop settlement creates a large biomass of small scallops that can be more valuable for vessels to target than a more dispersed distribution of larger scallops. To some extent, the higher processing cost for targeting small scallops and the lower price per pound is sufficient to keep vessels from targeting the small scallops. With a maximum crew size, the ability to land shucked scallops per day-at-sea declines with smaller size. Vessels with a seven man crew can shuck about 40,000 to 50,000 scallops per day and landings therefore double when the count declines from 30 to 15 meats per pound, for example. Many times, the price per pound also is higher for larger scallops, although market dynamics can change this general pattern.

In addition to reducing localized overfishing, **area based management** (described in Section 5.3.2) can accommodate regional differences in scallop growth and mortality rates, as well as regional differences in dredge efficiency and non-catch mortality on different bottom substrates. Some information is known about these effects is known [e.g. scallop dredges are more efficient and have less non-catch mortality in sandy areas (Section 8.2.1) and have been included in the biological estimates, but even without complete knowledge, area base management offers benefits over stock-wide effort allocations for the reasons given in the above paragraph.

Two non-area based management alternatives are also described below. Increasing the dredge rings from 3 ½-inches to 4-inches reduces mortality on small scallops, which in turn increases yield as these fast-growing scallops escape capture. Another alternative proposes to rebalance the day-at-sea allocations by gear sector, based on the amount of mortality per day created by vessels using each gear. The difference arises from the variation in size targeted and landed by vessels using each gear, rather than from differences in area swept after adjustments to correct for differences in swept area by the two gears. Shifting days from the gear that catches smaller scallops to the one that catches larger scallops potentially has the same effect as improving gear selectivity or area rotation that reduces the availability of small scallops to fishing.

5.3.2.1 General area rotation policies

The following general policies would apply to the area rotation management strategies described in the following sections, including mechanical and adaptive strategies, but not including area-based management (which does not specifically include area rotation).

Unlike the current management measures, area rotation would introduce a systematic structure that determines where commercial vessels may fish for scallops and for how long. Area rotation also establishes a planned set of criteria or guidelines that would regularly close areas to fishing when small scallops are more abundant than large scallops, due to abundant new recruitment, due to the effects of fishing, or both. Areas would close when the expected increase in exploitable biomass exceeded a pre-defined level and re-open to fishing when the annual increase was less than another, lower threshold. This happens when the stock structure favors young, fast-growing scallops or older, slower growing scallops, respectively.

Three types of areas would be established under an area rotation management system: Closed rotation area, re-opened rotation area, open fishing areas. In addition to these classifications, Amendment 10 may also create long-term closures to protect sensitive habitat or avoid bycatch where it is exceptionally high and cannot otherwise be avoided. The general area rotation rules for these area classifications are described in Table 11.

Table 22. General management structure for area rotation management.

Area type	Criteria	General management rules	Who may fish
Closed rotation	Biomass growth rate exceeds a pre-defined ceiling; biomass in newly closed areas (after accounting for existing closed areas) may not exceed a pre-defined upper limit.	• No scallop fishing allowed • Scallop limited access and general category vessels may transit closed rotation areas provided fishing gear is properly stowed. • Scallop bycatch must be returned intact to the water in the general location of capture.	• Any vessel may fish with gear other than a scallop dredge or scallop trawl • Zero scallop possession limit
Recently re-opened	Biomass growth rate is less than a pre-defined floor after closure. Status expires when time averaged mortality declines to resource-wide target.	• Fishing mortality target is determined by time averaging since the beginning of the most recent closure. • TACs and special limits on day-at-sea or trip allocations with a possession limit and day-at-sea tradeoff. • Transfers of scallops at sea would be prohibited • Potential gear conflicts will be reduced by timely notification of fixed gear	• Limited access and general category vessels may fish for scallops only on authorized trips. • Other vessels may fish with non-scallop gear. • Vessels with incidental catch permits may be allowed to retain more than 40 pounds.

Area type	Criteria	General management rules	Who may fish
		fishermen that may have gear set in a closed scallop rotation area.	
Open	Scallop resource does not meet criteria to be classified as a closed rotation or recently re-opened area	• Limited access vessels may target scallops on a regular day-at-sea • General category vessels may target sea scallops with a daily possession limit. • Transfers of scallops at sea would be prohibited	All vessels may fish for scallops and other species under applicable rules.
Long-term closures	Areas closed to protect habitat, avoid bycatch, or for other reasons.	Closed to fishing by vessels using one or more gear types	Vessels may use any gear not prohibited.

Area rotation also allows for differences in annual fishing mortality targets to catch scallops at a higher than normal rate, precisely (used in a relative sense) when the scallops are at an optimum size. This optimum is defined by a biomass growth rate that declines as scallops age below losses due to natural mortality. Interestingly, it also is defined by a gear efficiency vector with scallop size (see comparison of 3 ½ and 4-inch rings in Section 8.2.8). reducing the tow time (and environmental impacts) needed to catch scallops that maximize yield (appropriately reduced to account for risks due to uncertainty and to achieve economic and social objectives). Thus when scallops are abundant and near the optimum size, fishing mortality should be higher during that time than the appropriate level that would generally apply otherwise.

One way to account for temporary changes in annual fishing mortality is by using time averaged fishing mortality, such that the average for an area since the beginning of the last closure will be equal to the resource-wide fishing mortality target (80% of F_{max},F=0.20). To do this, either the length of time when a rotation area is deemed to be "recently re-opened" should be known, or the average annual fishing mortality target for recently re-opened areas is set in advance.

In addition to a constant target fishing mortality rate for recently re-opened areas, the annual target may change over the time when an area is recently re-opened, **as long as the average since the last closure doesn't exceed the resource-wide target**. Sometimes an area may re-open when not all the scallops there are at optimum size or the high biomass in re-opened areas cause surges in landings (which affects price). As a buffer, the annual TAC and fishing mortality target for an area may vary from a constant target fishing mortality rate during a re-opened status. This approach seems particularly useful when rotation closures are shorter (2-4 years) rather than longer (5 or more years).

For example, after a closure period of three years and a planned re-open period of another three years, the time-averaged fishing mortality target is 0.4 [i.e. 0.2 times 6 years divided by 3 years (the total period as a re-opened area)]. A useful variation on this calculation (and one that is risk adverse and reduces variability in landings) is to catch scallops at less than 0.4 in the first re-opened year, at 0.4 in the second year, and higher than 0.4 in the third (and last) re-opened year. The first year might be fished at a rate of 80% of the time averaged target (or F=0.32), the second year at 100% (F=0.40), and the third year at 120% (F=0.48).

In a recently re-opened rotation management area, hard quotas may apply and these areas would close to fishing for the year when landings equal the TAC, irregardless of whether some vessels had authorized trips remaining.

Whether or not the annual fishing mortality target increases with time or not, the time-averaged fishing mortality declines to the norm in the seventh year (i.e. F=0.20). Also, in the seventh year (or whenever the time averaged fishing mortality target declines to the norm), the fishing area becomes reclassified as an "open" fishing area under general scallop fishing rules and under most of the strategies below, there would be no area specific limits or a hard TAC.

Variations (often dictated by adaptive area rotation strategies) on the above example include the length of the closure, the length of the recently re-opened period, and the "ramping" strategy applied to the annual mortality targets in the re-opened areas. The following tables show how this would work:

Table 23. Example of ramped fishing mortality targets for re-opened areas, compared to mortality targets with no rotation and simple rotation with constant fishing mortality targets when re-opened. See Sections **8.2.1** and for analysis of impacts.

YEAR	Year N	1	2	3	4	5	6	7 - N	1	All
Status	**Open**	**Closed**	**Closed**	**Closed**	**Re-opened**	**Re-opened**	**Re-opened**	**Open**	**Closed**	**Average**
No rotation	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Simple rotation	0.20	0.00	0.00	0.00	0.40	0.40	0.40	0.20	0.00	0.20
Ramped rotation	0.20	0.00	0.00	0.00	0.32	0.40	0.48	0.20	0.00	0.20

Table 24. Management policies and fishing mortality targets for rotation areas.

Area type	**Rotational management policy**	**Annual fishing mortality target and TAC**
Closed rotation	Temporarily closed to scallop fishing	Set to zero
Recently re-opened	• Area specific day-at-sea allocations or trips with possession limits and day-at-sea tradeoffs • Quotas ("hard TACs") apply and areas close when landings meet the TAC. • Areas re-open to fishing at the beginning of the fishing year (Section 5.3.9.4), unless there is a seasonal closure to avoid unacceptably high bycatch of finfish or turtles.	Equals the time average since the beginning of the last closure, possibly modified by a ramped strategy (e.g. 80%, 100%, 120% of the time-averaged target for three consecutive years) during the re-opened period.

Area type	Rotational management policy	Annual fishing mortality target and TAC
Open	• Open to scallop fishing under general rules • Target TAC applies and day-at-sea allocations based on the number of days calculated to achieve the target • Rotational management areas that are in an open status may have seasonal closures to avoid unacceptably high bycatch of finfish or turtles	Equals 80% of F_{max}
Long-term closures	Closed to scallop fishing	Set to zero

<u>Boundaries of rotational management areas:</u>

The chart below (Map 7) shows the boundaries of rotational management areas associated with fixed boundary strategies in the following alternatives. Although there are exceptions, the overwhelming majority of scallops and scallop productivity are contained within the candidate boundaries.

Nine rotational management areas in the Mid-Atlantic region are mostly arranged along strips of three ten-minute squares, until reaching the vicinity of Hudson Canyon, where the coastal shelf bends and scallops are distributed along a northwest-southeast axis. From Hudson Canyon to Long Island, the candidate rotational management areas run diagonally, using long, straight boundaries to accommodate the different resource distribution and reduce community and vessel size impacts associated with an inshore/offshore bands of potential closures.

Scallops in the Georges Bank region are not as neatly organized as those in the Mid-Atlantic, because the bathymetry is less orderly from the arrangement of Georges Bank. The candidate boundaries also take into account, the existing management areas that have influenced the distribution of the resource. Management can take advantage of this difference in resource distribution in the groundfish closed areas, at least over the short term, to improve or stabilize yield and effort allocations, using these areas as a reservoir.

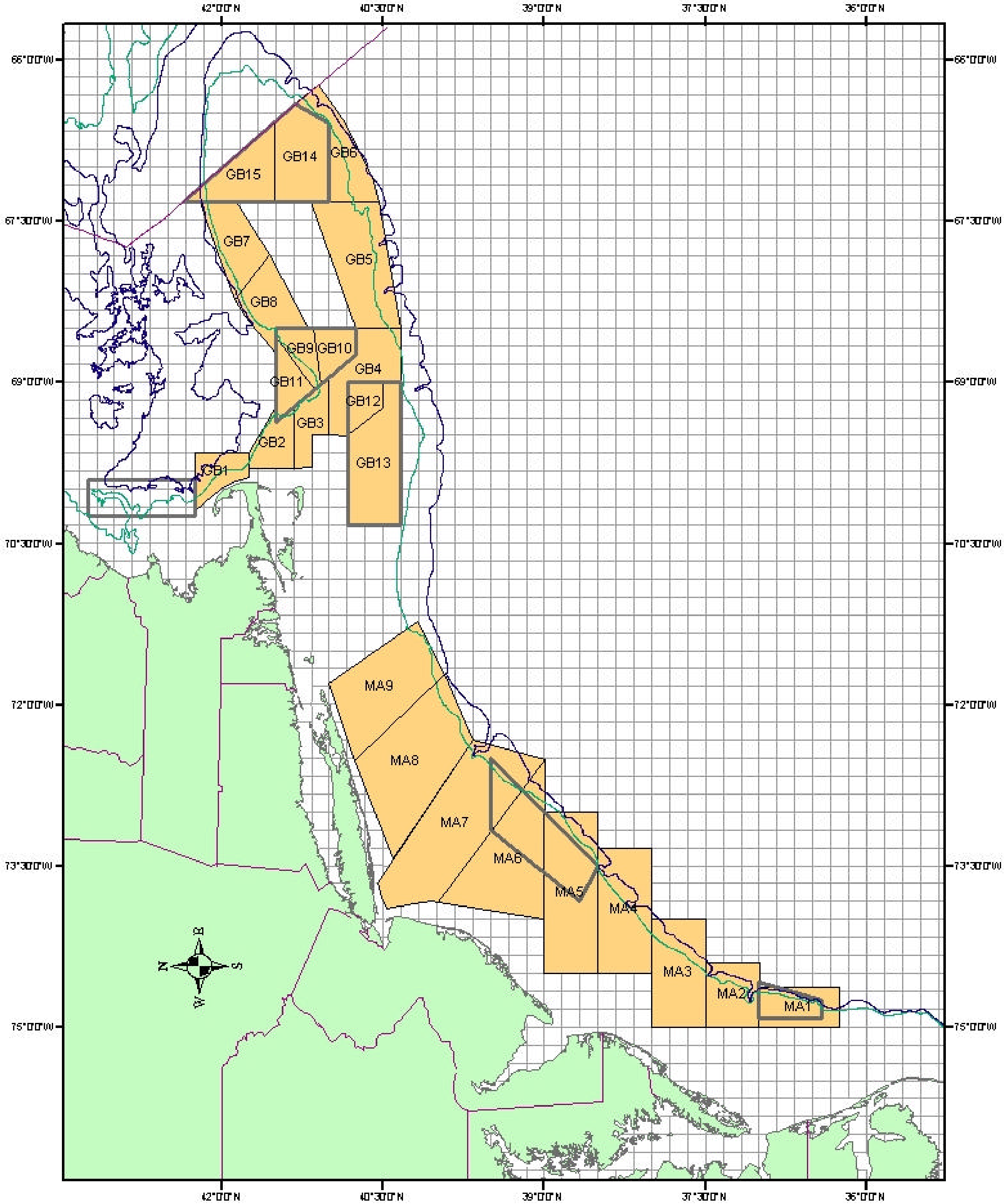
Taking these factors under consideration, the rotational management areas in the vicinity of the Great South Channel are drawn in east-west bands, but the southern bands move to the east because of the axis of the channel and the boundaries of Closed Area I and the Nantucket Lightship Area. In addition, two areas (GB9 And GB12) follow the boundaries established by Framework Adjustment 13, which took habitat, bycatch, and gear conflict concerns into account.

On the central and eastern part of Georges Bank, the candidate area boundaries use straight lines to cover the edge of Georges Bank, where scallops occur. Few scallops are found on the top of Georges Bank or in the deep waters off the bank. Closed Area II is split into two rotational management areas, recognizing the difference in features found in the two areas and using the boundaries established by Framework Adjustment 11, which took habitat, bycatch, and gear conflict concerns into account.

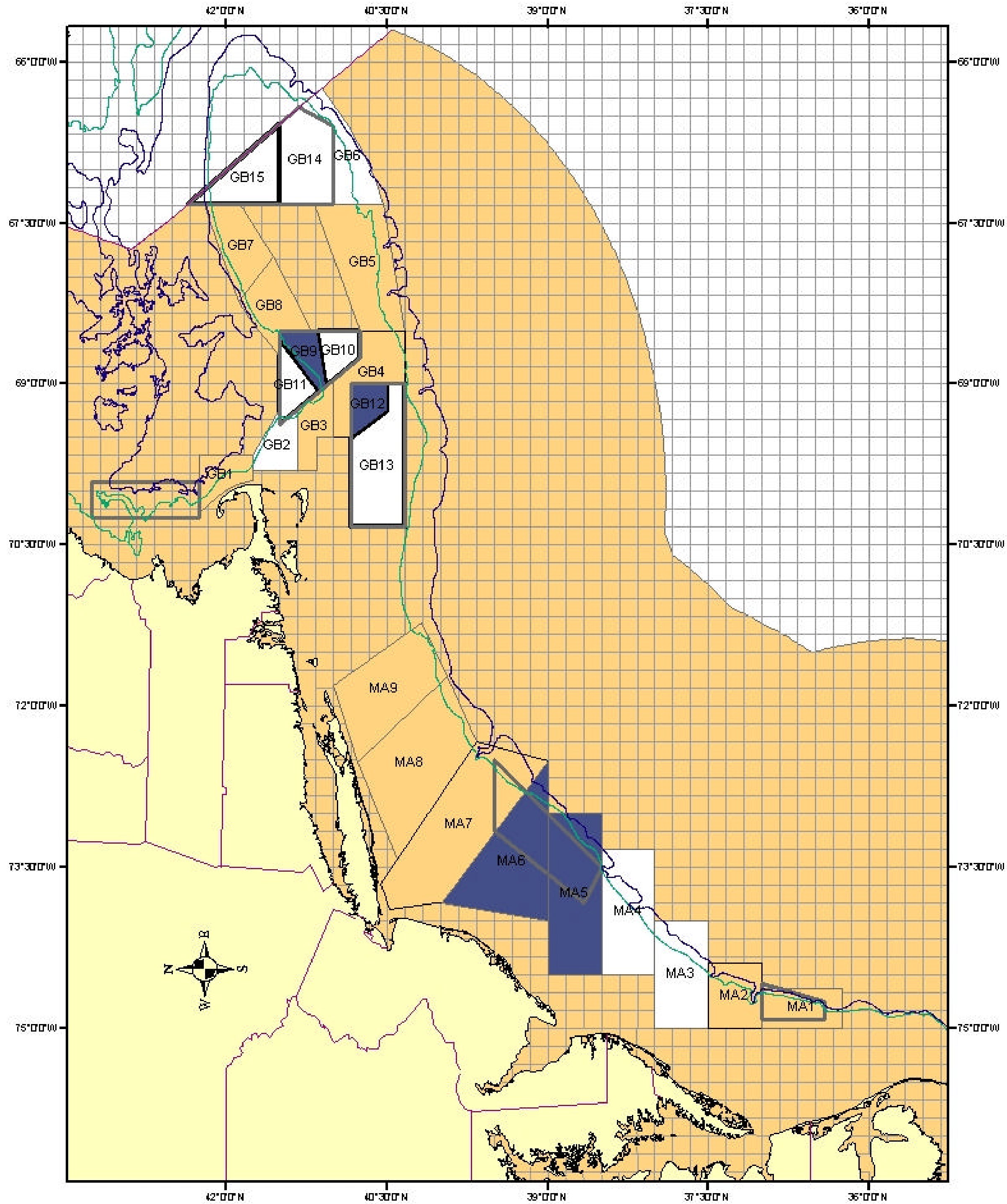
Although the PDT chose these areas to evaluate the performance of different area rotation systems in a general sense, the choices were made while considering the resolution of existing data (survey and commercial) and the general ability to manage and enforce understandable regulations.

Where possible, these candidate boundaries followed the advice of the Council's Enforcement Committee (i.e. straight boundaries along lines of latitude and longitude) and partly developed during initial deliberations about area rotation during 2000 (i.e. latitudinal strips of three ten-minute squares in the Mid-Atlantic region and blocks of 6 to 9 ten-minute squares in the Georges Bank region. No boundaries were evaluated or proposed in the Gulf of Maine, due to the relatively sparse source of information about the resource or the fishery.

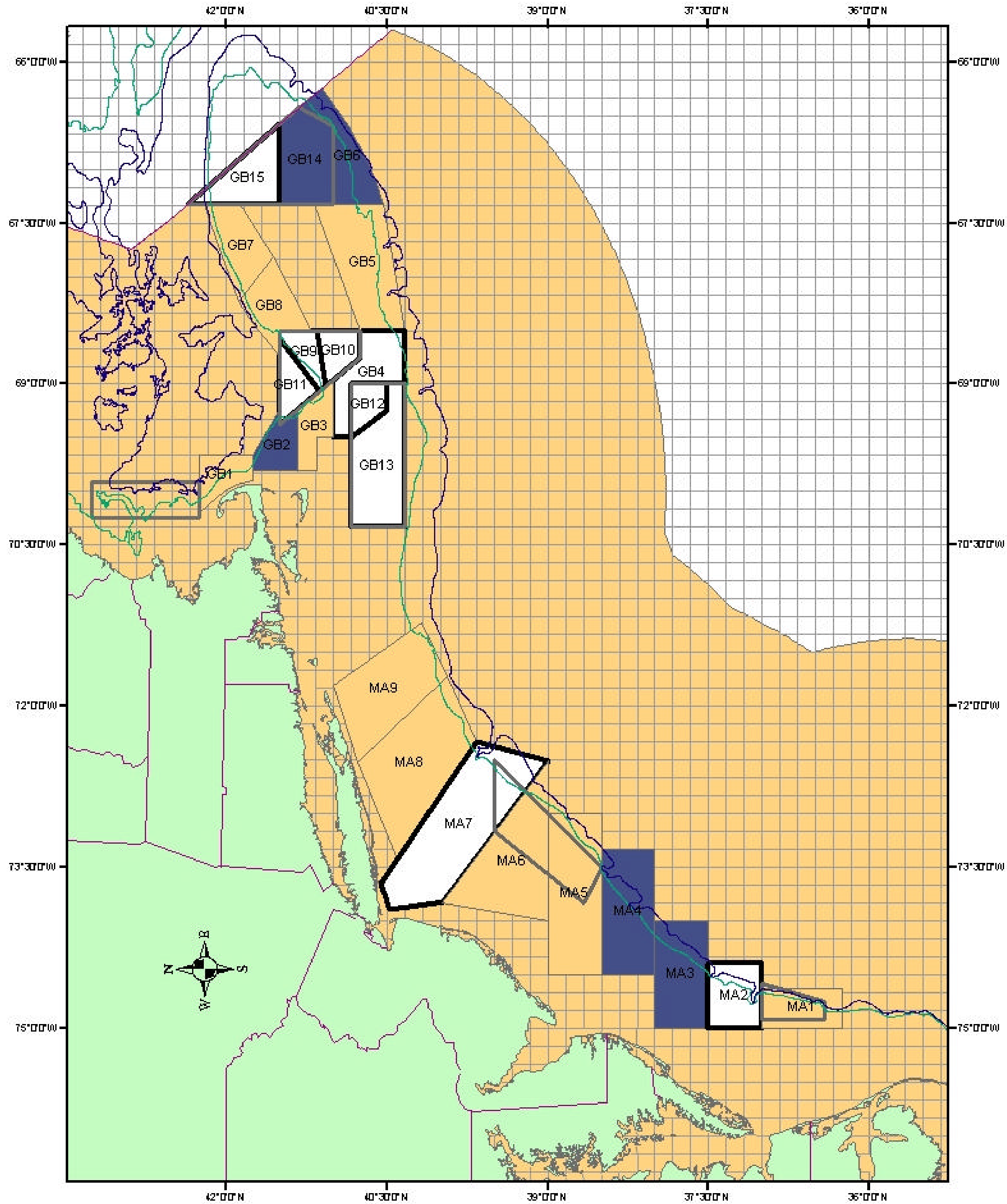
Modest changes in the configuration and boundaries of one or more of these proposed areas is unlikely to radically change the analysis and evaluation of area rotation systems. Nonetheless, it will be difficult, if not impossible to select fixed boundaries that are ideal and if the Council chooses a fixed boundary area rotation system, it is likely that minor modifications from time to time will be necessary as problems arise or because new information exists.



Map 7. **Candidate area rotation boundaries analyzed in the DSEIS to evaluate area rotation systems with fixed boundaries using existing resource data.**



Map 8. **Example area rotation scenarios, where white areas represent closed rotation areas and blue areas represent re-opened rotation areas. All orange areas would be open to normal scallop fishing by scallop vessels with limited access and general category permits.**



Map 9. **Example area rotation scenarios, where white areas represent closed rotation areas and blue areas represent re-opened rotation areas. All orange areas would be open to normal scallop fishing by scallop vessels with limited access and general category permits.**

5.3.2.2 Mechanical area rotation with fixed area boundaries

Rotation management areas (e.g Map 8 and Map 9) close and open in order according to a fixed schedule and the amount of closed area in any one year is in the same proportion as the proportion of years that areas close. Rotation schedules ranged from 3 years open/3 years (i.e. 50% of areas close at any time) closed to 5 years closed/1 year open (i.e. 83% of areas close at any time).

The initial choice of areas to close when implemented would be those areas that have the smallest average size of exploitable scallops, followed annually by other areas in geographic order, from south to north in the Mid-Atlantic region and from east to west in the Georges Bank region. Rotation areas in the Mid-Atlantic and Georges Bank regions would be treated separately, so that at least one area in each region is open to fishing every year.

For a 3/3 year rotation schedule, the annual adjustment would rotate the areas sequentially, i.e. year 1 – areas A, B, C; year 2 – areas B, C, D; year 3 – areas C, D, E, etc., until the whole schedule recycles in N years[24]. N minus three areas would be open to fishing and "recently re-opened" targets and management rules would apply to some areas for three years that were previously closed. Time averaged mortality limits would apply and since the closed and re-opened schedule is fixed, the time averaged fishing mortality rate is two times the general fishing mortality target (i.e. 80% of F_{max})

For a 5/1 year rotation schedule, the same strategy would apply, but a re-opened status would apply for one year according to the time averaged mortality limit, equal to six times the general fishing mortality target for one year, followed by an annual target equal to 80% of F_{max} until the area closes again.

Rationale: Other than the initial choice of areas, mechanical rotation is the least costly form of area rotation, because the boundaries are fixed and the subsequent choice of areas to close does not depend on surveys. On average, benefits accrue because the areas that are scheduled to close have been opened for the longest time and the age structure of those scallops are the most affected by fishing. The system therefore tends to close areas with smaller scallops than areas that are slated to open. On the other hand, occasionally an area would close despite the presence of abundant, small scallops or re-open to fishing precisely when a large year class of small scallops is present.

Probable short-term consequences

The short-term consequences for mechanical area rotation are the same as for adaptive closures (Section 5.3.2.3) with fixed duration, because the initial selection of closed area would be based on the same information as the criteria used in the adaptive closure rules.

5.3.2.3 Adaptive closures, for a fixed duration and with fixed area boundaries

The next simplest area rotation system is to choose which pre-defined areas (e.g. Map 7) should close to fishing on an annual or more frequent basis. The criteria for area closures would be a minimum potential biomass increase (range 10 – 40%) and a maximum amount of exploitable biomass (range 25 – 75%) that would be protected when areas first close. The potential biomass increase is the annual change in the total biomass of scallop meats if no fishing occurs. Exploitable biomass is the total meat weight of scallops that are selected by fishing, accounting for gear and cull size, at the beginning of the fishing year. The Council may, at its discretion, vary from these criteria to reduce risk of recruitment failure (i.e

24 N years is equal to the number of areas for a given region.

respond to an overfished condition) or to improve yield (i.e postpone mortality on exceptionally high recruitment).

The proportion of exploitable biomass in closed rotation areas may increase above this ceiling due to the growth of biomass while closed for a fixed amount of time. An area, once closed, would remain closed for a pre-defined period (range 3-5 years), when the area would be classified as "re-opened" (see Section 5.1.3.1). When scheduled to re-open, an area may remain closed for a second cycle if it still meets both criteria for closure and has the highest potential biomass growth rate. Such an event could occur if there was an exceptional recruitment event just before an area is slated to re-open.

Table 25. Rotation management rules for adaptive closures, with fixed duration and fixed boundaries.

Action	Criterion 1	Criterion 2
Rotational management areas would close when:	The potential biomass growth must exceed a pre-defined value (15–40%, 25% preferred)	The exploitable biomass in newly closed areas shall not exceed a pre-defined limit (25-75%, 25% preferred)
Rotational management areas would remained closed:	For a fixed duration (3-5 years, 3 preferred)	Not applicable
Rotational management areas would re-open to scallop fishing when:	The fixed duration closure expires	Not applicable
Rotational management areas would be classified as recently re-opened:	For a period no greater than the length of closure, or when the average exploitable meat weight is no greater than 20 percent of the average meat weight in regular open fishing areas	Not applicable

If the number of areas that exceed the growth criteria would close more than the ceiling on the amount of exploitable biomass to conserve via rotational closure, then the areas with the highest growth rate would be chosen first. In sequential order, if a candidate area that met the growth criteria pushed the total amount of exploitable biomass over the maximum limit, the area would not be closed in that year, or until the biomass in the closed areas fell below the biomass limit, or when closed areas re-open to scallop fishing.

Scalloping grounds outside the groundfish closed areas would be divided into fixed areas, about 9 in Georges Bank (in addition to the groundfish closed areas) and 9 in the Mid-Atlantic. There areas at any given time would be characterized as being either closed, open-unrestricted, or recently reopened-restricted fishing. No more than some percentage (somewhere between 25-75%) of each of three broad regions (Georges Bank, New York Bight, and Delmarva/Virginia Beach/NC) would be closed at any one time. New closures would be determined after the annual survey and any supplemental industry survey has been completed and analyzed. Areas would be ranked according their potential biological growth rate of an area (in percentage terms). The highest ranking areas (i.e. those with the smallest scallops which tend to grow faster relative to other areas with larger scallops) would be closed if they meet a minimal threshold for potential biological growth rate, and if they do not bring the percentage of the potential productivity that is closed in the region beyond the level allowed. If that more areas meet the closure threshold than can be closed, the ones with the highest suitability indices would be closed.

Through an automatic sunset provision, closed rotation management areas would normally close for three years, but may through framework adjustment (Section 5.3.9.3) or annual specification (Section 5.3.9.2) be closed for one or two extra years, or opened a year early under appropriate conditions. When reopened, areas would be subject to restricted fishing for two to three years. Fishing in the area would be limited by a TAC, and either a DAS tradeoff and trip limit, as is practiced presently, for that area. It would be best to "ramp up" the effort as the dominant cohort nears its full growth potential by starting at a low fishing mortality the first year the area is reopened, and increase it each year while classified as recently re-opened.

Rationale: Unlike mechanical rotation (Section 5.3.2.2), the order of closed area rotation would be adaptive, i.e. it would depend on the age structure of the resource in the rotational management areas. Adaptive closures of pre-defined rotational management areas prevent the closure of the wrong area that could occur under a mechanical rotation strategy.

Areas may meet the closure criteria simply because it had been subject to high fishing effort for lengthy periods (i.e. few large scallops) or due to recent above average recruitment (i.e. lots of small scallops), or both. Provided that the pre-defined areas are compatible with the annual survey data, annual evaluations and adjustments could rely on existing data, but smaller (and more) rotational management areas would be possible with added survey tows or additional cooperative resource surveys.

Other aspects of area rotation would not be adaptive, which could keep continuous monitoring costs at practical levels and would allow the industry to plan on upcoming fishing rules. Planning is possible, in this case, because there would be a very high probability that closed areas would re-open on schedule and based on the survey data, the amount of scallop landings when the area re-opens is predictable. Monitoring costs would be less than more adaptive strategies, because a detailed survey is needed only in the year before an area re-opens – to accurately estimate the TAC and effort limits when it re-opens. Continuous monitoring to determine whether an area should remain closed is unnecessary with a fixed duration closure.

<u>Probable short-term consequences</u>

In the short term – the management rules for the fixed boundary area rotation alternatives are dominated by the current status of the resource, where a significant portion of the biomass is in the groundfish closed areas on Georges Bank and in the Hudson Canyon Area. Although there is significant biomass in the open areas of the Mid-Atlantic, the highest mortality in 2001 and 2002 is and appears to be in the Delmarva region (rotational management areas MA2 to MA4) and along the inshore boundary of the Hudson Canyon Area (part of rotational management areas MA5 and MA6. Projections indicate that MA2 and MA4 have more than a 90% probability of closure with most area rotation closure criteria, and would remain closed for three or more years.

Likewise, the high mortality on 2000 recruits appears to be in rotational management area GB1 and GB7, which has a 50% probability of meeting the closure criteria, followed by GB2 or GB3. Rotational management area GB2 has a high probability of closure when GB1 and GB7 would presumably re-open in 2006, after a three-year closure.

The amount of landings and day-at-sea allocations between alternatives and closure criteria options vary little in the short term. Most of the differences in landings and day-at-sea allocations occur because of differences in Georges Bank area access policy (Section 5.3.2.8).

5.3.2.4 Adaptive closures and re-openings, with fixed area boundaries

Like the alternative above, rotational management areas would have pre-defined configurations and would close when the areas met criteria for potential biomass growth rates and for maximum percent of exploitable biomass in closed areas. Closed rotation areas would re-open when the potential biomass growth rate declines below a limit associated with the optimum harvest size. The duration of rotational closures will vary over time for each area, due to subsequent recruitment and resource conditions, allowing other areas with higher potential biomass growth rates to close.

Table 26. Rotation management rules for adaptive closures and re-openings, with fixed boundaries.

Action	Criterion 1	Criterion 2
Rotational management areas would close when:	The potential biomass growth must exceed a pre-defined value (15–40%, 25% preferred)	The exploitable biomass in newly closed areas shall not exceed a pre-defined limit (25-75%, 25% preferred)
Rotational management areas would remained closed:	Until the potential biomass growth rate declined below a minimum threshold (10-25%, 10% preferred)	Not applicable
Rotational management areas would re-open to scallop fishing when:	The potential biomass growth declines below a pre-defined value (10-25%, 10% preferred).	Not applicable
Rotational management areas would be classified as recently re-opened:	For a period no greater than the length of closure, or when the average exploitable meat weight is no greater than 20 percent of the average meat weight in regular open fishing areas	Not applicable

Scalloping grounds outside the groundfish closed areas would be divided into fixed areas, about 9 in Georges Bank (in addition to the groundfish closed areas) and 9 in the Mid-Atlantic. There areas at any given time would be characterized as being either closed, open-unrestricted, or recently reopened-restricted fishing. No more than some percentage (somewhere between 25-75%) of each of three broad regions (Georges Bank, New York Bight, and Delmarva/Virginia Beach/NC) would be closed at any one time. New closures would be determined after the annual survey and any supplemental industry survey has been completed and analyzed. Areas would be ranked according to a "closure suitability index" based on both the relative growth rate of an area (in percentage terms). Areas would be closed if they meet a minimal threshold in the suitability index, and if they do not bring the percentage of the potential productivity that is closed in the region beyond the level allowed. If that more areas meet the closure threshold than can be closed, the ones with the highest suitability indices would be closed.

Areas would close until the potential biomass growth rate declined below a pre-defined threshold. When one or more closed rotation areas meet the criteria for being re-opened, other areas with higher annual potential biomass growth rates could be closed, as long as the maximum limit on exploitable biomass in closed areas would not be exceeded by the new closures.

When reopened, areas would be subject to restricted fishing for two to three years. Fishing in the area would be limited by a TAC, and either a DAS tradeoff and trip limit, as is practiced presently, for that area. It would be best to "ramp up" the effort as the dominant cohort nears its full growth potential by starting at a low fishing mortality the first year the area is reopened, and increase it each year while classified as recently re-opened.

Rationale: The premise for this alternative is the same as the one for adaptive closures with fixed duration and boundaries (Section 5.1.3.1), except that there may be times when a fixed duration closure would be too short or too long, depending on the scallop age structure in the area and subsequent recruitment after the area was originally closed.

The length of rotational closures therefore varies (see Section 5.1.3.1), but to keep the rotational closures from becoming chaotic, an area once closed would remain closed until the biomass declined below the threshold for re-opening it. If this occurs earlier than a fixed duration period, the adaptive re-opening would allow other areas with higher potential biomass growth rates to be candidate rotational closures (similar to a baseball salary cap). If subsequent recruitment is above average and the potential biomass growth rate in a closed area stays high, then the adaptive re-opening criteria would prevent a rotational closure from opening too early on small scallops.

Probable short-term consequences

The short-term consequences are the same as for the fixed closure duration alternative above (Section 5.3.2.3). Differences might occur in 2005 to 2007, however, because of recruitment events in 2003 to 2005, causing closed rotational areas to open earlier or later than expected. Over the intermediate term, the average annual landings should be higher than the above alternative, but the costs of continuously monitoring the age structure and potential biomass growth in closed areas during its closure would be higher.

5.3.2.5 Adaptive closures and re-openings, with fixed boundaries and mortality targets or frequency of access that vary by area

Unlike the other mechanical and adaptive rotational management alternatives, the management strategy described below considers other factors to define the annual fishing mortality target for re-opened rotation management area and in special management areas that have more sensitive habitat or above average bycatch, for example. These factors include considerations such as the relative size of scallops in re-opened areas, habitat sensitivity, or bycatch. For example, a re-opened area may have a different mortality ramping strategy (see Section 5.1.3.1) than normal because it has scallops that are very large when the area re-opens to scallop fishing, or vice versa.

Areas with above average habitat sensitivity or bycatch could also have a lower time-averaged fishing mortality target, instead of 80% of the Fmax value as specified in the overfishing definition control rule. For example, portions of the Georges Bank closed areas or other designated sensitive areas (Section 5.3) might be part of the area rotation system, but the time-average target mortality rate could be 50 percent of the overfishing definition target. In this case, the mortality rate and amount of fishing effort would be half of the normal amount, but the yield derived from these areas would be a greater fraction of the maximum sustainable catch.

This approach uses the area rotation approach described in Section 5.1.3.1 and the time-averaged mortality calculation for defining annual mortality targets for rotation management areas. It also allows for variations and contingencies in scallop size, habitat sensitivity, and bycatch to define the annual mortality targets and resulting TACs. It is therefore consistent with the proposed overfishing definition (Section 3.4.1), but allows a greater range of considerations when setting area-specific mortality targets.

This alternative would create four types of scallop areas according to their characteristics, having fixed boundaries until changed by plan amendment. Open areas would be those with a mix of scallops near optimum size for fishing. Rebuilt areas would be those with predominately large scallops and harvested at an above average level. Special management areas would be those that require a reduction in effort due to potentially high habitat or bycatch impacts. Finally, protected scallop areas would be those where scallop and possibly other fishing effort would be reduced to enhance survival of small scallops and increase future yield.

<u>Open areas</u>	Locations with a mix of scallops at optimum harvestable size considering the overall harvest rate. No less than 50% of the scallop resource area would be categorized as an open area and these areas should be widely distributed along the coastline to minimize local impacts.
<u>Rebuilt areas</u>	Locations where larger scallops predominate and if not harvested at the present time would begin to return a negative rate of return due to mortality and slow growth.
<u>Special management areas</u>	Locations where scallop fishing must be less than optimal for the scallop resource, because of sensitive habitat and/or unavoidable high bycatch or interactions with endangered or threatened species. Initially, these areas would be the same as the areas proposed for closure to reduce bycatch (Section 5.3.5.7) and habitat (Section 5.3) impacts.
<u>Protected scallop areas</u>	Locations where small scallops predominate and therefore scallop and possibly other fishing are curtailed (possibly to zero) to increase survival and future yield. No more than 25 percent of the scallop biomass will be included in protected scallop areas at any one point in time. Conceptually, these would be areas that exceed the potential biomass growth rate threshold in other area rotation alternatives and possibly other areas that are close to but not above the closure threshold.

Special management areas for habitat and bycatch are built in and integrated into area rotation system. Area closures are distributed geographically along the coastline to ensure local areas remain open for fishing by vessels from nearby ports. Area boundaries are fixed according to similarities of scallop biology and productivity, further subdivided by habitat or bycatch zones, with allocations that are inversely proportional to habitat sensitivity and bycatch vulnerability and proportional to habitat resiliency.

The following general rules would apply:

- <u>All open areas are managed with the same control</u>, i.e. days-at-sea or TACs, without tradeoffs or substitute allocations (e.g. trips and a possession limit)
- <u>Initial area boundaries are fixed</u> (not "adaptive") using the same candidate area boundaries for other area rotation alternatives using fixed boundaries, until changed by framework adjustment (as opposed to specification setting)
- Initially <u>day-at-sea allocations or TACs are not tradable</u>, but fully open areas are geographically dispersed

- ❖ Harvest rates in all areas follow a pre-determined formula based on scallop size, projected scallop populations in other areas, vulnerability of habitat and bycatch to scallop fishing, including in some cases a zero fishing mortality limit in areas with very sensitive habitat or areas with bycatch that jeopardizes overfishing other managed stocks.
- ❖ All vessels receive equal shares of area-specific day-at-sea allocations or TACs, based on their permit category
- ❖ Allocations are area-specific in rebuilt and special management areas, but a vessel's allocation of open area days-at-sea or TACs may be applied in any open area

Harvest rates (rather than closures) would be controlled by the following guidelines and set by framework adjustment:

- ❖ All areas have an annual specification of day-at-sea allocations or TAC
  - o Allocations for some areas may be zero for long periods
  - o Frequency of non-zero allocations may be specified in Amendment 10 to address habitat and/or bycatch concerns

- ❖ Allocation is proportional to the average price per scallop
  - o Allocation increases with declining average count, if the expected price is higher than smaller scallops
  - o Allocation increases with price

- ❖ Allocation is proportional to abundance and future yield potential of all other areas
  - o Allocation increases if scallop abundance and future yield are high
  - o Preserves rebuilt scallops when abundance and future yield look bleak

- ❖ Allocation is inversely proportional to habitat sensitivity to scallop fishing and proportional to habitat resiliency
  - o Measures that reduce habitat impacts (e.g. gear modifications, better precision of fishing locations, reduced contact time, etc.) could allow higher scallop allocations and landings

- ❖ Allocation is inversely proportional to the expected non-target catch per day-at-sea or per pound of landed scallop
  - o Measures to reduce the bycatch (e.g. seasons, gear modifications, etc.) could allow higher scallop allocations and landings

Rationale: This alternative is intended to allow greater flexibility to set target fishing mortality rates in special management areas, while still making at least 75 percent of the exploitable biomass managed under general day-at-sea and crew limits. Because of this lower limit on the amount of biomass in closed or special management areas, much of the resource would still be open to general fishing and it would not require costly one-to-one trading of area-specific day-at-sea allocations or trips.

This strategy would provide greater flexibility to set area-specific target fishing mortality rates in re-opened areas, both to take into account differences in growth and natural mortality and also bycatch and habitat impacts. Area rotation would function the same as the above alternative (Section 5.3.2.4), but with a lower ceiling on the amount of area closed during a year. Fishing mortality targets in re-opened areas would be adjusted to take into account bycatch and habitat objectives, rather than relying on seasons, bycatch TACs, or indefinite closures.

Although the reducing fishing effort and area swept in areas with sensitive habitat, high bycatch, and/or small scallops will have benefits, there would be more uncertainty about the effects compared with other area rotation alternatives. This is especially true with regard to habitat impacts where, according to the Joint PDT meeting on habitat conclusions, the first pass of the dredge is the most damaging. On the other hand, the alternative may achieve a significant amount of the benefits of other methods without relying as much on area closures and area-specific limits on effort.

Probable short-term consequences

This alternative may require a lower level of fishing effort in areas that might otherwise be closed to scallop fishing. The specific results cannot be estimated at this time, because it relies on a more generalized approach to minimizing bycatch and habitat impacts.

5.3.2.6 Adaptive closures and re-openings, with adaptive boundaries identified by survey when the areas are closed

Unlike other area rotation alternatives, a fully adaptive strategy would estimate whether various configurations of potential areas meet closure and re-opening criteria. Ten-minute squares (Map 3) about 75 nm^2 are the proposed basis for evaluation, which is considerably smaller than the annual biomass estimates from the existing resource survey will allow. Instead, a procedure utilizing an industry supported survey described below would provide a detailed assessment of candidate rotational management areas.

The boundaries of the rotational management areas would be established by future framework adjustment, based on the distribution and abundance of scallops at size. The guidelines described below would keep the size of the areas large enough and regular in shape to be effective, while allowing a greater degree of flexibility to defined closed rotation areas.

Like other area rotation alternatives, the decision about whether an area should close or re-open to fishing would depend on its expected potential biomass growth rate if closed, following pre-defined criteria. Closure criteria range from 25 to 40 percent (40 percent preferred) and re-opening criteria from 10 to 25 percent potential biomass growth rates (25 percent preferred).

5.3.2.6.1 Closure shaping rules

Invariable roles: Boundaries and distribution of rotational closures

Scallop management regions would be divided into "blocks", each approximately 75 square nautical miles in area, by the existing grid of latitude and longitude lines at 10-minute intervals. [West of 72°30'W], the blocks spanning the depth range [15 to 45 fathoms] are grouped into east-west "strips", each 10 nautical miles wide, north-south. The blocks would be grouped into five "regions":

- Gulf of Maine – [all blocks north of 42°20'N].
- Georges Bank – [all blocks south of 42°20'N and east of 68°30'W].
- South Channel – [all blocks south of 42°20'N, west of 68°30'W and east of 72°30'W].
- Hudson Canyon – [all blocks west of 72°30'W and north of 38°30'N].
- Southern – [all blocks south of 38°30'N]

Within these regions, the following rules would apply to determine the number and configuration of areas that would be closed to scallop fishing until the potential biomass growth rate declined below the minimum threshold, reclassifying the area as "recently re-opened".

Invariable Rule: Number of Closures

Unless the combination of all other closed areas in a region exceeds the maximum acceptable closure extent, there will be one and no more than one scallop rotational closure in each region at any time, except the Gulf of Maine region. In that region, there may be either zero or one scallop rotational closure at any time. Areas indefinitely closed to scalloping (to minimize bycatch or habitat impacts, or for other reasons) will not be considered "rotational closures" for this purpose. If areas are temporarily closed to scalloping by management measures outside of this scallop rotation system, those areas may be (but need not be) considered to fulfill this requirement for having a rotational closure in each region. In other words, long-term or indefinite closures of scallop fishing areas may satisfy the requirement to have at least one rotational closure in each of the five regions.

Invariable Rule: Minimum Closure Sizes

Closures may be larger than but may not be smaller than:

- Georges Bank region: 9 blocks arranged in a 3x3 square.
- Hudson Canyon and Southern regions: 3 adjacent strips.
- Gulf of Maine and South Channel regions: Any 6 contiguous blocks, where blocks are considered to be contiguous if it is possible to pass from one to any of the others by only crossing the boundaries of abutting blocks with the six.

Where a closure spans the boundaries of two or more regions, it shall be at least as large as the minimum size for any of the regions concerned. In the Hudson Canyon and Southern regions, strips may only be closed or re-opened as whole units.

Invariable Rule: Maximum Closure Extent

Closures in each of the five regions may not close more than 50 percent of the scallop fishing areas, or 75 percent of the biomass, whichever is less. In no case will areas be closed under this rotational system if doing so would result in the total area closed to scalloping (including all closed areas, not simply rotational closures) exceeding 50% of the productive blocks in a region. For this purpose, the sum of the total blocks and that of those in closures will be weighted by the relative productivities for the ten-minute squares in a region (Map 2). Blocks that are cut by the boundaries of federal waters or by the boundaries of closed areas will be weighted pro rata to their included area. Similarly, no areas will be closed under this system if doing so would result in 75% or more of the scallop biomass in a region (as estimated by the best scientific estimates available) being in areas closed to scalloping.

If some blocks in a region are subject to seasonal closures to scalloping, the above requirement must be met at some point during the year. In addition, no areas will be closed under this rotational system if doing so would result in the total area closed to scalloping (including all closed areas, not simply rotational closures) at any point during the year exceeding 75% of the productive blocks in a region, with the weighted sum calculated as above. Similarly, no areas will be closed under this system if doing so would result in 90% or more of the scallop biomass in a region being in areas closed to scalloping at any point during the year.

Invariable Rule: Boundaries

Straight lines will form all boundaries of rotational closures. The internal angles between such lines will never be greater than 180°, except that 270° internal angles may be used when the boundary lines that meet at such an angle both extend for at least 21 nautical miles. Where possible, the boundaries will follow the edges of blocks (north-south and east-west boundaries). However, where a rectangular closure would enclose one or more corner blocks that would not themselves merit closure, the Council may select a diagonal boundary aligned from one corner of a block to one corner of another. Long-term closures abutting a rotational closure will be considered when applying this rule.

Basic Rules for closure

Subject to the above invariable rules, the areas to be included in each year's closures shall be selected so as to include as many as possible of the blocks for which the annual potential increase has been estimated to be above the closure criteria for the potential biomass growth rate, plus as many as possible of those blocks closed in the previous year for which the annual potential increase has been estimated as 25% or more, while incorporating as few other blocks as possible.

When it is not possible to include all of the blocks for which the annual potential increase exceeds the relevant levels, preference may be given to closing those with higher values of the product of current biomass and annual potential increase.

Low-Biomass Blocks

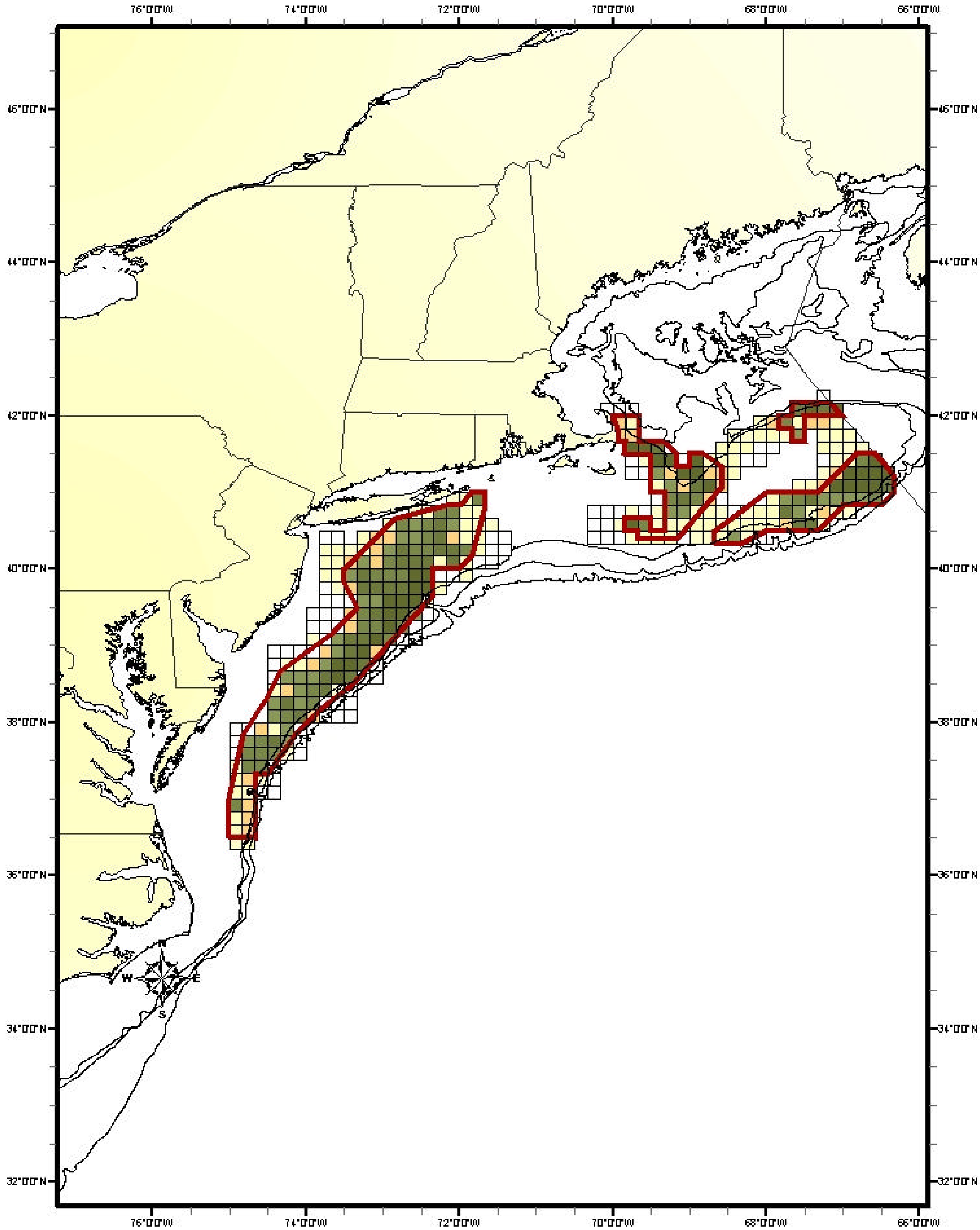
Blocks with scallop biomasses currently estimated as less than 400 tons of meats in the block will be treated as having zero annual potential increase when applying the basic rule. They may be included in rotational closures, however, when necessary to satisfy the requirements of the invariable rules.

Closure Expansion

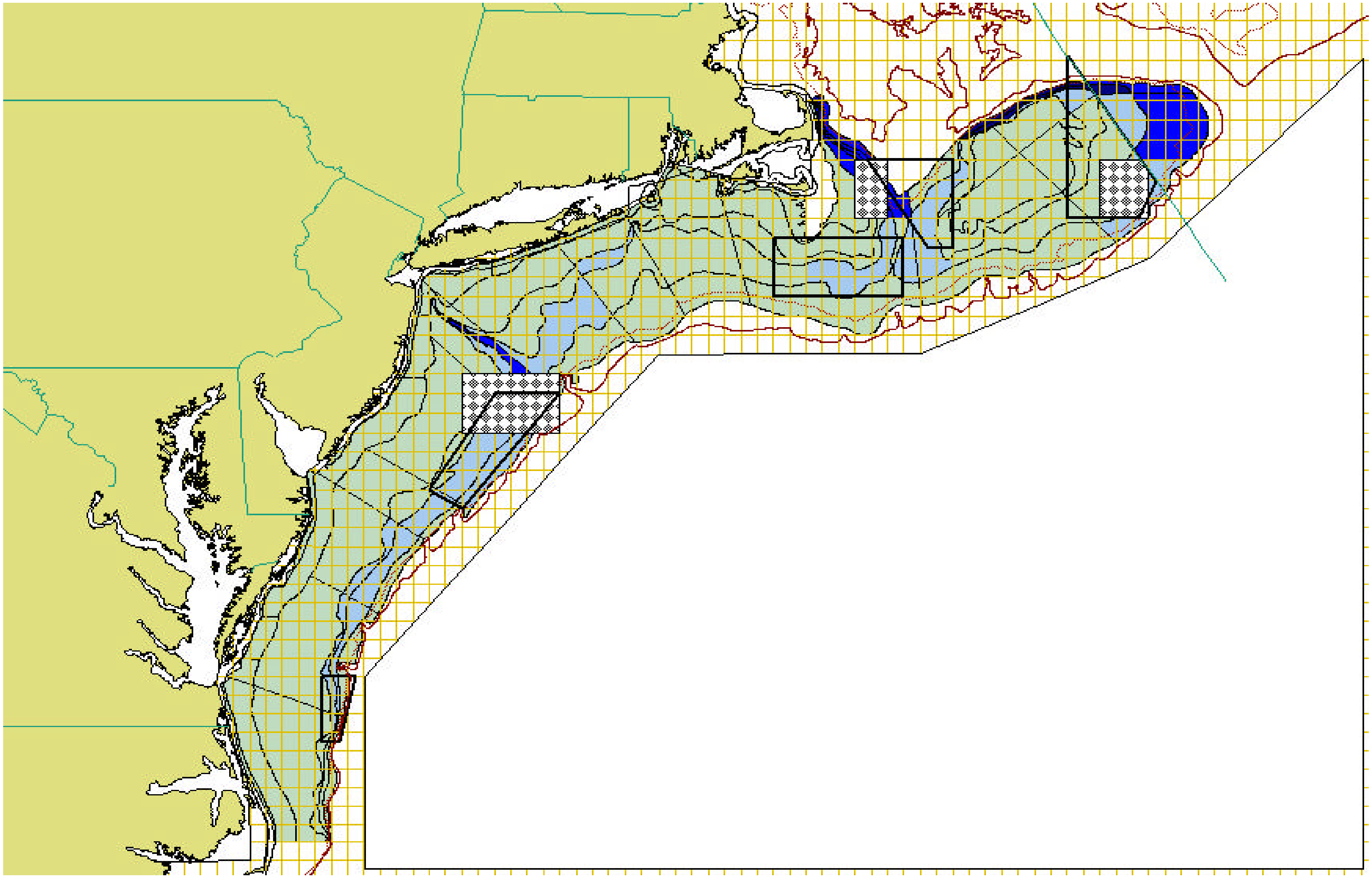
Blocks abutting a block in either the Georges Bank or South Channel regions that itself meets the annual potential increase requirements of the basic rule may be included in a closure if the directions of water movement are such that dispersal of scallops into the additional block from a closure is probable. Other blocks will only be added to closures when essential to meet the requirements of the invariable rules.

Overall Requirement

Except where required to meet minimum of one closure per region, each rotational closure must, as a whole unit, meet the requirements of the basic rule. For that purpose, the biomass-weighted average of the annual potential increases of the blocks included in the closure (with any part blocks further weighted by the proportion of their areas in the closure) must equal or exceed a biomass-weighted average of the [40%] target for those blocks not currently closed and [25%] for those under rotational closure in the previous year. Any long-term closures will be excluded from these calculations.



Map 10. Map of estimated scallop productivity by rotation management area, distributed by average recruitment by ten-minute square in the 1982 – 2000 scallop survey. Darker shades (green) represent higher productivity levels. The polygons encircle areas of high productivity.



Map 11. Example basemap for area rotation with adaptively managed boundaries, showing potential size and configuration of closures (hatched) to protect concentrations of small scallops.

The average scallop biomass in the blocks included in the closure (with any part blocks weighted by the proportion of their areas in the closure and excluding any long-term closures) must exceed 400 tons of meats per block. If no closure in a region (except for the Gulf of Maine region) can meet these requirements, the minimum-sized closure which would enclose the largest sum, across its included blocks, of the product of biomass and annual potential increase for each block shall be selected for rotational closure.

5.3.2.6.2 Closure Process

The closure process will use a notice action procedure described in Section 5.3.9.1 unless it coincides with an annual framework adjustment or annual specification (Section 5.3.9.2 and 5.3.9.3). The following description of a standard process includes an timeline that is compatible with the present fishing year. If Amendment 10 changes the fishing year, the standard process timeline described below would advance by the amount of months between the present and new fishing years.

Identification of appropriate closure areas would be based on either a combination of NMFS Survey and industry-based surveys or industry-based surveys alone. NMFS Surveys are not designed to identify resource conditions at the level of precision on which this alternative is based. Therefore, if NMFS Surveys are used, the NMFS Survey would identify broad areas which would need to be refined by further industry-based surveys. Alternatively, industry may locate areas during fishing activities and initiate industry-based surveys without NMFS Survey information

Standard Process

1. **July-August:** Discovery survey to locate areas with abundant seed, with shell heights 40-70mm. [The existing NMFS summer survey will serve as the discovery survey.]
2. **September**: Joint meeting of Scallop PDT, Scallop Advisors and Scallop Oversight Committee receives data from discovery survey and selects blocks for potential closure.
3. **September-October**: Commercial scallop boats, with pre-arranged charters and necessary exemptions, survey selected blocks using [NMFS survey dredges]. [Ten] randomized standard tows per block are required.
4. **November**: [NMFS] receives the data and calculates the "annual potential increase" (see below) of the scallops in each selected block. The number of years required before the annual potential increase will reduce to [25%] will also be estimated.
5. **November**: Joint meeting of Scallop PDT, Scallop Advisors and Scallop Oversight Committee receives results of calculations and, following the Closure Shaping Rules, develops closure alternatives, with the expected duration of each closure. Where more than one closure alternative is possible under the Shaping Rules, multiple alternatives will be prepared. If a region has blocks with re-opening days other than [March 1] and if new closures on [March 1] would violate the limitation on maximum closure extent, the joint meeting may prepare an alternative that would involve delayed closure of some blocks, provided all Shaping Rules are followed at all times.
6. **December**: Council holds public hearing and, if more than one alternative available, selects the closure option, including the expected re-opening date.
7. **December**: Regional Administrator proceeds under [Notice Action] process.
8. **March 1**: New closures take effect.

Additional Process

The following process will only be used in rare cases when a major seed bed has not been detected by the discovery survey.

1. Month 1: Fishermen detect area of dense seed not detected by discovery survey. Report seed to NEFMC. Joint meeting of Scallop PDT, Scallop Advisors and Scallop Oversight Committee determines whether additional closure may be appropriate and selects blocks for potential closure.
2. Month 2: Commercial scallop boats, with pre-arranged charters and necessary exemptions, survey selected blocks using [NMFS survey dredges]. [Ten] randomized standard tows per block are required.
3. Month 2: [NMFS] receives the data and calculates the "annual potential increase" (see below) of the scallops in each selected block. The number of years required before the annual potential increase will reduce to [25%] will also be estimated.
4. Month 2: Joint meeting of Scallop PDT, Scallop Advisors and Scallop Oversight Committee receives results of calculations and, following the Closure Shaping Rules, develops closure alternatives, with the expected duration of each closure. Where more than one closure alternative is possible under the Shaping Rules, multiple alternatives will be prepared.
5. Month 3: Council holds public hearing and, if more than one alternative available, selects the closure option, including the expected re-opening date.
6. Month 3: Regional Administrator proceeds under [Emergency Action] process.
7. Month 3: New closures take effect immediately.
8. Council proceeds to incorporate emergency closures into a subsequent Notice Action.

5.3.2.6.3 Monitoring and Re-Opening

6. All closed blocks will be surveyed annually by a commercial scallop vessel with a NMFS survey dredge to determine current biomass, size composition and growth rates. These surveys will also extend over all blocks immediately adjacent to a closed one. They will also cover all blocks currently subject to re-opening TACs.

7. NMFS receives the data and calculates the "annual potential increase" of the scallops in each closed block.

8. Block closures re-open on the appropriate opening day of the year set by the Council at the time of closure unless:
   a: The discovery of additional seed of younger year-classes, during the period of a closure, requires extension of that closure,
   b: The shaping of new closures requires re-opening in advance of the expected year, or
   c: An early re-opening is made under an Emergency Action (e.g. if mass mortality of scallops in closure is suspected).

   No other alterations to the timing of re-opening may be made without a Plan Amendment.

9. For each re-opening, a TAC will be set, based on survey estimates (corrected for catchability) of harvestable biomass and, for most blocks, a target fishing mortality rate calculated as a "synthetic" FOY. Some blocks may have a lower allowable mortality rate while "black" blocks do not re-open. The biomass estimates will include scallops in all blocks immediately adjacent to the re-opening, provided that they will be open in the coming year. Such blocks will then be subject to the same TAC control as those in the re-opened area.

10. The TAC will be allocated [by one of the alternative allocation methods being separately considered for Amendment 10].
11. Separate TAC management for re-opened areas will continue for [a sufficient period to reduce catch rates within the area to approximate equality with those outside – such period being presently estimated at one to two fishing years].

Rationale: Although this is the most complicated (and probably most costly to administer) area rotation alternative, it is intended to produce the highest benefits by protecting small scallops during their highest growth rates, and more accurately determine areas that should be closed. Improvements in yield and fishing efficiency, compared with fixed boundary area rotation alternatives, will result from temporal and geographic heterogeneities in age structure, growth, and recruitment that may not be captured by other alternatives.

The higher potential biomass growth rate criteria, compared to the other alternatives is believed to be warranted because the adaptive boundaries and frequent surveys will be able to earlier and better identify the concentrations of small scallops. As a result, the more dynamic and adaptive approach would better conserve smaller and faster growing scallops than an annual review process with fixed boundaries.

Probable short-term consequences

The short-term results of this strategy are impossible to predict, because the detailed information needed to define closures at this level are presently unavailable, except for some select areas where video surveys have been done recently. As a result, a new data collection and monitoring plan, using industry vessels with standard gear or bottom video cameras, would probably delay area rotation closures.

Over the long term, estimates indicate that the improvement in yield will be about 0 to 5 percent above the performance of adaptive rotation with fixed boundaries.

5.3.2.7 Area based management –with area-specific fishing mortality targets without formal area rotation

Similar to other fixed-boundary area rotation alternatives, The range of the scallop resource would be divided into management areas based on recruitment patterns and historical scallop fishing effort. Vessels would receive area-specific effort (trips, days, etc.) allocations (Section 5.3.3) to reduce localized overfishing, taking into account area-specific differences (where known) in growth and mortality rates, at a scale that is consistent with fishing and historic recruitment patterns, possibly the same as the fixed boundary areas that were used to evaluate area rotation alternatives. Except under unusual circumstances, there would be no area closures to protect small scallops and there would be no formal area rotation system.

Closed areas, HAPCs, MPAs, and other possible zoning restriction are layers that affect scallop management opportunities but not the delineation of scallop areas. In the future, scallop areas could be subdivided into primary and secondary (marginal) scalloping grounds, closed seed beds, scallop HAPCs (if any), scallop enhancement areas (rotational management of seeded areas), etc.

Because limited access vessels would receive area-specific days, voluntary participation in a trading day-at-sea mechanism (Section 5.3.3.3) would be necessary to efficiently use the day-at-sea allocations. Due to the absence of unrestricted fishing areas in this proposal, special consideration must be given to vessels with general category scallop permits that occasionally target sea scallops (Section

5.3.6). Catches (or expected catches) in each area by vessels with general category permits would be counted against the day-at-sea or trip allocations for the limited access vessels, so that the area-specific mortality targets are achieved.

Rationale: This proposal capitalizes on heterogeneities within the scallop resource in order to increase yield and economic returns without a formal closed area policy. Differences in scallop productivity and ecology throughout the Northeast shelf most likely result in **localized overfishing**, which would be significantly reduced by the area-specific fishing mortality controls. This alternative relies more on area-specific allocations to prevent targeting of strong year classes, rather than area closures based on surveys.

Historical recruitment patterns and traditional fishing areas would be used to delineate scallop beds for separate area management. Each area could be fine-tuned in the future (e.g., closed seed beds). Area-specific harvest rates are set annually on the basis of long run sustainability and then adjusted to accommodate competing demands in each area such as EFH, bycatch, and closures by other fisheries (e.g., DAS/TAC reductions, gear restrictions, bycatch quotas, land bycatch, other management closures or MPAs). Foregone scallop yield is measured as a cost of such adjustments.

The area basis will require a mechanism such as trading individual area allocations or block allocations that allows each fisherman to select where he prefers to fish for scallops. Management costs (survey, administration, enforcement) would increase above current levels to continuously monitor the resource on a more detailed scale of resolution.

Probable short-term consequences

Area-specific fishing mortality targets would be established at F=0.20 in all areas, until new information about scallop biology indicates that faster local growth or higher local mortality rates indicate a higher fishing mortality target, or vice versa. Vessels would receive area-specific effort allocations and would be allowed to trade them on a one-for-one basis before the start of the fishing year.

Over the short term, the total TAC and day-at-sea allocations would be about 20% higher than with area rotation closures (40% higher if there is no access to the Georges Bank closed areas, but would not protect small scallops as well. Over the long term, area rotation can be more effective to increase yield and day-at-sea allocations.

5.3.2.8 Georges Bank access to groundfish closed areas

Portions or all of the four groundfish closed areas (see map of the Western Gulf of Maine area, Nantucket Lightship Area, Closed Area I, and Closed Area II) may be open for scallop fishing on a periodic basis, either as part of a rotation strategy (e.g.. one area open under an annual access program), according to a reservoir approach (where scallop fishing would occur when the expected landings from other areas declined below a long-term average level), or as a regular rotation management area using time-averaged mortality and ramped annual targets described in Section 3.4.1.

Three area boundary/access options are proposed under this alternative:

1. No access (Map 14)
2. Access alternative 1: Mechanical rotation of areas opened by Framework Adjustment 13 (Map 13), Nantucket Lightship Area and Closed Area I TACs derived from F=0.4 target, Closed Area II TACs derived from F=0.2 target.

3. Access alternative 2: Southern part of Closed Area II only, TAC derived from F=0.2 target (refer to Map 13).
4. Access alternative 3: Continuous access to portions of the Nantucket Lightship Area, Closed Area I, and Closed Area II (Map 13), TAC derived from F=0.2 target.
5. Access alternative 4: All non-HAPC areas (Map 12)

Should the groundfish closed areas be modified, the above rotation scheme would also need to be modified to be in conformity to it. If some portion of the current groundfish closed areas become open to bottom trawling and dredging, then these areas will be treated like a reopened scallop closure area (see rotation area classifications above), where catches as a "re-opened" rotation management area will be controlled for several years by a TAC, day-at-sea allocations, or trips with possession limits and day-at-sea tradeoffs.

Scallop dredging would be prohibited indefinitely in certain portions of the closed areas that are judged to be especially important to groundfish stocks and/or especially sensitive to dredging. The cod HAPC area is one likely candidate for such a designation.

Mechanical rotation option

With a rotation approach, one of the three groundfish closed areas (or portions thereof) would be open to scalloping each year. It is anticipated that a fairly regular rotation would be used, but the order of rotation could be altered due to changing resource conditions (e.g., recruitment events). Such a rotation may give some yield-per-recruit advantage. For example, it is likely that the initial rotation will start with the Nantucket Lightship Area, which has the largest average sized scallops, followed by Closed Area I, and finally Closed Area II (south), which currently has many small rapidly growing scallops for which delaying harvest would be beneficial. Having only one area open each year would also simplify administration and enforcement issues. In the year before it is fished, an area would be intensively surveyed by one or more fishing vessels, from which a TAC could be determined. Optimal fishing mortality in an area that is open once every three years is about F = 0.7, or about a 50% exploitation rate. Experience (and logic) has shown that bycatch and bottom contact time increase as an area gets depleted. This could be avoided by slightly "underfishing" the area, i.e., fishing at an exploitation rate of less than 50%.

Reservoir management option

With a reservoir approach, one or more areas would be open to fishing only when the expected landings from other open fishing areas declines below a threshold, perhaps representing a long-term average. The scallop TAC from the groundfish closed areas would be less (or zero) when yields are high outside the closed areas, and more when yields are lower. Exploitation rates in the area that is open could vary between zero and 50%, depending on conditions.

Regular rotation management area policy

A third option is to treat the portions of the Georges Bank areas where periodic scallop fishing is permitted according to the rotation management area rules described in Section 5.3.2.8. All portions that are not subject to long-term scallop fishing closures would be evaluated with respect to its potential biological growth rate and maximum amount of scallop area closures. If re-opened to scallop fishing, the annual mortality target would be set based on a time-averaged mortality rate since the areas were closed to scallop fishing in 1994, or eventually since the most recent closure according to the time-averaging policy in the proposed overfishing definition (Section 3.4.1). The Council might classify these areas as "re-opened" for longer than normal or adjust the annual mortality ramped strategy, but otherwise as a transition strategy there would be no different treatment of the accessible portions of the Georges Bank groundfish closed areas.

Rationale: Over the short term, scallop biomass in the groundfish closed areas is about 50 percent of the entire resource and due to the large size of scallops, offers and opportunity to reduce mortality and promote rebuilding elsewhere, while also reducing the number of used days and swept area by commercial fishing gear. Depending on where the reductions in fishing time occur, the action could also reduce bycatch and habitat impacts. The effects would vary by species and bottom type, but with the exception of the Western Gulf of Maine area, the groundfish closed areas were chosen to protect spawning activity and concentrations of spawning cod and haddock. Other species, like flounders and monkfish, are more vulnerable to the gear as scallop bycatch and occur in areas that are presently open to fishing. There also appear to be as many or more valuable habitats in other areas where scallop fishing occurs, compared to some areas within the groundfish closed areas.

Scallops in these areas may still contribute to future yield by spawning, and would serve as a useful control for scientific research. Because gravel and sand habitats are often interwoven, and prime scallop areas are often associated with gravel bottom, it would not be appropriate to close all areas containing some gravel bottom. As the current scallop biomass in the closed areas is estimated to be about 80,000 mt, excellent sustainable scallop yields can be obtained from the remaining areas even if one quarter of the biomass was unavailable. According to the 2000 survey, the northern portion of Closed Area II, including the cod HAPC, contains less than 8% of the total scallop biomass in all of the groundfish closed areas.

Eventually, the Sea Scallop FMP should treat the accessible portions of the Georges Bank groundfish closures as part of a regular rotation management area system. A mechanical rotation or reservoir strategy could perpetuate the current imbalance in the scallop resource where it might be unnecessary over the long term. Including the accessible portions in the regular area rotation management system would allow a quicker transition to a more normal resource distribution. A longer classification as a "re-opened" rotation management area and/or a steeper annual mortality target ramping strategy could ameliorate the spike in landings that would occur with application of the general rules (Section 5.3.2) for area rotation management.

Probable short-term consequences

At a target F (F=0.20), access to all three groundfish closed areas (area access alternative 3) could increase yield to 22,930 mt in 2004 and 20,581 mt in 2005 (Table 27), or nearly double the yield that can be taken from all other open scallop fishing areas. Although the preferred alternative (area access alternative 1) only opens portions of the Nantucket Lightship Area and Closed Area I, the projected yield is 15,870 mt in 2004 and rises to 20,733 mt when those areas close and the southern part of Closed Area II would re-open to fishing in 2004. These two area access alternatives would keep the remaining portions of the Georges Bank groundfish areas closed to scallop fishing, where landings would rise to 26,958 mt in 2004 and 24,304 mt in 2005.

The day-at-sea use to catch these scallops would be only about equal to the days-at-sea for all other open fishing areas, due to the high catch rates (about 2,400 to 2,800 pounds per day) in the areas under consideration for controlled access. For area access alternative 1, the day-at-sea use would be about 14,000 days in 2004, rising to 17,000 days in 2005-2007 (Table 27). In contrast, the day-at-sea use would rise to around 20,000 to 22,000 days if all but the HAPC area were open to scallop fishing under area access alternative 4.

In contrast, taking no action would result in day-at-sea use about 8,000 to 9,000 days (Table 27). Status quo, i.e. achieving a target F=0.20 with no access would allow day-at-sea use to rise to around 11,000 to 14,000 days. These are also compared to 2002 day-at-sea use based projections, where day-at-sea use would be about 29,000 days. In this case, landings would be about 23,000 mt in 2004, declining to about 17,000 mt in 2007. Allocated days-at-sea would be approximately 33% higher than those in Table 27, to account for allocations that are not used by inactive vessels and allocations to Confirmation of Permit Histories and are not fished by a vessel.

In Amendment 10, the collateral impacts on bycatch and habitat would be mitigated by the effort shift that reduces fishing effort in areas that also have varying amounts of bycatch and habitat impacts. In addition, Amendment 10 also contemplates a new set of habitat closure areas which may more effectively limit impacts on sensitive and complex habitat that is vulnerable to scallop fishing (See Section 5.3). Overall, however, the total area swept (Table 27) for the area access alternatives is about 2,500 nm^2 for the preferred alternative (area access alternative 1), compared to 1,200 to 1,400 nm2 for no action, 2,000 to 2,500 nm2 for the status quo, and 7,400 to 9,500 nm^2 with a status quo policy of allocating 120 days to full-time limited access scallop vessels.

Table 27. Summary of short term effects of area access alternatives.

Rotation alternative	Closed area access alternative	Fishing year	Total landings (mt)	Limited access day-at-sea use.	Average meat count.	Limited access fleet area swept (nm^2)
Area rotation	Area access alternative 1	2004	15,870	14,057	15.1	2,459
		2005	20,733	17,663	14.2	2,488
		2006	19,925	17,406	14.3	2,803
		2007	21,198	17,713	14.6	2,001
	Area access alternative 2	2004	21,225	18,276	14.8	2,415
		2005	19,108	16,511	14.5	2,486
		2006	18,550	16,465	14.7	2,801
		2007	20,080	16,969	15.0	1,999
	Area access alternative 3	2004	22,930	19,539	14.5	2,544
		2005	20,581	17,627	14.2	2,614
		2006	19,847	17,474	14.4	2,928
		2007	21,248	17,900	14.8	2,125
	Area access alternative 4	2004	26,958	22,856	14.3	2,992
		2005	24,304	20,752	14.1	3,061
		2006	23,356	20,470	14.3	3,374
		2007	24,604	20,808	14.6	2,570
	No access	2004	12,757	11,696	16.3	2,172
		2005	11,055	10,371	16.5	2,239
		2006	11,079	10,791	16.9	2,553
		2007	13,149	11,692	17.0	1,751
No action	No access	2004	9,360	7,963	16.5	1,240
		2005	9,342	7,989	16.5	1,276
		2006	10,416	8,963	16.5	1,420
		2007	10,521	8,979	16.4	1,390
Status quo (F=0.20)	No access	2004	15,247	14,444	17.1	2,524
		2005	14,895	14,106	17.1	2,597
		2006	12,659	12,248	17.8	2,378
		2007	11,186	10,518	17.9	1,979
2002 day-at-sea use	No access	2004	23,000	28,983	18.8	7,389
		2005	19,993	28,337	19.3	7,907
		2006	16,448	28,139	21.3	8,859
		2007	16,734	28,798	22.5	9,469

Over the short-term, the preferred alternative (area access alternative 1) would produce total economic benefits that are 82 percent of the maximum if all areas but the HAPC were open to fishing (area access alternative 4). Compared to no action, the total economic benefits of area access alternative 1 increase by 72 percent (Table 28), an increase of 33 percent compared to the status quo without access and even increases total benefits by 8 percent with 2002 day-at-sea use and no access. Habitat closures would, of course reduce the economic benefits from these area access alternatives if there were substantial overlap between the two.

Because of the cost savings associated with reduced fishing time to harvest optimum yield, the area access alternatives provide greater producer surplus than taking no action, adopting the status quo, and even continuing with 2002 day-at-sea allocations (Table 28). Producer surplus (most of which accrue to vessel owners and crew) would be 95 percent of the maximum with all areas open (area access alternative 4) and 38 percent higher than taking no action.

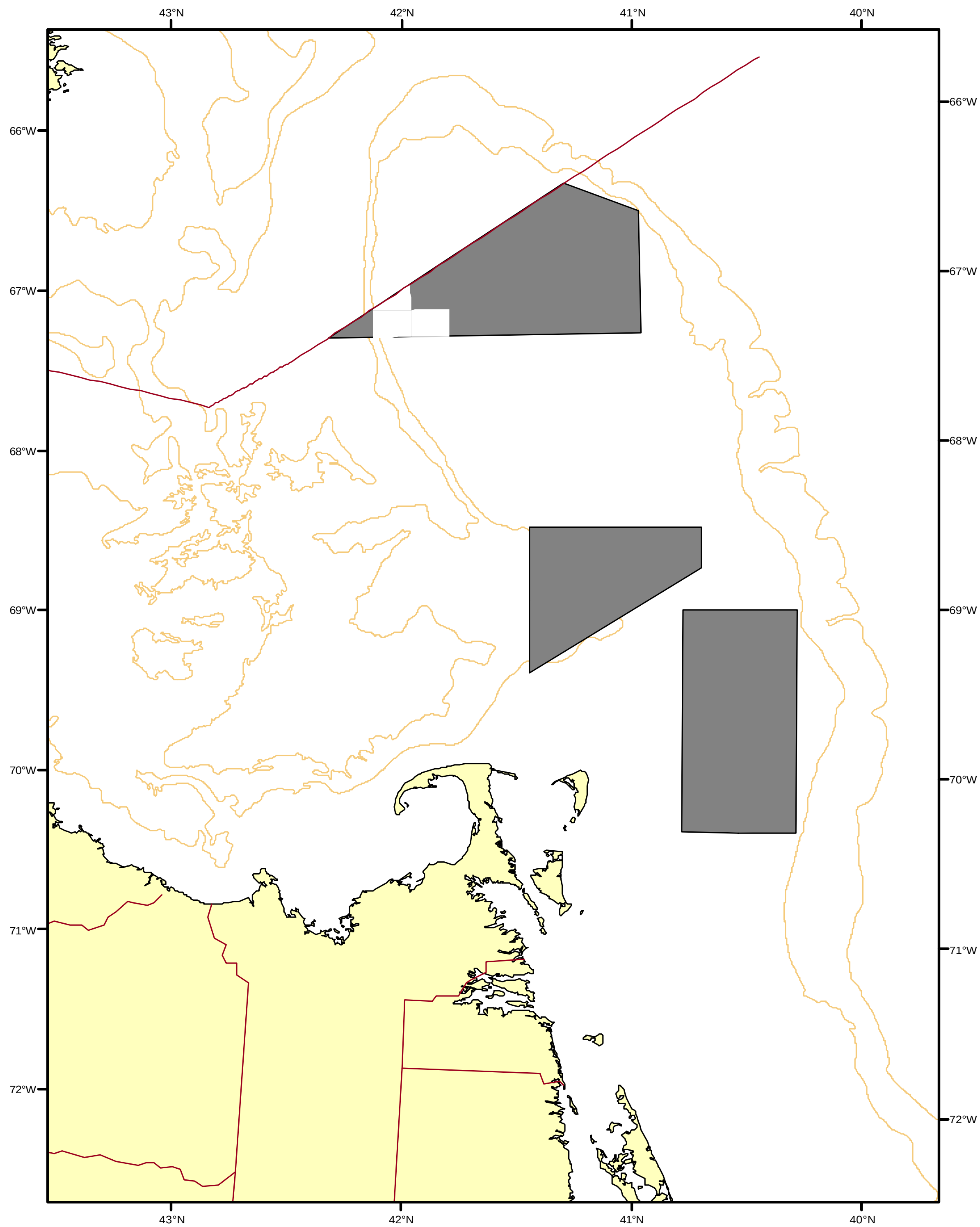
Table 28. Summary of short-term economic effects of proposed area access alternatives.

Alternatives	**Total Economic Benefits 2004-2007[25]**	**Producer Surplus 2004-2007[26]**
Area access alternative 1	768	505
Area access alternative 2	783	511
Area access alternative 3	826	520
Area access alternative 4	929	532
No Access	522	407
No Action, No Access	446	365
Status quo: No Rotation, F=0.2, no access	577	432
2002 DAS use – no access	710	446

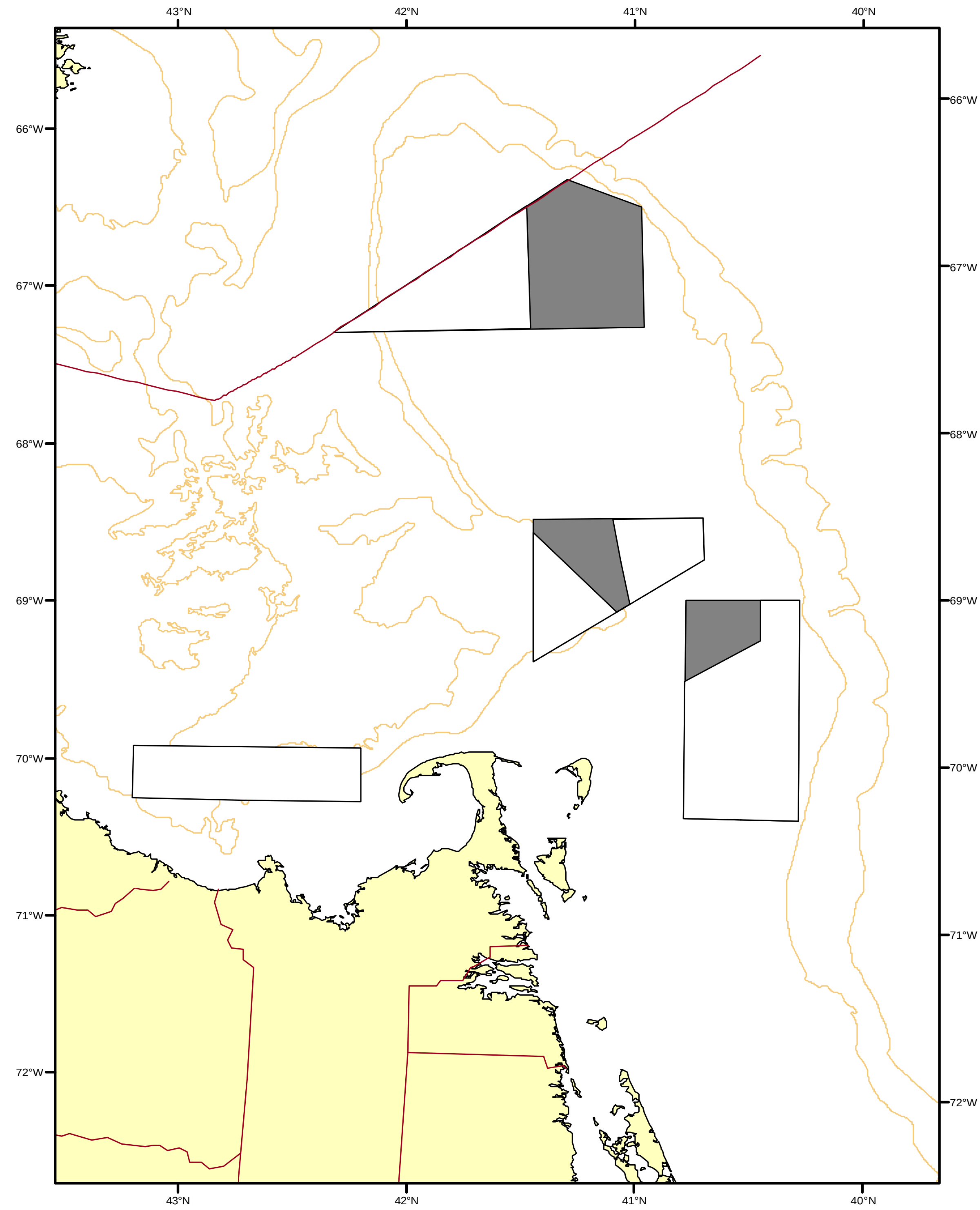
Over the long term, scallop productivity within the Georges Bank groundfish closed areas would be about 33 percent of the total for the entire EEZ. Total long term yield from all of the Georges Bank closed areas is about 8,500 mt.

Considering the current status of the resource, the best scallop yield for the Framework 13 areas would be if portions of Closed Area I and the Nantucket Lightship Area open for fishing in 2004, followed by a two (possibly even three) year closure while Closed Area II South opened in 2005 and 2006. Scallops in Closed Area I and the Nantucket Lightship Area were lightly fished in 2000, following a six year closure and the average scallop size remains large. Closed Area II, on the other hand, has had an access program in 1999 and 2000, while a near-record year class appeared there in 2000. Scallop biomass in Closed Area II is expected to increase by 19% during 2003, compared to a decline of 2% in Closed Area I and the Nantucket Lightship Area, assuming that all areas would be closed in 2003.

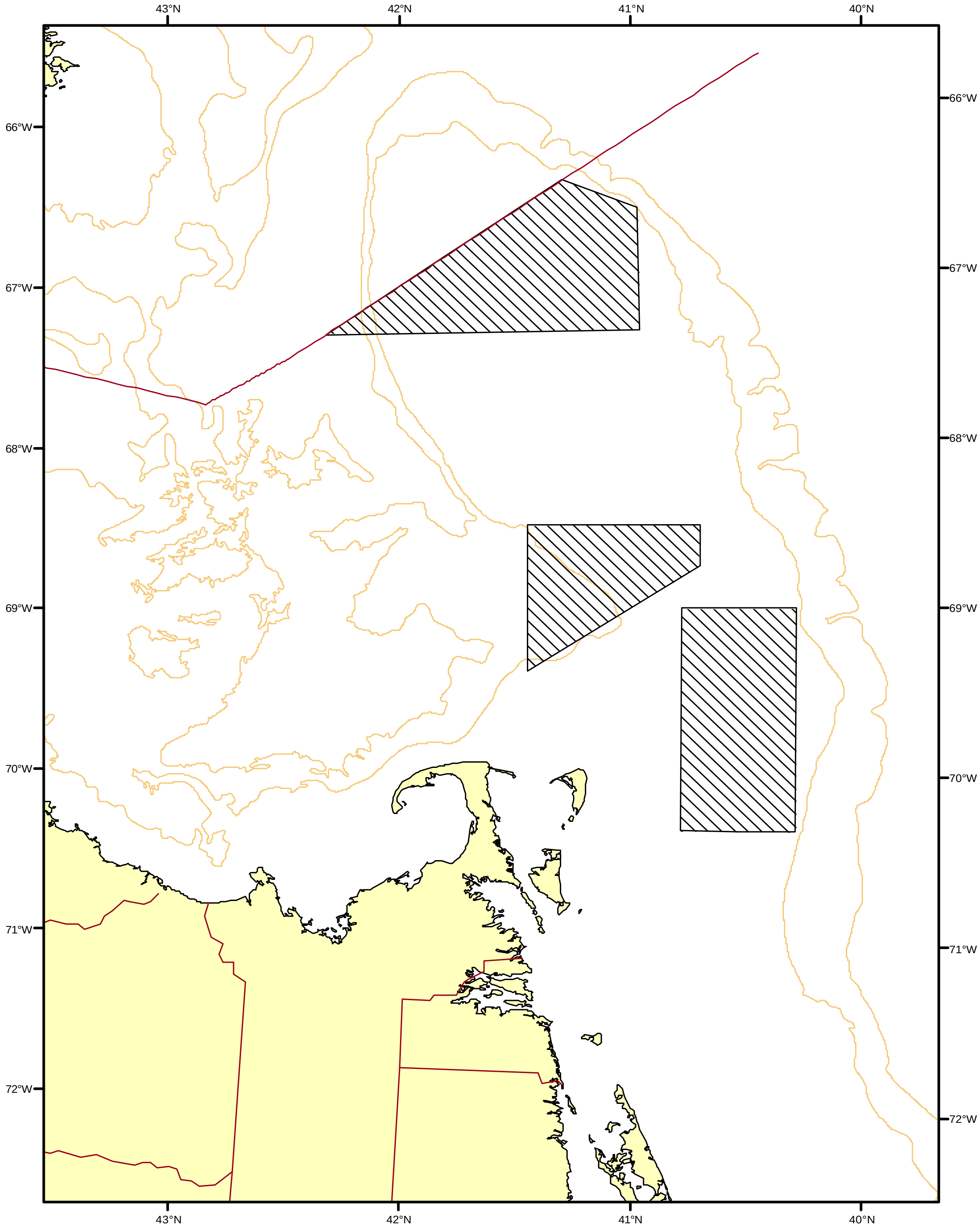
25 Consumer and producer surplus: Cumulative discounted values for 2004-2007 in 1996 dollars.
26 Cumulative discounted values for 2004-2007 in 1996 dollars.



Map 12. Location of scallop fishing areas for an access option that would sometimes re-open all but habitat areas of particular concern. The areas that would potentially open for scallop fishing are shown as shaded portions of the Georges Bank groundfish closed areas.



Map 13. Location of scallop fishing areas for an access option that would sometimes re-open portions of the groundfish closed areas that were opened to fishing in 2000. The areas that would potentially open for scallop fishing are shown as shaded portions of the Georges Bank groundfish closed areas.



Map 14. Areas (hatched) that would remain closed for an alternative that would re-open no part of the Georges Bank groundfish closed areas.

5.3.2.9 Increasing the minimum ring size to 4-inches in all or select areas

Scallop dredges would be required to be constructed with 4-inch rings, increasing from 3-½ inches. One option would make this a requirement everywhere and second option would make it a requirement for areas in a 're-opened' status, including the groundfish closed areas if an access program (Section 5.1.3.1) is active.

Vessels would have the option of using dredges constructed with 3 ½ inch rings in open rotation areas for one year after implementation of Amendment 10 regulations. Six months after implementation of Amendment 10, vessels must use dredges with 4-inch rings on re-opened area trips, including authorized trips in the Georges Bank groundfish closed areas.

Rationale: Larger rings allow more small scallops (70-110 mm) to escape capture. This has some benefit to reducing discard mortality[27] and improving yield. Just as important however, is that gear efficiency for large scallops increases, thereby reducing tow time to catch a possession limit or an amount that the crew can shuck.

The smaller tow durations reduce the total area swept, non-catch mortality of sea scallops, the amount of bycatch, and habitat effects in almost equal proportion. Reducing non-catch mortality per scallop landed and reducing the discard rate (even when low) both contribute scallop survival and yield improvement.

The one exception to this outcome is when few large scallops (greater than 110 mm) exist in areas that are open to fishing. In this case, tow times for the 4-inch dredge can increase because it is less able to catch the intermediate size scallops. The gear's catch rate declines below the crew's shucking capability and/or it takes more fishing to achieve a possession limit. Requiring 4-inch rings only in re-opened areas and the groundfish closed areas would ensure the gear was used where there are sufficient large scallops to cause a decline to tow time.

Implementation of this measure would be delayed by up to a year to allow suppliers to manufacture or obtain the larger rings. It would also allow suppliers to draw down existing gear inventory and allow fishermen time to use gear purchased before Amendment 10 is implemented. Full-time vessels replace dredge bags about once per year, although this varies from vessel to vessel depending on the amount and location of fishing activity.

No additional alternatives for increasing the minimum ring size in scallop dredges from 3.5 inches were considered because no information exists to determine what other ring size may be effective in improving scallop yield.

Probable short-term consequences

If applied throughout the resource, the target TAC and annual day-at-sea allocations would be slightly less than those when a 3-½ ring would be required, but mortality on small scallops would decline and in a few years, the annual TAC and day-at-sea allocations would be higher than if a 3-½ ring were required. Not unlike some other gears, the efficiency of catching the target sizes using the larger rings

27 Discard mortality of sea scallops is low under most conditions, so increasing selectivity has a small benefit to those scallops that are sometimes crushed on deck while the catch is handled and sorted.

increases by about 10-15 percent. The larger sizes of scallops allow the crew to shuck more pounds of scallop per day (i.e. LPUE increases) and the days associated with the target mortality rate declines, because of the higher gear efficiency with larger rings (Section 8.2.8).

5.3.2.10 Gear specific day-at-sea allocation adjustments based on equal mortality per day-at-sea

Vessels authorized to use trawls would receive day-at-sea allocations in proportion to the number of scallops landed per day-at-sea, compared to vessels using dredges. Initially the gear-specific day-at-sea allocations would be determined with existing data, but the gear-specific day-at-sea allocations could change by framework adjustment as new data become available, or the performance of the fleet using (possibly redesigned) dredges or trawls changes. Owners may permanently convert a trawl-authorized limited access permit to a dredge-only permit and would receive an allocation associated with a dredge-only permit for a vessel's permit category. A vessel with a trawl-only limited access scallop permit could also convert to a small-dredge permit and qualify for the next higher limited access category.

Rationale: Day-at-sea allocations are one of the most important elements of the Scallop FMP to control fishing effort and mortality. It was originally known that vessels using trawls were more effective when small scallops are available, but the size distribution of the catches were similar because there were fewer large scallops available in the 1990's.

Since mortality has declined and the resource has recovered, a day-at-sea on a dredge vessel produces less mortality per day-at-sea than it used to because the dredge is more effective than trawls at catching large scallops and the number caught and landed is less. Crew limits and day-at-sea allocations promote fishing with dredges in areas that have larger scallops now that they are more available than in the past. Trawls, on the other hand, are more effective at catching smaller scallops that swim (i.e. "clap") and are captured by the higher profile and wider trawls. Crew requirements to handle trawl gear are also less, due to longer tow times and other factors. Since the trawls are less effective on large scallops, the scallop trawl fishermen tend to continue targeting concentrations of smaller scallops, even though large scallops are present in fishing areas but are less available to the gear.

__**Probable short-term consequences**__

Analysis of landings data from 1998 to 2000 (Section 7.1.1.1.2), when the count of landed scallops has been recorded, trawl vessels have landed about a third more scallops in number per day-at-sea than do dredge vessels from the same three digit areas and time of year. Trawl vessels would therefore receive 75% of the days-at-sea allocated to dredge vessels to equalize the annual mortality associated with a trawl and dredge limited access permit.

5.3.2.11 No action alternative

The no action alternative with regard to area rotation is the Amendment 7 regulations, accounting for the sunset of applicable area and day-at-sea regulations in Framework Adjustment 14. The no action alternative includes no additional closures; Amendment 7 day-at-sea allocations; and Georges Bank areas remain closed until changed in Multispecies FMP. Vessels would continue to use 3 ½ inch rings and vessels using trawl and dredge gears would be allocated an equal number of days-at-sea, consistent with their full-time, part-time, or occasional limited access permit.

Rationale: This is the no action alternative with respect to area rotation, because Amendment 7 does not have any closures scheduled to take place, and no regulations would be in place to supercede the groundfish area closures on Georges Bank and in the Gulf of Maine.

5.3.2.12 Status quo alternative

The status quo alternative are those management measures that are likely to transpire by framework action under Amendment 7 regulations, including re-specifying the day-at-sea allocations to achieve the Amendment 7 fishing mortality objective and/or ad hoc area closures to protect small scallops. The no action alternative includes ad hoc area closures; day-at-sea adjustments to achieve annual mortality target; Georges Bank areas remain closed until changed in Multispecies FMP. Vessels would continue to use 3 ½ inch rings and vessels using trawl and dredge gears would be allocated an equal number of days-at-sea, consistent with their full-time, part-time, or occasional limited access permit.

Rationale: This is the status quo alternative with respect to area rotation, because Amendment 7 allows framework adjustments to create ad hoc closed areas for protection of strong year classes and annual day-at-sea adjustments to achieve the fishing mortality targets

5.3.3 Alternatives for Allocating Effort

Amendment 10 does not propose to change the method for controlling fishing effort or catch, but certain modifications to the day-at-sea allocations are necessary to accommodate area-based management, including area rotation. Two methods are proposed for allocating area-specific effort and catch controls, area-specific day-at-sea allocations or trip allocations with possession limits and day-at-sea tradeoffs. Limited access vessels would receive equal area-specific allocations, consistent with the effort limits for their full-time, part-time, or occasional permit. General category vessels are not allocated fishing effort, but would fish under a restrictive possession limit and an area specific TAC for recently re-opened rotation areas.

Both effort allocation methods would require a TAC estimate, based on Albatross and/or cooperative industry survey data, for recently re-opened rotation areas. Effort and catch management in the remaining open fishing areas would continue under current rules, i.e. limited access scallop vessels would receive an annual day-at-sea allocation to fish anywhere an area is open to regular scallop fishing (see Table 11).

A third allocation mechanism, one-to-one trading, is needed to allow fishermen to better utilize their area-specific allocations. A procedure would allow vessels with limited access scallop permits to trade area-specific allocations with another limited access vessel. A vessel from Gloucester, MA, for example, might trade days or trips in the Mid-Atlantic for days or trips in a Georges Bank area that were originally allocated to a vessel from Hampton, VA.

Effort allocations, whether in open or recently re-opened areas, are calculated using estimates of the TAC, the landings per day-at-sea, the number of active permits[28], and their expected use of allocated days[29]. Area-specific and open area TACs are estimated by projecting the exploitable biomass based on the most recent survey, and calculating the catch using the catch equation (projection methods are

28 Inactive permits do not contribute to fishing mortality.

29 Unused day-at-sea allocations do not contribute to fishing mortality.

described in Section 8.2.1), after taking into account commercial dredge efficiency[30], size selectivity of the gear and crew (cull), discard mortality[31], and non-catch mortality[32].

Annual target fishing mortality rates for re-opened areas based on time-averaging

The target fishing mortality in the open areas is the stock-wide target, 80 percent of F_{max} (F=0.20). In re-opened areas, the target fishing mortality is the time-averaged fishing mortality since the beginning of the most recent closure, as a constant annual level or ramped to begin at moderate levels and increase over the duration of the recently re-opened period, as long as the time-averaged fishing mortality does not exceed 80 percent of F_{max}. For example, a three-year closure followed by a three-year recently re-opened status would mean that the target F would be two times F_{max} (F=0.40) for the recently re-opened area. In the seventh year, the fishing mortality would decline to the stock-wide target to ensure that the time-averaged mortality does not exceed the stock wide target. Table 29 provides some examples using different closure durations that could result from adaptive rotation and different recently re-opened periods.

Table 29. Constant annual fishing mortality targets for recently re-opened rotation areas and time averaged fishing mortality targets with different closure and recent re-open durations. Calculations assume that the stock-wide target equals 0.20.

	Duration of recently re-opened status			
Duration of closure (years)	2	3	4	5
2	0.40	0.33	0.30	0.28
3	0.50	0.40	0.35	0.32
4	0.60	0.47	0.40	0.36
5	0.70	0.53	0.45	0.40

Increasing or ramped fishing mortality targets for re-opened rotation management areas

Each year, the fishing mortality rate in a re-opened area will be estimated and monitored, allowing for adjustments to the recently re-opened annual fishing mortality target (and TAC) for overages or underages in the previous years. Under a ramped strategy, the first year of the recently re-opened period would have a lower fishing mortality target than subsequent years. For example, the fishing mortality target in the first year of a three-year period would be 80% of the time-averaged target (or F=0.32), 100% of the time-averaged target (or F=0.40) in the second year, and 120% of the time-averaged target (or F=0.48) in the third year. Table 30 provides some examples using a ramping strategy that begins with 80% and ends with 120% of the time-averaged target and different recently re-opened periods. The ramping strategy could be steeper or less steep depending on conditions and the anticipated schedule for re-opening other closed rotation areas, so that the Council may stabilize and optimize the annual day-at-sea allocations and expected landings.

Table 30. Ramped annual fishing mortality targets for recently re-opened rotation areas and time-averaged fishing mortality targets, after a three-year closure. The example ramping strategy

30 50 percent in the Georges Bank region and 70 percent in the Mid-Atlantic region (NEFMC 2001).
31 Estimated to be 10 percent of the catch.
32 Estimated to be 10 percent of the catch on Georges Bank and 3 percent of the catch in the Mid-Atlantic, based on the results of Caddy (1975) and Murawski and Serchuck (1989).

begins with 80% and ends with 120% of the time-averaged target, assuming that the stock-wide target equals 0.20.

	Duration of recently re-opened status			
Year after re-opening	2	3	4	5
1	0.40	0.32	0.28	0.26
2	0.60	0.40	0.33	0.29
3	0.20	0.48	0.37	0.32
4	0.20	0.20	0.42	0.35
5	0.20	0.20	0.20	0.38

Probable short-term consequences

See Section 8.xxx for estimates of day-at-sea allocations, TACs and trip allocations for controlled access areas, and the effect of day-at-sea tradeoffs based on projected daily catch rates.

5.3.3.1 Individual day-at-sea allocations by management area

Instead of allocating total days-at-sea to limited access vessels to fish throughout the stock areas, some areas in a recently re-opened status would have day-at-sea designated for that use only. In lieu of a hard TAC or quota, limited access vessels would receive annual days-at-sea to fish in specific recently re-opened areas when they are open to fishing. The vessels would also receive annual days-at-sea to fish in open (i.e. non-restricted) scallop fishing areas. The number of days each vessel receives for each area would be based on the following factors:

- The vessels limited access permit category (i.e. full-time, part-time, occasional, dredge-only, trawl authorized)
- The number of active permits
- The proportion of days used by each permit category
- The target TAC for re-opened or open fishing areas, and
- The expected average catch per day-at-sea by area.

Rationale: Area-specific day-at-sea allocations allow greater flexibility for vessels to determine how and when they will fish in a re-opened area. Unlike the other alternative, vessels that return to port early do not risk loosing extra days, despite their inability to land a possession limit on a trip.

Area-specific day-at-sea allocations also easier to administer. They do not require managers to estimate a viable choice of possession limits and day-at-sea tradeoffs. If a possession limit were too low for the day-at-sea tradeoff, then fewer vessels would fish in a re-opened area. Conversely, if a possession limit is too high for the day-at-sea tradeoff, the area would be fished using fewer days off the clock and fishing mortality in the other open areas would be too high. Area-specific days-at-sea could also be monitored with existing VMS equipment, without tracking trips taken and monitoring compliance with a possession limit.

Primary harvest control	Advantages	Disadvantages
Area-specific day-at-sea allocations	❖ Successful fishermen can increase gross profits ❖ May be self-correcting with regard to uncertainty in the biomass estimate (i.e. LPUE changes if the estimate is too high or low) ❖ Easy to enforce with VMS or call-in ❖ Except for shucking scallops off the clock, avoiding compliance is difficult	❖ Requires assumptions about annual catchability and day-at-sea use ❖ Requires controls on fishing power or adjustments when fishing power increases from new technology or vessel improvements ❖ Difficult to adjust since the relationship between fishing mortality and day-at-sea allocations has low precision ❖ Downward adjustments difficult because need to reduce becomes apparent when catch rates are low, thereby increasing short-term economic hardship.

Probable short-term consequences

Vessels would receive the expected days to catch the possession limit, totaled over the number of trips allocated for each areas. Thus, the total number of days allocated would be those given in Sections 8.2.3[33], without the effect of the added days for the day-at-sea tradeoff, but about 7 of those days would be for fishing in the Nantucket Lightship Area and Closed Area I, and about 25 days would be for fishing in the Hudson Canyon Area in 2004. The remaining fishing days would be available for fishing in other open fishing areas.

5.3.3.2 Area-specific trip allocations with possession limits and day-at-sea tradeoffs

Similar to the present management of the Hudson Canyon and VA/NC scallop areas (NEFMC 2001), vessels with limited access scallop permits would be authorized to take up to a specific number of trips into re-opened rotation management areas. These trips would have a possession limit and an automatic day-at-sea charge or 'tradeoff' for any declared trip to a re-opened area. Vessels that legally transit re-opened areas would not be charged a day-at-sea tradeoff. The trip allocation may apply to one or more areas, either combined or allocated to each re-opened area in a fishing year. It would be more likely if the allocations are combined (like they were in 2001 and 2002 for the Hudson Canyon and VA/NC area access program), if the scallop resources in the two or more areas are similar enough that it doesn't matter how much fishing effort targeted each area individually (up to the applicable TAC for each area).

Either the day-at-sea tradeoff or the possession limit for trips in re-opened areas will be held constant. The number of re-opened area trips to be authorized will be the TAC divided by the number of vessels eligible to fish and the possession limit, taking into account the ability for vessels with part-time and occasional permits to take authorized trips subject to their annual day-at-sea allocation. "Banked"

[33] This is a new analysis in the FSEIS that updated Sections 7.2.1.1 and 7.2.3.3 in the DSEIS, including the revised DAS tradeoff and area-specific DAS allocations. The new section may no longer agree with the summary in this summary of short term consequence.

days created from the day-at-sea tradeoff versus the number of days expected for vessels to land the possession limit, will be added to a vessels annual day-at-sea allocation, to account for the expected day-at-sea tradeoff.`

Vessels would be authorized to take area-specific trips for re-opened rotation areas and would be charged a fixed amount of days, regardless of the actual trip duration. If fewer vessels than expected fish in re-opened areas, the Regional Administrator would be authorized to adjust the number of authorized trips or the possession limit half way through the period when trips are authorized to fish in re-opened areas. This would increase the likelihood that the re-open area TACs would be taken and that fishing mortality in regular, open fishing areas would not be higher than anticipated because vessels chose not to fish in re-opened rotation areas.

Vessels would be able to take authorized re-opened area trips at any time, but the Council may through framework adjustment place seasonal limits on the amount of trips vessels may take in an area, if there is need to prevent derby style fishing reduce bycatch, or prevent gear conflicts.

Rationale: As in past area access programs (NEFMC 1999, NEFMC 2000, NEFMC 2001), fishing effort in re-opened areas could be regulated with trip allocations and possession limits. The number of trips that would be allocated to limited access vessels to fish in re-opened areas, would depend on the TAC for an area, the possession limit chosen by the Council, and the number of vessels that will fish in the area[34]. Typically, the possession limit would be the product of the days-at-sea accumulated on a re-opened area trip (i.e. a day-at-sea tradeoff) and the average landings per day by the fleet in other open rotation areas, where regular day-at-sea accounting applies. A slightly higher possession limit may be needed to attract fishing effort, although it cannot be so high that vessels cannot land the possession limit in less time than the day-at-sea tradeoff.

Since the catch rates in different re-opened areas may vary (but restrained by the crew's shucking capacity), it will be necessary to either vary the possession limits with a consistent day-at-sea tradeoff, or vary the tradeoff and keep the possession limits constant for all re-opened areas in a fishing year. Otherwise, one re-opened area may be fished heavy while another would receive little fishing effort and fail to achieve the intended benefits of area rotation.

Unlike the current management approach, the day-at-sea allocations for open areas would be calculated to achieve the fishing mortality target for that class of rotation areas. At the present time, scallop mortality in only the open fishing areas is higher than the stock-wide target (F=0.20). The day-at-sea tradeoffs associated with area access cause reductions in the available day-at-sea allocations to fish in regular, open fishing areas. Day-at-sea tradeoffs therefore have a positive effect in reducing days (and area swept) in greater amounts than if the area access trips had accounted for only the actual days.

With area specific TACs and management, it is no longer necessary to reduce open area day-at-sea allocations via a day-at-sea tradeoff. Instead, the annual allocation of days-at-sea in open rotation areas would be adjusted to compensate for the expected day-at-sea tradeoffs in the re-opened rotation areas. **In other words, the expected day-at-sea tradeoff (i.e the difference between days used and days charged in re-opened areas) can be treated as 'banked' days and added to the annual allocations in areas that days would be traded to fish in re-opened areas**.

34 As in past actions, the number of vessels that are expected to fish will assume that it equals the number of active limited access permits, accounting for the number of trips and day-at-sea tradeoffs a vessel can count against its annual day-at-sea allocation.

Primary harvest control	Advantages	Disadvantages
Trip allocations with a possession limit	❖ Uses present experience and strategy to manage re-opened areas ❖ Could offer more flexibility if vessels are not obligated to use the trips if they don't also loose allocations elsewhere ❖ Allows for a 'tradeoff' mechanism to reduce effort in other areas in exchange for higher catches in a re-opened area	❖ Possession limit could be inaccurate, i.e. not achieve desired results, because the catches in other areas are different than what was expected ❖ Possession limits are hard to enforce, especially if multiple possession limits for individual areas are needed or illegal landings occur ❖ Highgrading could increase (scallop discard mortality ~ 10-20%) ❖ Could increase annual trip expenses for vessels that typically have above-average catches ❖ Could discourage participation by vessels that typically have above-average catches if they can fish elsewhere without a possession limit

<u>Probable short-term consequences</u>

The total number of days allocated would be those given in Sections 8.2.3 including the effect of the day-at-sea tradeoffs to add to the total, compensating for the extra fishing effort charged for trips taken in the Nantucket Lightship Area, Closed Area I, Closed Area II, and the Hudson Canyon Area.

5.3.3.3 One-to-one exchanges of area-specific allocations (days-at-sea or trips)

The alternative could apply to area specific day-at-sea allocations (Section 5.3.3.1) or to area-specific trip allocations (Section 5.3.3.2). It would enable vessels with a limited access scallop permit and area-specific allocations to trade them with another limited access scallop vessel for allocations in preferred areas, thus allowing the vessel greater flexibility to choose where to fish without significantly changing the total allocation for any rotation management area. Although vessels that do not use trips allocated for re-opened rotation management areas do not loose the ability to fish elsewhere in a regular fishing area, it would come closer

In addition to regular day-at-sea allocations to fish in open scallop areas, NMFS would allocate area-specific day-at-sea or trip allocations to vessels with limited access scallop permits. These allocations may be for "unrestricted" open-area fishing or could be area specific, depending on the area rotation/management option eventually adopted by the Council and approved by NMFS.

Permit holders could exchange area-specific days-at-sea or re-opened area trips on a one-for-one basis with any other vessel with a limited access scallop permit, but must immediately report the transaction to the NMFS. If the trading takes place during the fishing year, there would be a 30-day waiting period before the recipient vessel could use the traded days or trips, or until the recipient vessel receives notice that NMFS has recorded the exchange. After vessel owners had legally agreed to the exchange, vessels would be prohibited from using area-specific days or trips that were transferred to another vessel.

Vessels could not trade TAC or days that had already been used during the fishing year by the vessel receiving the original allocation, but it could trade TAC or days that had been received by another vessel in an earlier trade. Trades would not be permanent and the vessel would receive its original share and distribution of TAC or days at the start of the next fishing year.

Rationale: This alternative enables vessel owners and captains to decide where to fish and allows more flexibility during the fishing year, allowing them to better utilize their area-specific allocations. This would restore some flexibility in deciding where to fish, which might otherwise be impossible under area rotation where re-opened areas are managed with area-specific days or day-at-sea tradeoffs.

Key benefits	Important costs and other drawbacks
❖ Vessel owners and captains could have more flexibility to choose where to fish, if there is another vessel that would be willing to trade days or TAC. ❖ Changes in total fishing power are only as permanent as the trade arrangements	❖ Vessel owners would have to report the trades and NMFS would need to track trades and monitor TAC or days-at-sea against the present status ❖ The distribution of these allocations could affect fishing power and therefore mortality in each area, adding uncertainty to the estimated area-specific total allocation of days-at-sea or TAC ❖ There would have to be a mechanism to prevent vessels from trading days or TAC that had already been used

5.3.3.4 Status quo

This alternative exists to continue the current effort allocation schema without area-specific day-at-sea or trip allocations and tradeoffs, in case area rotation is not implemented. Unrestricted day-at-sea allocations would be made to vessels with limited access scallop permits and may be used to fish in open fishing areas. Additional rules established by framework adjustment may apply to day-at-sea use in one or more special areas.

Rationale: The status quo is incompatible with area rotation or area based management alternatives, but could continue if the Council or NMFS decides not to implement area rotation. There would be no limit (other than total day-at-sea allocations) on the amount of fishing effort directed toward scallops once an area re-opens to fishing. Coupled with area rotation that would periodically open areas with high scallop biomass, it would probably have a negative effect on price, product quality, and safety.

5.3.4 Alternatives for Reducing Habitat Impacts

The following alternatives in Amendment 10 would affect fishing with scallop dredges and trawls only, because the Scallop FMP only regulates scallop fishing or fishing that has an affect on the scallop resource. The intent of the proposed habitat alternatives in Amendment 10 are to minimize the impacts of scallop fishing of EFH for all species which have EFH designated within the range of the scallop fishery.

Although Amendment 10 alternatives apply to only scallop fishing, the effectiveness of the following habitat closure alternatives could be significantly greater if the areas were also closed to other bottom-tending mobile fishing gear, rather than only to scallop fishing. The intent of the proposed habitat closures in Amendment 10 could soon apply to other bottom-tending mobile fishing gear regulated by this FMP or other FMPs under the Council's authority.

5.3.4.1 No additional habitat-related management measures (Alternative #1: Status Quo / No Action)

This alternative retains the groundfish year-round closed areas in existence during Fishing Year (FY) 2001 prior to the settlement agreement (CLF et al. v. Evans et al.) that serve to protect habitat and minimize the impacts associated with fishing activities (WGOM, CA I, CA II, NLCA)(Map 15). Although not closed specifically to achieve habitat conservation, portions or all of the Georges Bank groundfish closed areas would remain closed for scallop fishing and therefore would have beneficial effects for protecting EFH found there. Like in Framework Adjustments 11 and 13, however, the Council may in the future allow periodic scallop fishing access in parts or possibly all of these areas on an ad hoc basis. If the Council took no future action to allow access the Georges Bank groundfish areas would remain closed.

Under the status quo management, no new measures would be implemented as part of Amendment 10 specifically to protect essential fish habitat or reduce the impacts associated with fishing activities. Significant reductions in day-at-sea allocations, coupled with vast changes in gear restrictions, and crew limits on shucking capacity may have already minimized total area swept and associated habitat impacts to the extent practicable (See cumulative impacts described in Section 8.1). Areas closed to protect other species and HAPCs in other plans could restrict scallop fishing, but no habitat closures would specifically be considered in the Scallop FMP.

Under status quo management, the Council may also adjust the day-at-sea allocations to achieve the annual fishing mortality targets, established as F = 0.20 by Amendment 7[35]. If the Council takes no future action to adjust the day-at-sea allocations, however, the allocations would remain as specified under current regulations. The Hudson Canyon and VA/NC area access program could continue under status quo management through future framework actions, but these areas would otherwise revert to a fully-open status on March 1, 2004 if the Council took no action.

5.3.4.2 Benefits of Other Amendment 10 Alternatives (Alternative #2)

There may be some incidental habitat benefits resulting from the measures considered by the Council under Amendment 10. This alternative identifies and assesses the habitat benefits that are attributed to non-habitat-specific measures in Amendment 10 and relies on these benefits to comply with the EFH provisions of the Magnuson-Stevens Act.

Rationale: The Sea Scallop FMP has reduced the amount of total scallop fishing time, through day-at-sea reductions and measures that reduce the amount to fishing associated with an allocated day-at-sea (e.g. crew limits, day-at-sea tradeoffs for controlled access areas). The FMP has also included area closures and gear restrictions that may have had a beneficial effect on EFH, through changes in where vessels fish for scallops and reductions in bycatch of groundfish, other prey fish, and benthic organisms. The sea scallop management alternatives in the amendment have the potential to build on this progress and may also have beneficial effects for reducing habitat impacts.

35 Amendment 7 specifies this as an appropriate target under a rebuilt condition. The NMFS has declared in 2002 that the Georges Bank and Mid-Atlantic scallop resource as rebuilt.

5.3.4.3 Habitat closed areas designed to protect hard-bottom habitats (Alternative #3)

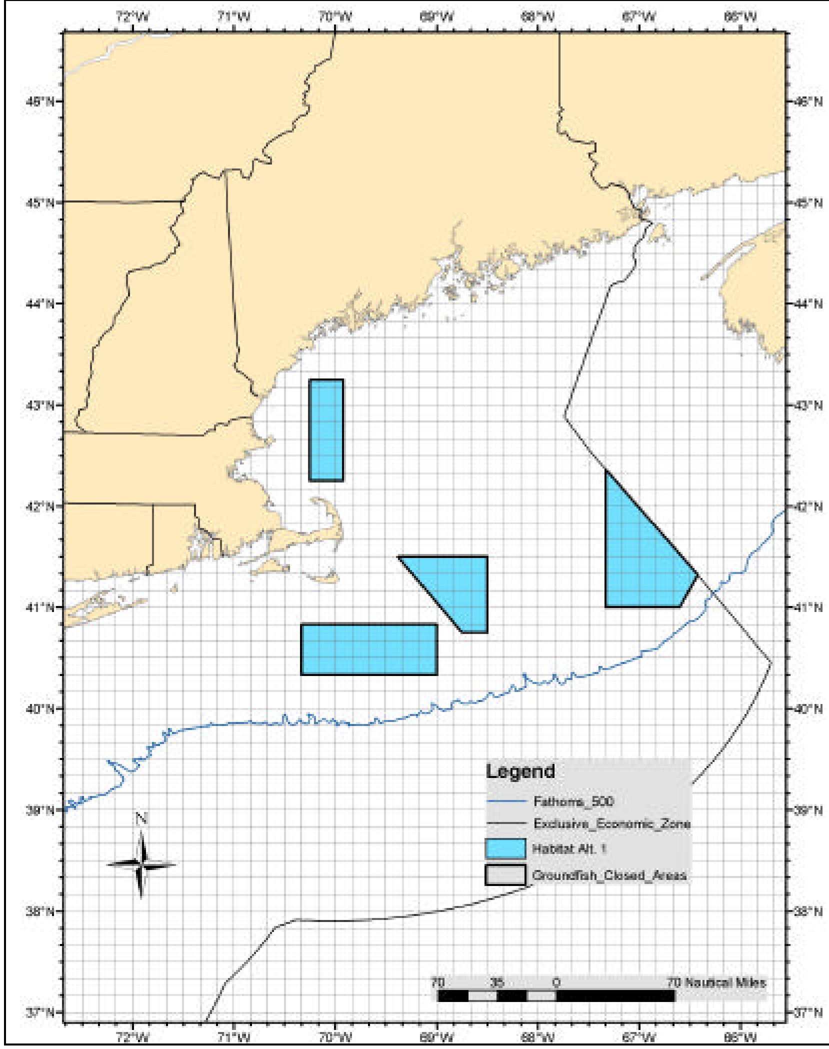
In this alternative, areas both inside and outside of the existing groundfish closures are identified for habitat closure to better protect complex hard-bottom and other sensitive habitats. The Council approved this alternative with two versions of the Western Gulf of Maine closed area. These have been incorporated as two options:

- Alternative 3A, which has a larger extension of the WGOM to the west.
- Alternative 3B, which has a smaller extension of the WGOM closure to the west.

Map 16and Map 17 provide a graphical representation of the proposed habitat closure options and coordinates for the boundaries of those areas.

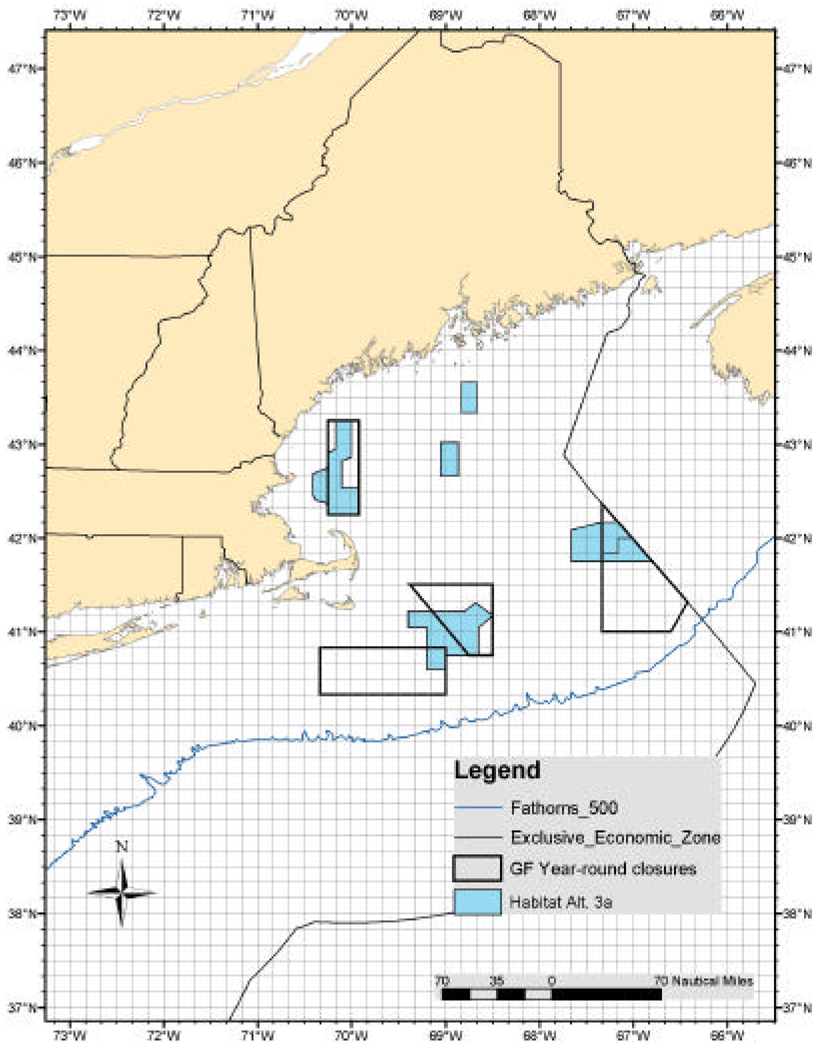
5.3.4.4 Habitat closed areas designed to protect hard-bottom habitats (Alternative #4)

Habitat closure areas in this alternative are derived from areas proposed in alternative 3 that overlap modified groundfish closed areas originally proposed as a stock rebuilding alternative for Amendment 13 of the NEFMC Multispecies Fishery Management Plan. While that alternative has been considered and rejected for stock rebuilding purposes, the Council did not expressly reject the closures proposed in Alternative 4 for habitat management purposes. Because these modifications were rejected for groundfish management purposes, adoption of habitat closed area alternative 4 would not affect the boundaries of the existing groundfish closures. The closures proposed in this alternative are intended to better protect complex hard-bottom and other sensitive habitats from any adverse impacts associated with fishing. They are shown in Map 18.



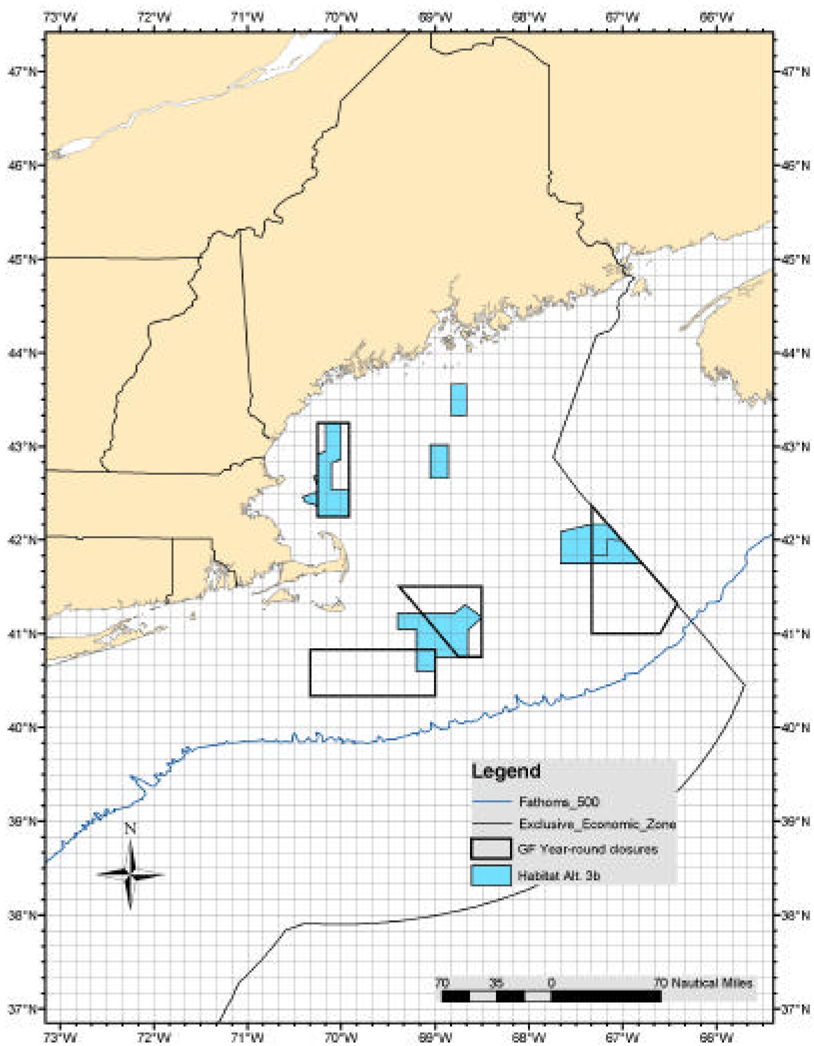
	LONGITUDE (°W)		LATITUDE (°N)	
	deg	**min**	**deg**	**min**
Closed Area I	69	22.8	41	30
	68	30	41	30
	68	30	40	45
	68	45	40	45
Closed Area II	67	19.5	42	21.7
	66	25.5	41	19.2
	66	36	41	0
	67	20	41	0
Nantucket Lightship	70	20	40	50
	69	0	40	50
	69	0	40	20
	70	20	40	20
WGOM	70	15	43	15
	69	55	43	15
	69	55	42	15
	70	15	42	15

Map 15. Map and coordinates for Habitat Alternative 1.



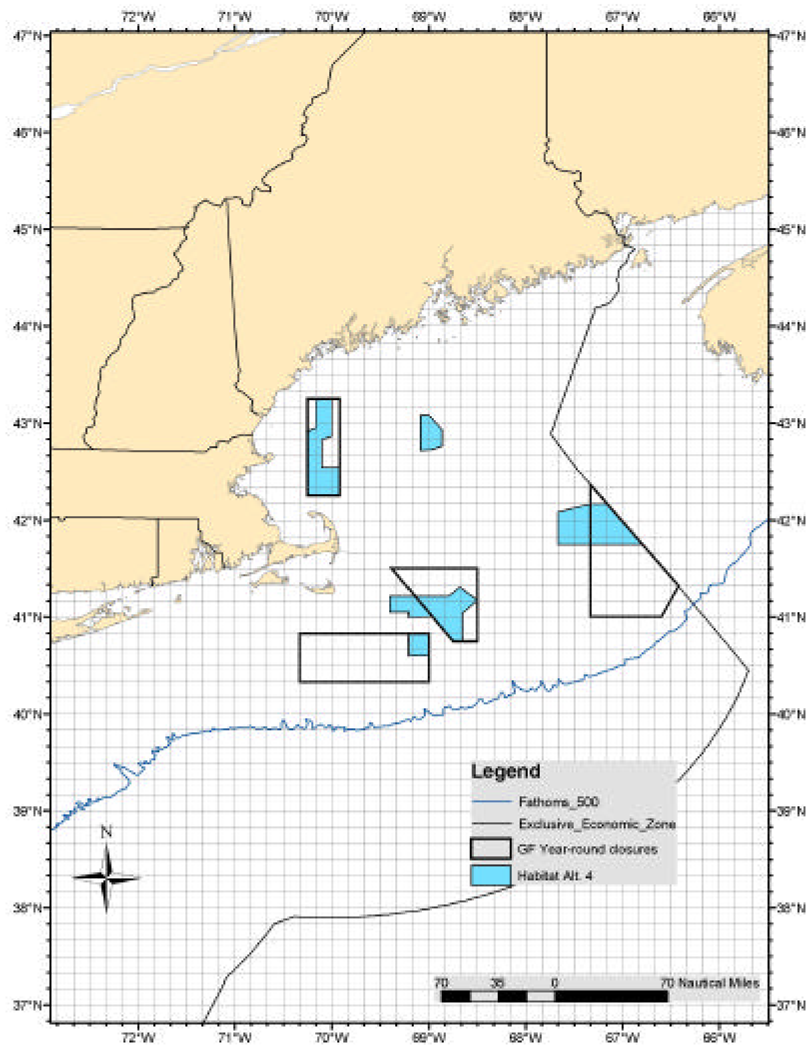
	LONGITUDE (°W)			LATITUDE (°N)		
	deg	min	sec	deg	min	sec
Habitat Area I	69	24	0	41	13	0
	68	48	0	41	13	0
	68	41	0	41	18	30
	68	30	0	41	10	30
	68	39	0	41	2	30
	68	39	0	40	45	0
	69	0	0	40	36	0
	69	0	0	40	36	0
	69	12	30	40	36	0
	69	12	30	41	3	0
	69	24	0	41	3	0
Habitat Area II	67	40	0	42	5	0
	67	20	0	42	10	0
	67	9	35	42	10	0
	66	47	48	41	45	0
	67	40	0	41	45	0
Cashes Habitat	69	3	22	43	1	14
	68	51	56	43	1	14
	68	51	56	42	39	46
	69	3	22	42	39	46
Jeffrey's Habitat	68	50	0	43	40	0
	68	40	0	43	40	0
	68	40	0	43	20	0
	68	50	0	43	20	0
WGOM Alt. 1	70	10	0	43	15	0
	70	0	0	43	15	0
	70	0	0	42	52	0
	70	6	4	42	49	33
	70	6	4	42	32	30
	69	55	0	42	32	30
	69	55	0	42	15	0
	70	15	0	42	15	0
	70	15	0	42	20	27
	70	17	0	42	23	0
	70	23	0	42	24	18
	70	24	42	42	27	44
	70	24	42	42	41	18
	70	15	0	42	45	14
	70	15	0	42	55	0
	70	10	0	42	57	0

Map 16. Map and Coordinates for Habitat Alternative 3a. Current Groundfish closed areas included for reference.



	LONGITUDE (°W)			LATITUDE (°N)		
	deg	min	sec	deg	min	sec
Habitat Area I	69	24	0	41	13	0
	68	48	0	41	13	0
	68	41	0	41	18	30
	68	30	0	41	10	30
	68	39	0	41	2	30
	68	39	0	40	45	0
	69	0	0	40	36	0
	69	0	0	40	36	0
	69	12	30	40	36	0
	69	12	30	41	3	0
	69	24	0	41	3	0
Habitat Area II	67	40	0	42	5	0
	67	20	0	42	10	0
	67	9	35	42	10	0
	66	47	48	41	45	0
	67	40	0	41	45	0
Cashes Habitat	69	3	22	43	1	14
	68	51	56	43	1	14
	68	51	56	42	39	46
	69	3	22	42	39	46
Jeffrey's Habitat	68	50	0	43	40	0
	68	40	0	43	40	0
	68	40	0	43	20	0
	68	50	0	43	20	0
WGOM Alt. 2	70	0	0	43	15	0
	70	0	0	42	52	0
	70	6	4	42	49	33
	70	6	4	42	32	30
	69	55	0	42	32	30
	69	55	0	42	15	0
	70	15	0	42	15	0
	70	15	0	42	20	27
	70	17	0	42	23	0
	70	23	0	42	24	18
	70	24	42	42	27	44
	70	15	0	42	31	27
	70	15	0	42	33	50
	70	17	35	42	41	0
	70	15	0	42	41	35
	70	15	0	42	55	0
	70	10	0	42	57	0
	70	10	0	43	15	0

Map 17. Map and Coordinates for Habitat Alternative 3b. Current Groundfish closed areas included for reference.



	LONGITUDE (°W)		LATITUDE (°N)	
	deg	**min**	**deg**	**min**
GOM	70	9	43	15
	70	0	43	15
	70	0	42	51
	70	6	42	49
	70	6	42	32
	69	54	42	32
	69	54	42	15
	70	15	42	15
	70	15	42	20
	70	15	42	54
	70	10	42	57
CAI	69	24	41	13
	68	47	41	13
	68	40	41	18
	68	30	41	10
	68	39	41	2
	68	39	40	45
	68	45	40	45
	68	57	41	0
	69	12	41	0
	69	12	41	2
	69	24	41	2
CAII	67	40	42	4
	67	20	42	10
	67	9	42	10
	66	47	41	45
	67	40	41	45
Nantucket	69	0	40	50
	69	0	40	36
	69	12	40	36
	69	12	40	50
Cashes	69	5.8	43	4.4
	68	59.5	43	4.4
	68	51.5	42	55.6
	68	51.5	42	45.6
	68	58.3	42	43.3
	69	5.8	42	43.1

Map 18. Map and Coordinates for Habitat Alternative 4. Current Groundfish closed areas included for reference.

5.3.4.5 Closed areas designed to protect EFH and balance fishery productivity (Alternative #5)

This alternative establishes closed areas that balance the protection of EFH and fishery productivity. Closed areas were determined on the basis of a model that assigned a value for EFH importance and fishery productivity (in the scallop, groundfish, and monkfish fisheries) in each ten minute square from the southern border of Canada to the northern border of South Carolina. Closed areas were then designated based on four decision criteria for each ten minute square: 1) reliance of the stocks on bottom habitat (life history considerations), 2) stock status, 3) relative value to the fisheries and 4) vulnerability of bottom habitat. The model identified one closed area, based on closure areas of more than eight (or nine, depending on the closure shape) contiguous ten minute squares, for each of the management areas (e.g. Gulf of Maine, Georges Bank, Southern New England and Mid-Atlantic). The following four options were developed:

Alternative 5A: EFH/Productivity tradeoffs using the original working group species EFH weights with equal emphasis given to scallop productivity and the combined weighted productivity of 37 other managed species.

Alternative 5B: Total EFH value only, using revised species EFH weights (omitting relative importance to the fishery as a factor), with no productivity tradeoff.

Alternative 5C. EFH/Productivity tradeoffs using the revised species EFH weights with equal emphasis given to scallop productivity and the combined weighted productivity of the other 37 managed species.

Alternative 5D. EFH/Productivity tradeoffs using the revised species EFH weights and productivity for each of the 37 managed species, considered individually. See Section 2.3 in Appendix IV for a detailed description of the model used to determine these closure areas.

Map 19 through Map 22 display maps and coordinates for these closures.

5.3.4.6 Habitat closures consistent with the Framework Adjustment 13 Scallop Closed Areas Access Program (Alternative #6)

In this alternative the year-round groundfish closed areas (WGOM, CA I, CA II and NLCA) that were in place during the 2001 fishing year are considered habitat closures with the exception of those areas opened under the Scallop FW 13 Closed Area Access Program.

See Map 23 for a map of the closures

5.3.4.7 Habitat closures designed to protect areas of high EFH value and low scallop productivity (Alternative #7)

This alternative would close ten minute squares of high EFH value and low scallop productivity, as defined by the same model used to develop habitat Alternative 5 (5a-5d) (See Section 2.3 in Appendix IV). EFH importance was based on the prevalence of EFH designations in each ten minute square. See Map 24.

5.3.4.8 Habitat closure on eastern portion of Georges Bank (inside and outside of Cod HAPC)(Alternative #8)

5.3.4.8.1 8a: Habitat closure encompassing the Cod HAPC on Georges Bank

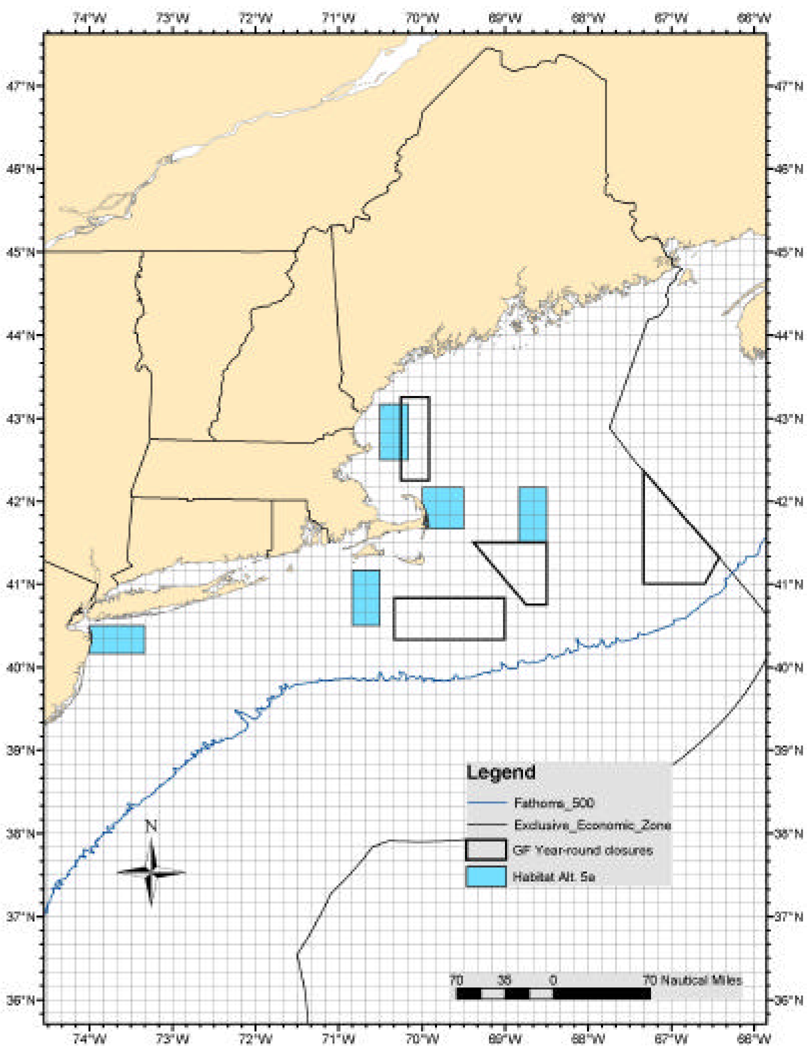
This alternative would change the status of the cod HAPC from a mortality closure to a habitat closure. Significant portions of these areas contain gravel pavement and cobble bottom, believed to be the most sensitive to the effects of scallop dredging.

8b: Habitat closure encompassing the Cod HAPC and an expansion to the west

This alternative would create a Habitat Closed area that includes the existing Cod HAPC on Georges Bank and includes additional area to the west. This alternative would NOT expand the actual HAPC designation, it would change the status of the Cod HAPC form a mortality closure to a habitat closure. The area that would be closed in this alternative is the same area as Habitat Area II in Habitat Alternative 3a and 3b. (See Map 26)).

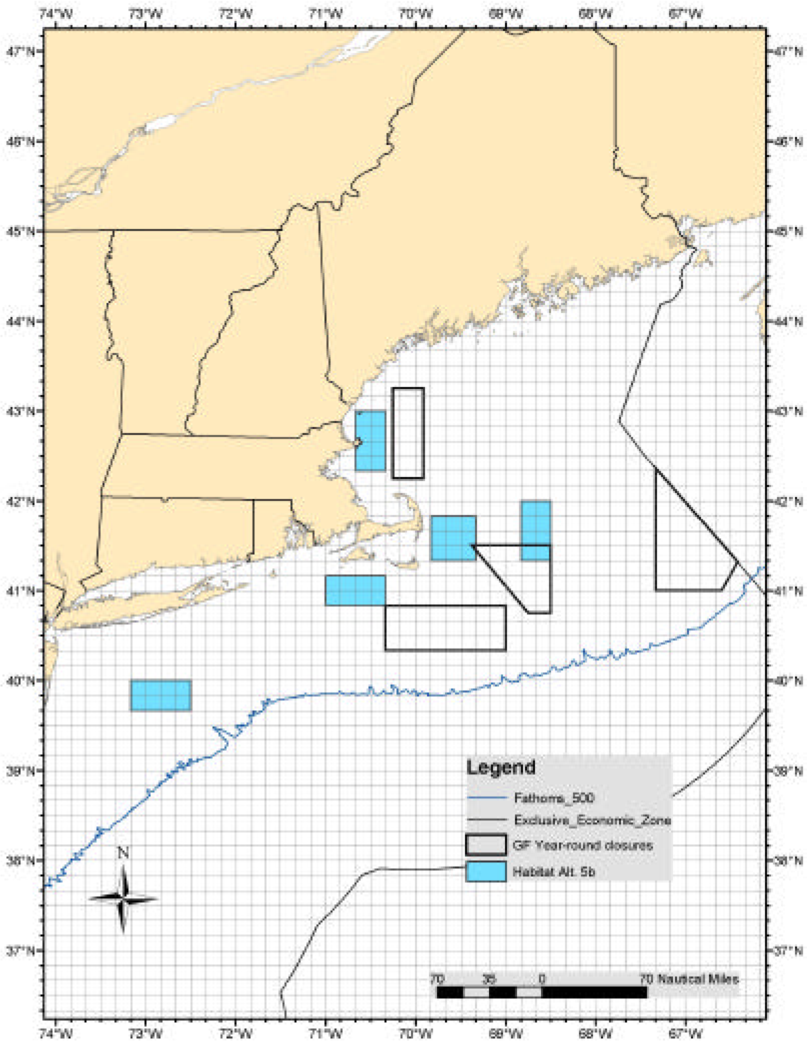
5.3.4.9 Existing groundfish mortality closed areas (Alternative #9)

The existing year-round groundfish closed areas (per the CLF vs. Daley settlement agreement) on Georges Bank and in the Gulf of Maine would continue to be closed to scallop fishing (gear adversely impacting scallop EFH or gear capable of catching scallops). These include Closed Area I, Closed Area II, Western Gulf of Maine Closure, Nantucket Lightship Closed Area and the new Year-Round Cashes Ledge Closure (See Map 27). This alternative would change the status of these closed areas from mortality closures to habitat closures.



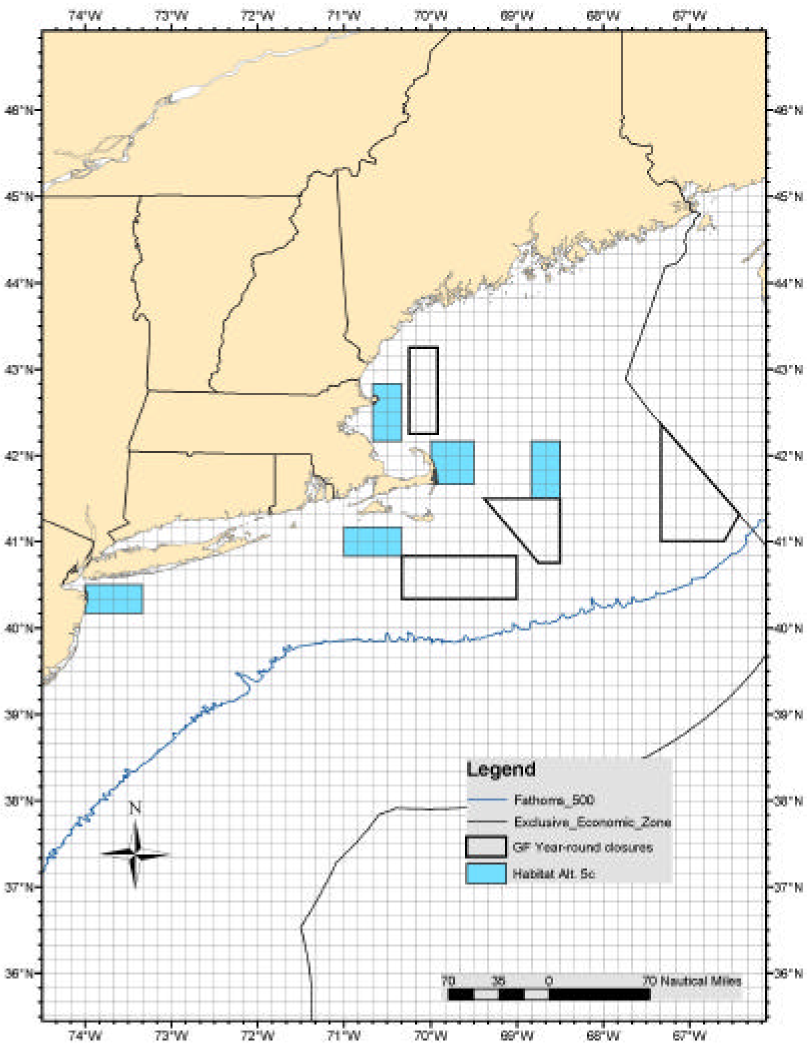
		LATITUDE (°N)		LONGITUDE (°W)	
		deg	min	deg	min
GB					
	NW	42	10	68	50
	NE	42	10	68	30
	SE	41	30	68	30
	SW	41	30	68	50
GOM					
	NW	43	10	70	30
	NE	43	10	70	10
	SE	42	30	70	10
	SW	42	30	70	30
GSC					
	NW	42	10	70	0
	NE	42	10	69	30
	SE	41	40	69	30
	SW	41	40	70	0
MA					
	NW	40	30	74	0
	NE	40	30	73	20
	SE	40	10	73	20
	SW	40	10	74	0
SNE					
	NW	41	10	70	50
	NE	41	10	70	30
	SE	40	30	70	30
	SW	40	30	70	50

Map 19. Map and Coordinates for Habitat Alternative 5a. Current Groundfish closed areas included for reference.



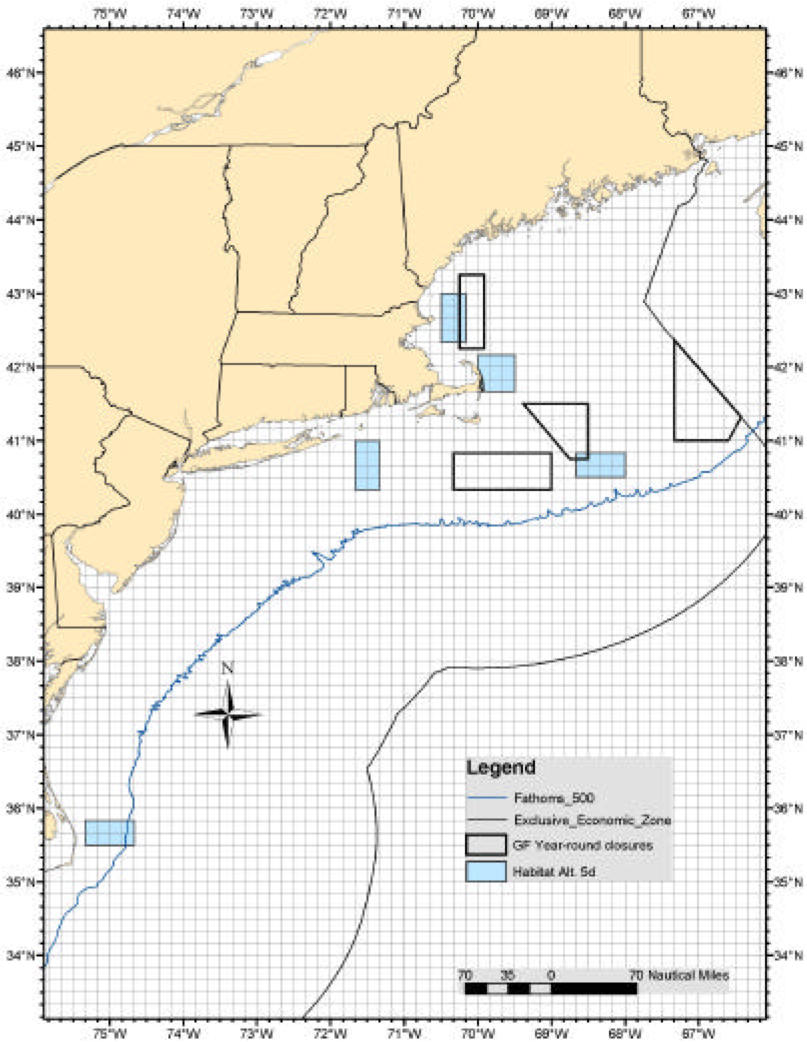
		LATITUDE (°N)		LONGITUDE (°W)	
		deg	min	deg	min
GB					
	NW	42	0	68	50
	NE	42	0	68	30
	SE	41	20	68	30
	SW	41	20	68	50
GOM					
	NW	43	0	70	40
	NE	43	0	70	20
	SE	42	20	70	20
	SW	42	20	70	40
GSC					
	NW	41	50	69	50
	NE	41	50	69	20
	SE	41	20	69	20
	SW	41	20	69	50
MA					
	NW	40	0	73	10
	NE	40	0	72	30
	SE	39	40	72	30
	SW	39	40	73	10
SNE					
	NW	41	10	71	0
	NE	41	10	70	20
	SE	40	50	70	20
	SW	40	50	71	0

Map 20. Map and Coordinates for Habitat Alternative 5b. Current Groundfish closed areas included for reference.



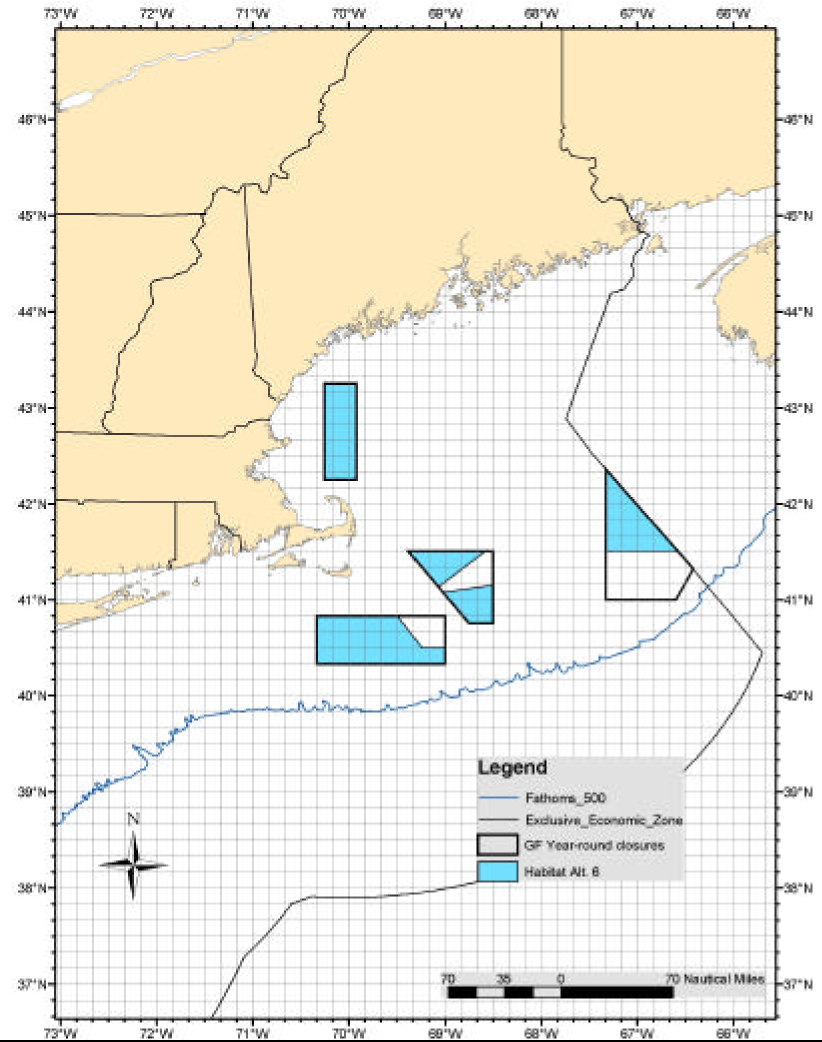
		LATITUDE (°N)		LONGITUDE (°W)	
		deg	min	deg	min
GB					
	NW	42	10	68	50
	NE	42	10	68	30
	SE	41	30	68	30
	SW	41	30	68	50
GOM					
	NW	42	50	70	40
	NE	42	50	70	20
	SE	42	10	70	20
	SW	42	10	70	40
GSC					
	NW	42	10	70	0
	NE	42	10	69	30
	SE	41	40	69	30
	SW	41	40	70	0
MA					
	NW	40	30	74	0
	NE	40	30	73	20
	SE	40	10	73	20
	SW	40	10	74	0
SNE					
	NW	41	10	71	0
	NE	41	10	70	20
	SE	40	50	70	20
	SW	40	50	71	0

Map 21. Map and Coordinates for Habitat Alternative 5c. Current Groundfish closed areas included for reference.



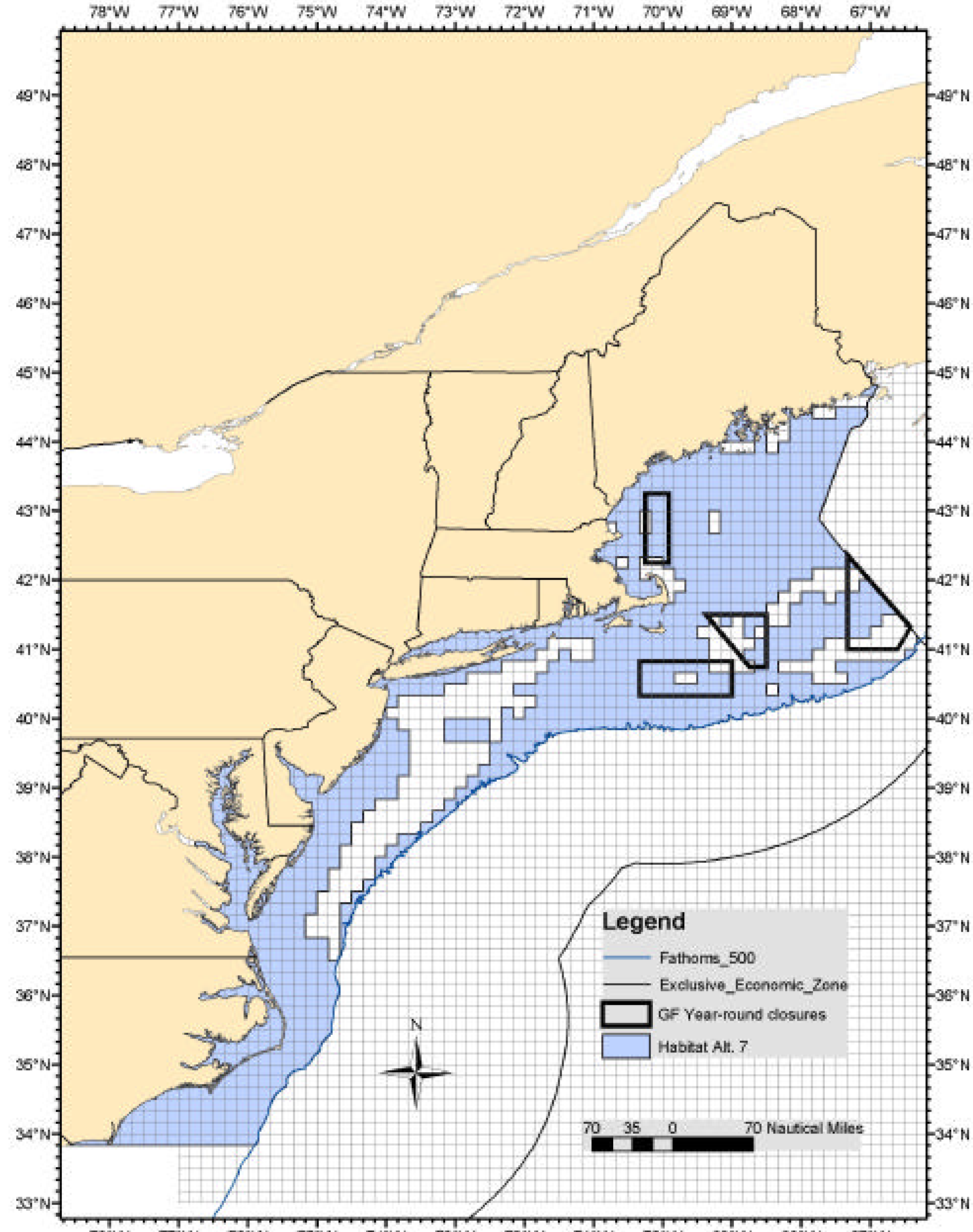
	LATITUDE (°N) deg	LATITUDE (°N) min	LONGITUDE (°W) deg	LONGITUDE (°W) min
GB				
NW	40	50	68	40
NE	40	50	68	0
SE	40	30	68	0
SW	40	30	69	40
GOM				
NW	43	0	70	30
NE	43	0	70	10
SE	42	20	70	10
SW	42	20	70	30
GSC				
NW	42	10	70	0
NE	42	10	69	30
SE	41	40	69	30
SW	41	40	70	0
MA				
NW	35	50	75	20
NE	35	50	74	40
SE	35	30	74	40
SW	35	30	75	20
SNE				
NW	41	0	71	40
NE	41	0	71	20
SE	40	20	71	20
SW	40	20	71	40

Map 22. Map and Coordinates for Habitat Alternative 5d. Current Groundfish closed areas included for reference.



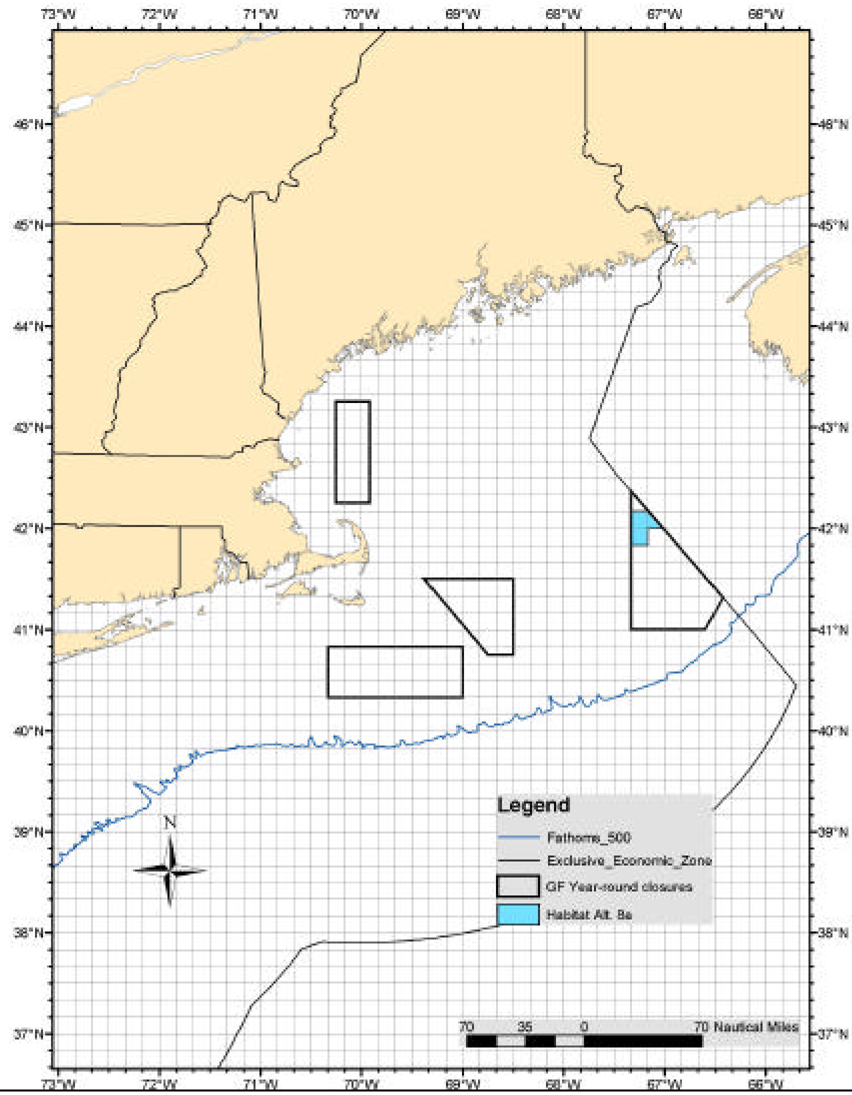
	LONGITUDE (°W) deg	LONGITUDE (°W) min	LATITUDE (°N) deg	LATITUDE (°N) min
CAI	69	1.2	41	4.5
	68	30	41	9
	68	30	40	45
	68	45	40	45
	69	23	41	30
	68	35	41	30
	69	4.3	41	8
CAII	67	20	42	22
	66	34.8	41	30
	67	20	41	30
Nantucket Lightship	69	0	40	20
	69	0	40	30
	69	14.5	40	30
	69	29.5	40	50
	70	20	40	20
	72	20	40	50
WGOM	69	55	42	15
	69	55	43	15
	70	15	43	15
	70	15	42	15

Map 23. Map and Coordinates for Habitat Alternative 6. Current Groundfish closed areas included for reference.



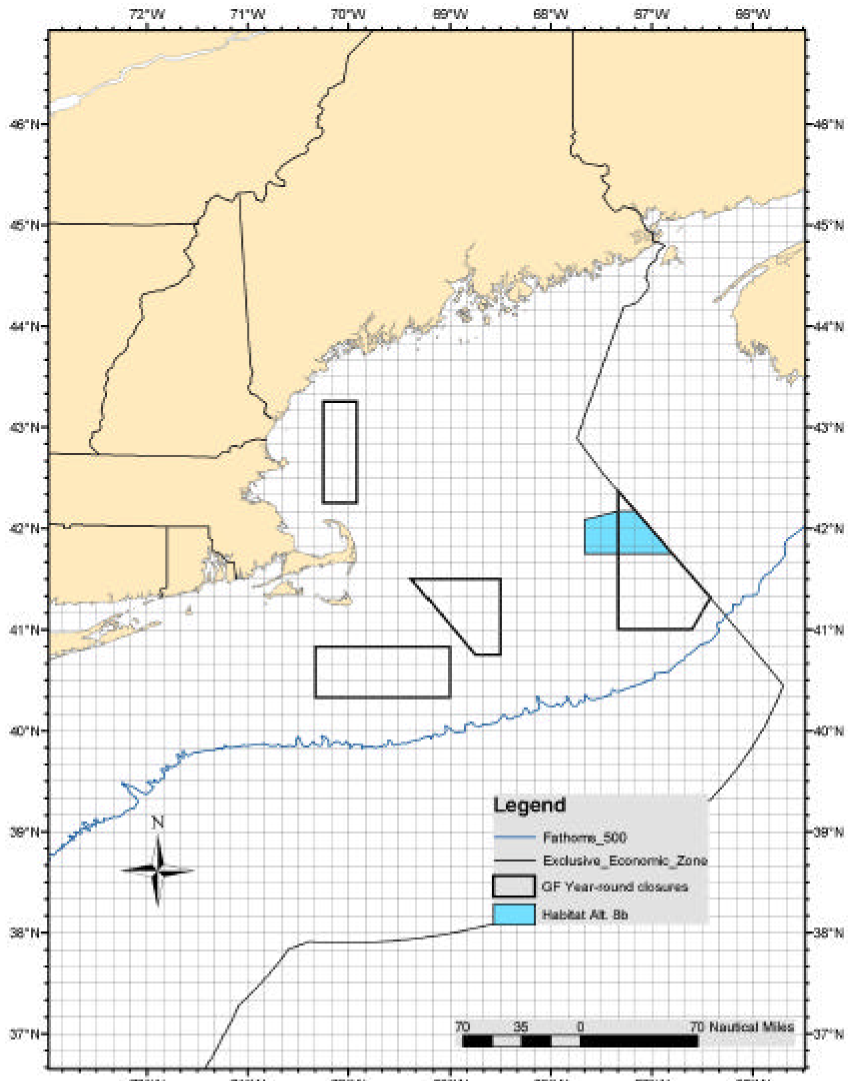
Coordinates for fishing to be applied by groups of ten-minute squares.

Map 24. Map and Coordinates for Habitat Alternative 7. Current Groundfish closed areas included for reference.



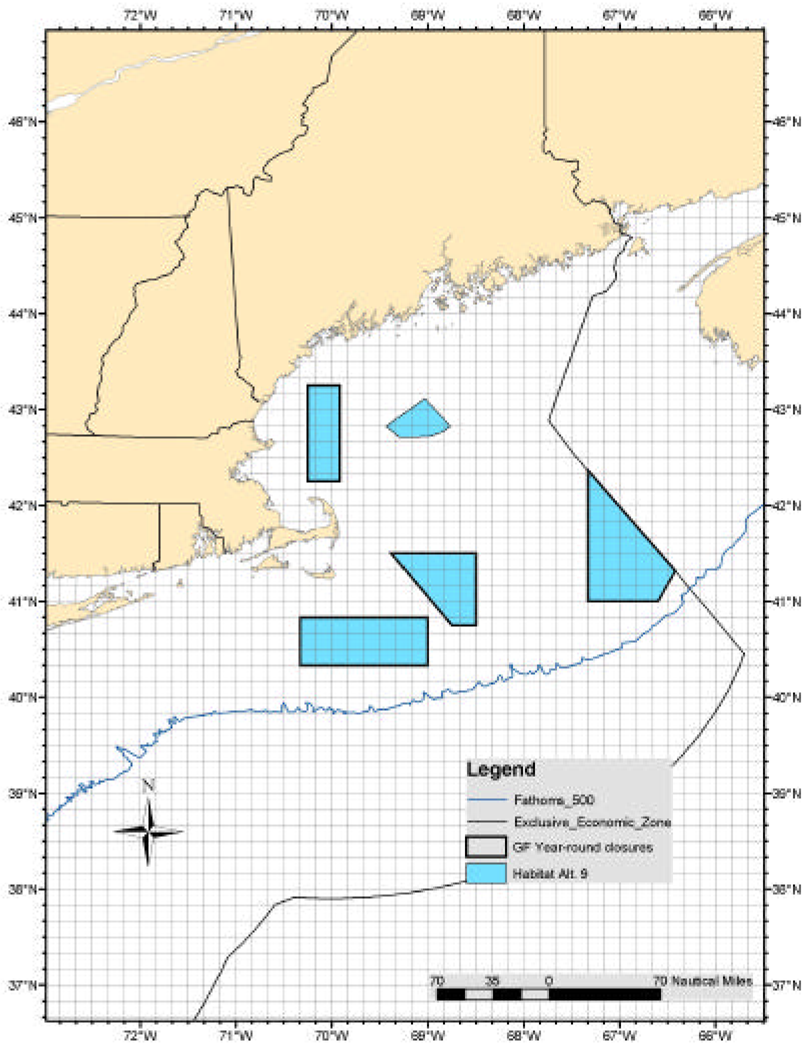
LONGITUDE (°W)		LATITUDE (°N)	
deg	**min**	**deg**	**min**
67	20	42	10
67	9.3	42	10
67	0.5	42	0
67	10	42	0
67	10	41	50
67	20	41	50

Map 25. Map and Coordinates for Habitat Alternative 8a. Current Groundfish closed areas included for reference.



LONGITUDE (°W)		LATITUDE (°N)	
deg	min	deg	min
67	40	42	5
67	20	42	10
67	10	42	10
66	48	41	45
67	40	41	45

Map 26. Map and Coordinates for Habitat Alternative 8b. Current Groundfish closed areas included for reference.



	LONGITUDE (°W) deg	min	LATITUDE (°N) deg	min
Closed Area I	69	22.8	41	30
	68	30	41	30
	68	30	40	45
	68	45	40	45
Closed Area II	67	19.5	42	21.7
	66	25.5	41	19.2
	66	36	41	0
	67	20	41	0
Nantucket Lightship	70	20	40	50
	69	0	40	50
	69	0	40	20
	70	20	40	20
WGOM	70	15	43	15
	69	55	43	15
	69	55	42	15
	70	15	42	15
Cashes	69	26	42	49.5
	69	2	43	7
	68	46	42	49.5
	68	50.5	42	46.5
	68	58.5	42	43.5
	69	17.5	42	42.5

Map 27. Map and Coordinates for Habitat Alternative 9. Current Groundfish closed areas included for reference.

5.3.4.10 Restrictions on rock chains (Alternative #10)

Vessels with limited access and general category scallop permits would have limits on the amount, and possibly configuration, of rock chains.

Rationale: Scallop vessels using dredges often use rock chains in some areas to deflect large rocks, boulders, and other debris. It prevents damage to fishing gear, handling problems at the surface and on deck, improves safety at sea, and reduces bycatch mortality due to crushing. On the other hand, the use of rock chains allows vessels to fish in more rugged areas, having complex habitats. Controlling the use of rock chains has the potential to reduce fishing in these areas having more sensitive and vulnerable habitats.

5.3.4.11 Increasing dredge ring size to 4-inches in all or select areas (Alternative #11; described fully in Section 5.3.2.9)

Option 1: Scallop dredge ring size would be required to be at 4-inches everywhere

Option 2: Scallop dredge ring size would be required to be 4 inches in a "re-opened" status, including groundfish closed areas if an access program is active.

Rationale: These alternatives are proposed primarily to reduce mortality on small scallops where scallops are of mixed sizes. Research has determined that the efficiency for catching larger scallops (e.g., greater than 110 mm shell height) also improves. Thus the improved dredge efficiency has the potential for reducing bottom time, non-catch mortality, bycatch, and possibly habitat effects. Option 2 is proposed because requiring the use of 4-inch rings throughout the resource could actually increase fishing time in areas where fewer large scallops are available.

5.3.4.12 Habitat research funded through scallop TAC set-aside (Alternative #12)

Scientists conducting habitat research that is related to the effects of scallop fishing could apply for funding through the research TAC/day-at-sea set aside (Section **5.3.8.1.4**). Research is needed to quantify or evaluate the long-term effects of scallop fishing on the essential fish habitat and to estimate habitat recovery rates. Some of the funds from a TAC set-aside would promote such research.

Rationale: This alternative would broaden the range of research types that could be funded through the scallop research TAC set aside, proposed in Section **5.3.8.1.4**. Research funded through this mechanism could identify fishing gear or methods that have fewer habitat impacts, or might be useful to identify ways that fishing is managed to minimize related habitat impacts.

5.3.4.13 Area based management and rotation based on habitat protection (Alternative #13)

This alternative would integrate habitat management with area rotation. The concept is outlined and described in Section **5.3.2.7**, one of the scallop area rotation alternatives. Under the alternatives, the frequency, duration, and intensity of scallop fishing in rotation management areas would be modified to minimize adverse habitat impacts. Although the concept and structure of this alternative is described in

Section **5.3.2.7**, specific criteria for controlling the frequency, duration, and intensity of scallop fishing have not been defined.
Rationale: Habitat impacts could vary with the frequency, duration, and intensity of scallop fishing. For example, rotation management area closures could reduce overall habitat impacts by allowing time for a more complete habitat recovery after a period of fishing. Some benthic species take longer to recolonize the bottom and restore ecological structure than it takes for scallops to grow from juveniles to an optimum size for harvest as adults. On the other hand, scallop yield loss from waiting too long to fish is small for a slightly longer closure (an additional 3-5 years, for example), but could have measureable benefits to the ecosystem. Over a longer period, the annual scallop yield loss (because scallops don't migrate) would approach the natural mortality rate, or about 20 percent per year. Very long rotation management area closures would also increase the risk of episodic, widespread scallop mortality from thermal stress or predation. Thus, habitat impacts from scallop fishing might be addressed through adjustments in area rotation strategies rather than long-term, indefinite closures described in other habitat alternatives in this section.

5.3.5 Alternatives for Reducing Bycatch and Bycatch Mortality

Area rotation and larger rings both significantly contribute to reducing bycatch by increasing dredge efficiency. By focusing fishing effort where catch rates are high and by improving the efficiency of catching large scallops, the total area swept by commercial dredges at the target fishing mortality decreases. In addition, a dredge using larger rings appears to catch fewer small fish for some species, and also catches fewer invertebrates (Section 8.2.8).

In addition to these alternatives described elsewhere in the document, the Council is proposing several additional measures that would reduce finfish bycatch and an alternative that would reduce the probability of interactions with sea turtles. The scallop fishery operates in areas that overlaps with concentrations of many other species of fish, marine mammals, turtles and other marine life. Because of the nature of the fishery, i.e., a mobile gear fishery, many species that are encountered have the potential for capture and mortality. Certain flounder species, such as yellowtail flounder, are frequently captured in scallop dredge and trawl gear, for example. Table 186 to Table 188 include a list of finfish species commonly caught in scallop fishery as bycatch. In addition, the scallop dredge fishery has seen an increase in sea turtle captures. In order to better comply with National Standard 9, which mandates that bycatch and bycatch mortality be minimized to the extent practicable, this section presents alternatives that are intended to reduce bycatch and bycatch mortality in the scallop dredge fishery. Alternatives are also included in order to address the takes of sea turtles which is prohibited or restricted under the Endangered Species Act.

5.3.5.1 Area rotation

These alternatives are described in Sections 5.1.3.1 to 5.3.2.8.

Rationale: Area rotation management will reduce fishing in areas with lower biomass of large scallops. Fewer vessels would target areas with abundant small scallops to pick larger scallops from the catch for shucking while towing large areas to compensate. This effect, combined with crew restrictions that cap shucking capacity, reduce the amount of fishing per day-at-sea when catch rates are higher than the crew's shucking capacity. Since finfish bycatch is proportional to the amount of area towed (unless effort is re-distributed to areas with higher finfish catch rates), bycatch declines as the amount of area swept decreases.

5.3.5.2 Increasing the minimum ring size to 4-inches in all or select areas

This alternative is described in Section 5.3.2.9

Rationale: Dredges with 4-inch rings increases efficiency for capturing large (> 110 mm) scallops by about 10-15 percent, thereby reducing the area swept by commercial dredges by 10-15 percent. Since finfish bycatch is proportional to the amount of area towed (unless effort is re-distributed to areas with higher finfish catch rates), bycatch declines as the amount of area swept decreases.

If few large scallops are available to the gear, however, it would take longer to capture the larger scallops retained by dredges with 4-inch rings. Tow duration would increase, and if the catches are near the crew's shucking capacity, the tow durations would increase to compensate for the reduced scallop catches. If the catch rates for a 3½-inch ring dredge were less than the crew's shucking capacity, the tow duration might increase only a little because the vessel hauled the dredge less frequently during continuous fishing operations. Vessels might also attempt to increase tow speed to compensate for the lower catch, if the 4-inch rings are used where abundance of large scallops is below average.

5.3.5.3 Increase minimum twine top mesh to 10-inches in all or select areas, and/or specify how twine tops should be installed in dredges

Scallop dredges would be required to be constructed with twine tops having mesh no less than 10-inches, increasing from 8-inches presently required in open scallop fishing areas. One option would make this a requirement everywhere and another option would make it a requirement for areas in a 're-opened' status. Factors that could be regulated include setting the number of meshes to be attached to the dredge, the minimum size of the twine top, and specifying the use of square or diamond mesh, whichever is more effective to allow finfish escapement.

Implementation would be delayed for six months for any rule that changed the type of twine tops that fishermen are required to use while fishing in open rotation areas. Implementation would coincide with the final rule for Amendment 10 for twine tops or configurations required in re-opened areas, including the groundfish closed areas.

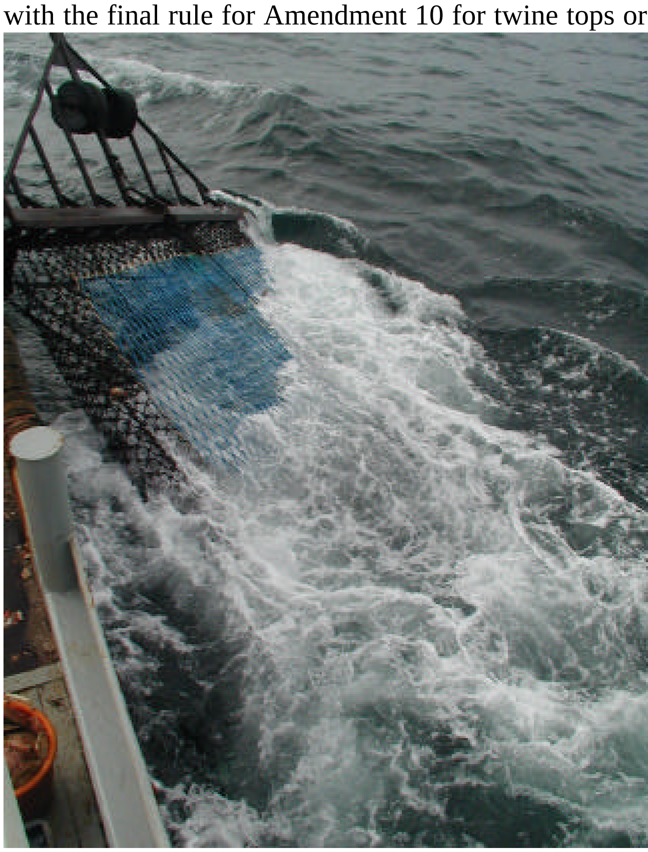


Figure 6. Picture of twine top with dredge at the surface.

Rationale: Larger twine tops reduce finfish bycatch for many species (Section 8.3.3), particularly in areas with large scallops that infrequently escape through the twine top. Specifications for how the twine tops is installed within the dredge or the number of meshes in a twine top could prevent fishermen from mitigating the effectiveness of the twine top.

Delayed implementation would allow suppliers to manufacture or obtain the 10-inch mesh twine tops. It would also allow suppliers to draw down existing gear inventory and allow fishermen time to use gear purchased before

Amendment 10 is implemented. Full-time vessels replace twine tops several times a year, but vessels keep a supply on hand to repair damaged dredges.

Twine top mesh larger than 10-inches was not considered in Amendment 10, because previous studies using 12-inch twine top mesh indicated excessive scallop loss, which would have the strong potential to reduce dredge efficiency and increase the effects of scallop fishing from compensatory towing and higher day-at-sea allocations to achieve optimum yield.

Probable short-term consequences

Twine tops with 10-inch mesh would immediately reduce finfish bycatch, particularly where large scallops are abundant. This would have little effect on the landings of non-target species because restrictive possession limits for many finfish already apply. Without measures to keep bycatch low, it is unlikely that scallop vessels would be authorized to fish in the Georges Bank groundfish closed areas, considerably reducing scallop yield and day-at-sea allocations.

Figure 7. Crewman sewing a twine top into a scallop dredge. This procedure takes about 30 – 45 minutes at the dock or in good weather.

5.3.5.4 Gear modifications based on recent research

Current research on finfish excluder devices (a modification of the dredge bail) show promising results for some species, but more testing is needed in a variety of areas and conditions. If the ongoing research show significant decreases of finfish catch and insignificant decreases in scallop catches, fishermen would be required to make modifications to the dredge bail to comply. The modifications to the research dredge have so far required only some changes to existing bails, which can be accomplished in a few hours by a welder. Alternatively, the Council may require gear modifications by framework adjustment, using a deliberative process outlined in Section 5.3.5.6.

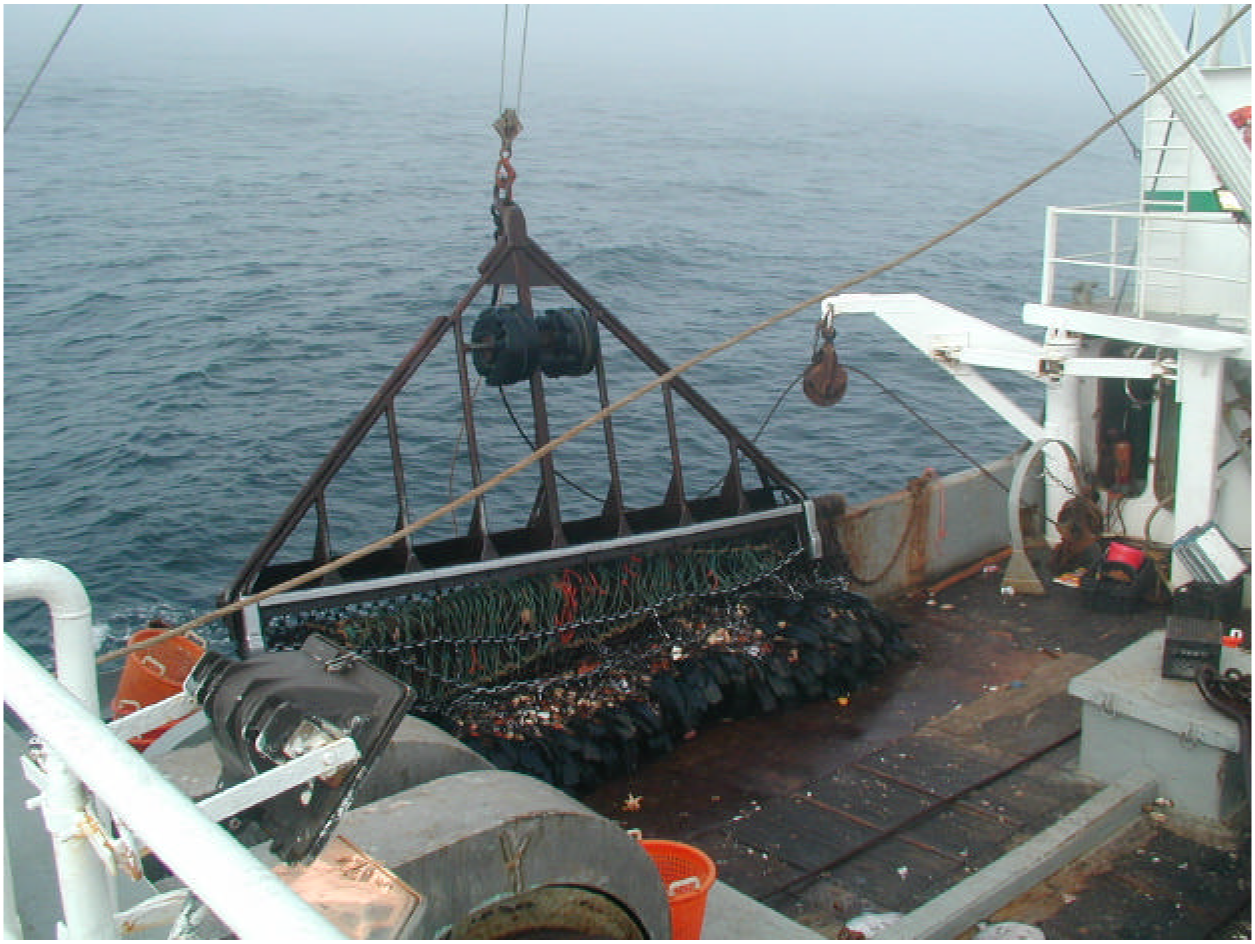


Figure 8. Bail of a scallop dredge. The frame acts to keep the dredge bag spread wide and on the bottom. Note the shiny part of the bail that keeps contact with the bottom, versus other portions of the bail that do not.

Rationale: Research to date has been conducted via paired-comparisons on a single trip to a groundfish closed areas. The results for some species show very significant reductions in finfish catches, but catches of other species are unaffected by the modifications. If additional research in other areas shows consistently better results over the control dredge, the gear modification would be required through the final proposed actions in Amendment 10 or a future framework action.

5.3.5.5 Area-specific possession limits for some finfish species

The Council would specify possession limits for non-target finfish catches in re-opened rotation management areas through framework or other adjustments. A procedure outlined in Section 5.3.5.6 would be followed to identify which species would be managed with a possession limit and the amount of fish that may be retained.

Rationale: Prohibiting scallop vessels from landing finfish could reduce the incentive to fish in portions of rotational management areas that have higher bycatch than in other areas. Species that might be regulated with an area-specific possession limit include species that are vulnerable to capture by scallop gear and are overfished, e.g. Southern New England yellowtail flounder, monkfish, and possibly winter flounder).

Figure 9. Club stick and chafing gear attached to the rear of a scallop dredge.

5.3.5.6 Area-specific TACs for some finfish species

The Council would specify total allowable catches for some species of finfish bycatch through framework or other management actions (including automatic sunsets and annual specifications) that re-open areas to fishing after a period of closure. Catches of non-target species would be monitored by sufficient observer coverage to estimate bycatch at the scale of the area-based management program (see

Section 5.3.7.1). When the total catch (retained and discarded) meets the TAC for any such bycatch species, a rotation management area would close to scallop fishing for the remainder of the scallop fishing year.

The process for closing management areas for scallop grow out will occur on a periodic basis. At the time of closing an area, a duration and geographic area will be set for the closure. Therefore, when an area is closed, it is also scheduled to re-open on a date specific or predicted to re-open if adaptive re-openings are chosen. When the Council expects an area to re-open, at least 18 months prior, the committee will send out a notice to the appropriate committees to solicit input from a broader group should the need arise. Relevant questions to be evaluated include:

Is there an identified need to be addressed under this scallop plan in the re-opening?

If yes, to what magnitude?

If there is a need to constrain mortality for a species caught in the scallop fishery, a consulted committee may recommend a total allowable catch (TAC) and inform the Scallop Oversight Committee of other relevant issues."

The Scallop Oversight Committee would respond with a framework adjustment or other management action, including an automatic sunset provision, that re-opens or set limits on re-opened rotation management areas. Possible actions include:

Set a season (Section 5.3.5.7)
Require a gear modification (Section 5.3.5.4)
Set a trip limit (Section 5.3.5.5)
Set a hard TAC for area opening (this alternative).

Rationale: The purpose of setting TACs for re-opened areas is to prevent incidental catches from exceeding biological limits from the higher than average scallop fishing effort in re-opened areas. The TAC for non-target species also is intended to induce fishermen to fish in portions of the area with lower bycatch and/or use gear or methods that reduce bycatch. If the catch of non-target species is above the biological limits, the scallop fishermen will have less access to the resource in a re-opened area that has critical species that are vulnerable to capture by scallop fishing. If the scallop fishermen can avoid catching these non-target species, the re-opened area could stay open as long as the scallop management plan allows.

<u>Probable effects in 2003 and 2004</u>

Several groundfish species are in an overfished condition and have a poor prognosis for rebuilding. It is likely that the Council would set TACs for re-opening the groundfish closed areas to scalloping, if the Council allows scallop fishing there. These species may include, but are not limited to yellowtail flounder, cod, winter flounder, barndoor skate, and monkfish.

5.3.5.7 Area-specific seasons to avoid bycatch

Based on analysis in Section 8.3.1, six of the 24 rotation management areas and 9 one-degree blocks are proposed for seasonal closures for all scallop gear to minimize bycatch. **The one-degree blocks only include areas that are outside of the rotation management areas that may overlap them**. Unless otherwise prohibited, transiting these areas would be allowed, provided that gear is properly stowed. These areas would protect species that are most vulnerable to scallop fishing and based on the analysis in this document to identify areas and seasons with extraordinary bycatch include:

1. Rotation management areas along the northern edge of Georges Bank (GB7 to GB9, and GB15) would be closed to scallop fishing in July to December.

2. In the Gulf of Maine, an area bounded by 42° to 43° N latitude and 67° to 71° longitude (4 one-degree blocks) would close to scallop fishing from July to October.

3. Two one-degree blocks around Cape Cod, bounded by 41° to 42° N latitude and 70° to 72° W latitude from July to December, excluding rotation management areas that may overlap these boundaries.

4. In the Mid-Atlantic rotation management area MA8 and an area bounded by 40° to 41° N latitude and 70° to 71° W longitude would close during October to December, excluding rotation management areas that may overlap these boundaries.

5. Rotation management area MA9 would close to scallop fishing from October to June.

6. Two one-degree blocks inshore of the rotation management areas offshore of NJ, bounded by 38° to 40° N latitude and 74° to 75° W longitude would close during July to September.

Rationale: These areas and seasons have the most frequent occurrences of high incidental catches and discards, for species that are frequently are caught by scallop dredges. Seasonal closures would allow scalloping during a portion of the year when finfish bycatch is not exceptionally high. Should the Council select this alternative, it may be necessary to modify the seasons to ensure practicability of the action when taken in combination with other actions in Amendment 10.

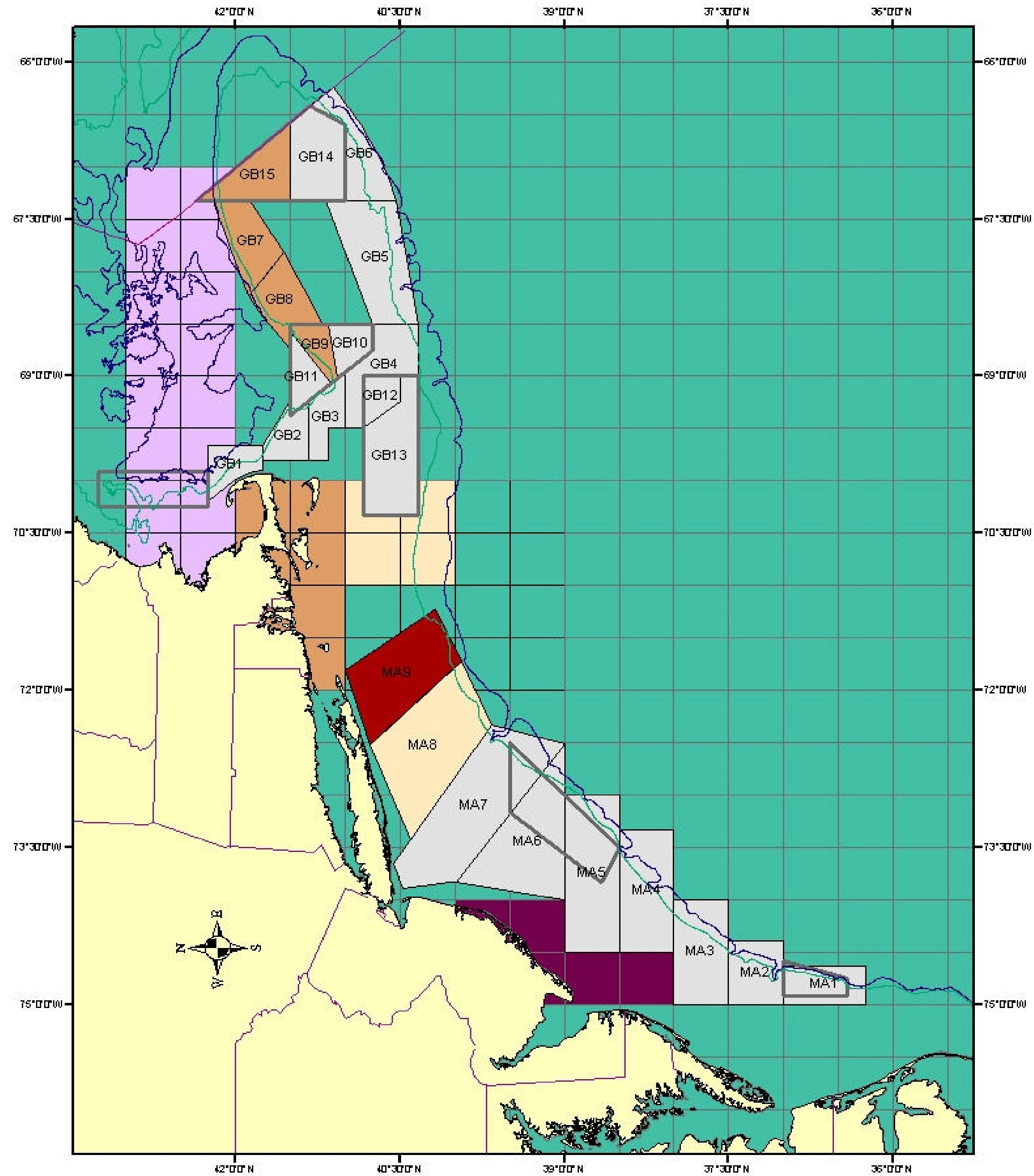


Figure 10. Proposed seasonal closures to minimize finfish bycatch and bycatch mortality. Violet areas (Gulf of Maine) would be closed during July to October. Orange areas (Georges Bank) would close during July to December. MA9 (maroon) would closed from October to June. Beige areas (MA8 and west of Nantucket Lightship Area) would close during October to December. Plum areas (Mid-Atlantic) would close during July to September.

5.3.5.8 Long-term, indefinite closures to avoid areas with high bycatch levels

Areas with high bycatch may be closed to scallop fishing indefinitely when other methods to minimize bycatch and bycatch mortality are unsuccessful. Rotation management areas and other scallop fishing areas may be closed in whole or in part until the regulation is no longer needed (i.e. conditions change to reduce the interaction or other measures become effective). Areas such as those under consideration for the NE Multispecies FMP may be incorporated in the scallop FMP under this alternative, or other areas may substitute.

Rationale: National Standard 9 requires the Council to minimize bycatch and bycatch mortality, to the extent practicable. This is a failsafe mechanism to ensure that National Standard 9 is achieved, especially if other methods cannot minimize bycatch and bycatch mortality to acceptable levels. Closures should be used when other methods to minimize bycatch and bycatch mortality are unavailable or when bycatch is frequently very high.

Probable effects in 2003 and 2004

Portions of the groundfish closed areas that remained closed to scallop fishing during 2000 (Framework Adjustment 13) appear to have the most frequent occurrences of high catches of non-target finfish. These areas include rotation management areas GB10, GB11, GB13, and GB15. Keeping these area closed indefinitely is one of the options considered in Section 5.3.2.8.

5.3.5.9 Develop a proactive protected species program

The Council passed a motion at its November 2001 meeting that established steps to be taken to address protected species issues in the scallop fishery. This alternative is proposed to address the majority of the recommendations set out at that meeting. It provides a mechanism to close areas through a framework adjustment to reduce the risk of encounters between turtles (as well as other protected species) and fishing gear used in the scallop fishery, and the necessary data collection and analyses needed to address the Council's recommendations. It also provides suggestions for gear research to determine how sea turtles are caught and how to reduce the potential for those captures.

Management Measures – The alternative described in Section 5.3.5.7 would allow area re-openings to be timed in a manner to minimize the interactions between scallop gear and protected species found in the action area, particularly sea turtles. This measure could be applied to the Mid-Atlantic region during the sea turtle concentration period from June to November and be modified as resource conditions or fishery operations change.

This section provides for closures of areas or modifications to gear or fishing operations to protect sea turtles and any other protected species through a framework adjustment to the FMP. Further discussion in future framework documents would address the specific problem and fully describe the timing, duration and other requirements associated with the action, as well as provide the appropriate analyses and background information.

Data Collection and Analyses – Current data collection levels may not be adequate in the mid-Atlantic region where sea turtles are found and where interactions have been documented. At a minimum the Council recommends increased coverage of the scallop dredge and trawl vessels fishing in the mid-Atlantic area from May through December to more adequately:

- Determine turtle catches, spatially and temporally, by gear type; and
- Evaluate the co-distribution of sea turtles and scallop effort to identify time/area 'hot spots'.

Gear Research – Sea turtle capture in, and escape from mobile bottom gear has been investigated by NMFS over many years of field gear research efforts. Therefore, it is important to involve the appropriate NMFS and Northeast scallop industry gear research experts in studying the operation of scallop dredge and trawl gear. Additionally, the alternatives in Sections 5.3.8.1 and 5.3.8.2 propose to establish a scallop TAC/DAS set-aside program that would include issues associated with protected species interactions. Useful areas of investigation at this writing include:

- Identifying how scallop gear may pose a threat to sea turtles during all phases of operation (towing on bottom, retrieving gear to surface, and towing at surface);
- Developing scallop dredge and trawl operations that would reduce or eliminate the threat of sea turtle capture;
- Developing appropriate escape gear or techniques that may be used without unacceptable reduction in scallop retention; and
- Comparing the turtle capture rates of similar gear in other fisheries such as the Mid-Atlantic summer flounder trawl fishery.

Rationale: In response to reports of sea turtle takes in the sea scallop fishery, NMFS reinitiated consultation under section 7 of the ESA on December 21, 2001. NMFS completed a Biological Opinion (BO) for the scallop fishery as a whole, including the measures included in Framework 15, on February 24, 2003. The BO concluded that the continued implementation of the scallop fishery and the proposed activity may adversely affect but is not likely to jeopardize the continued existence of loggerhead, Kemp's ridley, green, and leatherback sea turtles. No designated critical habitat was likely to be affected by the fishery. In the BO, NMFS provided an incidental take statement allowing the annual take of 88 loggerhead (up to 25 lethal), 7 Kemp's ridley (2 lethal), and 1 green (lethal or non-lethal) sea turtles in the sea scallop dredge fishery. In addition, the incidental take statement allows the lethal or non-lethal observed annual take of one loggerhead, Kemp's ridley, green, or leatherback sea turtles in the scallop trawl fishery.

Many of the alternatives (other than this one) being considered by the Council may reduce the current impacts of the fishing effort conducted under the Scallop FMP on sea turtles, but the cumulative impact (beneficial or adverse) of this amendment will not be known until the preferred alternatives are selected and the final assessment of the overall impact to sea turtles is completed.

The BO completed by NMFS acknowledges that there is insufficient information to determine the full scope of sea turtle and scallop fishery gear interactions because of an overall lack of sufficient data and understanding of the interactions. NMFS is continuing to monitor the observed takes of sea turtles in this fishery and evaluate the potential impact of these interactions, which will require extrapolations of observed sea turtle takes within and outside of the Hudson Canyon and VA/NC Areas. Lacking this information, the Council does not have the benefit of more complete observer data to determine how to best mitigate these takes prior to submitting the draft phase of Amendment 10. Further Council action without such information and careful consideration of all relevant factors could displace fishing effort into areas of higher turtle bycatch than currently exists. The Council, therefore, is currently proposing broad measures for use in future actions that would contribute toward the protection turtles and other protected species. This alternative, however, provides a framework mechanism to mitigate takes of turtles in the scallop fishery and recommends enhanced observer coverage to collect the appropriate protected species data to better identify the nature and scope of this problem. Further research to provide longer-term solutions is also recommended.

Figure 11

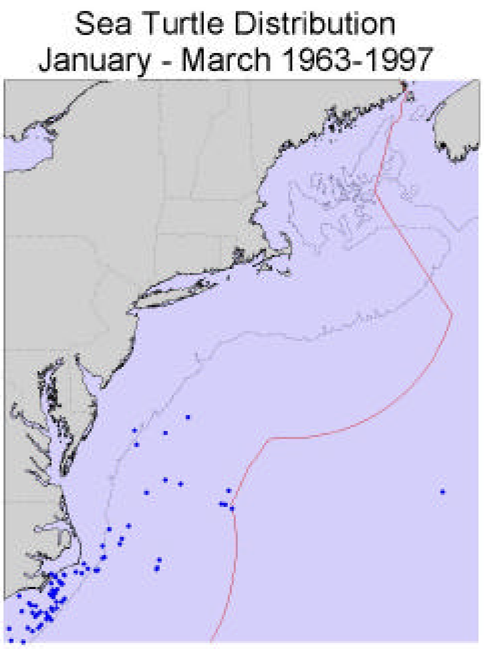


Figure 12

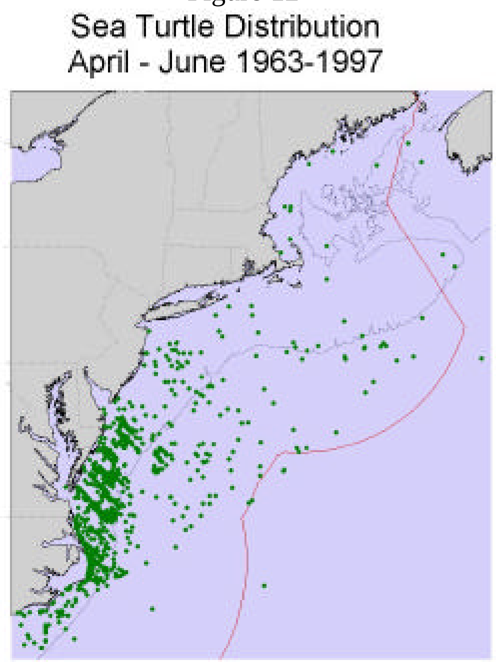


Figure 13

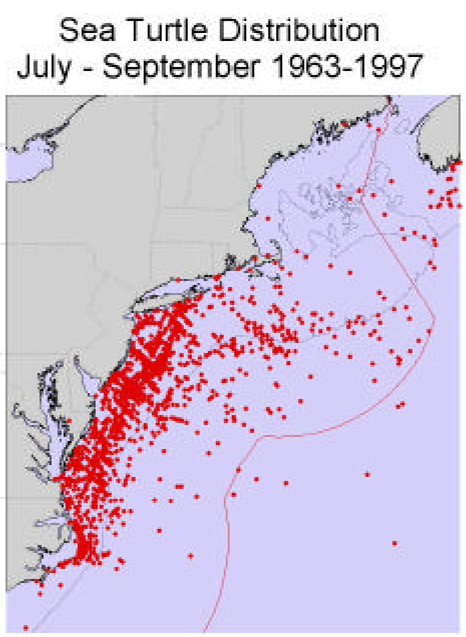
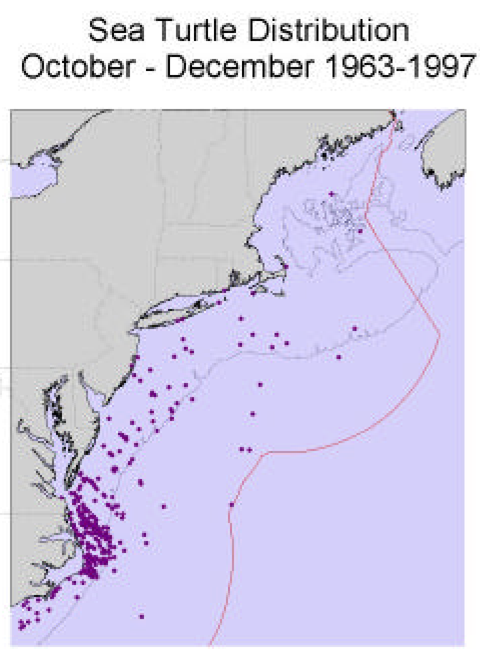


Figure 14



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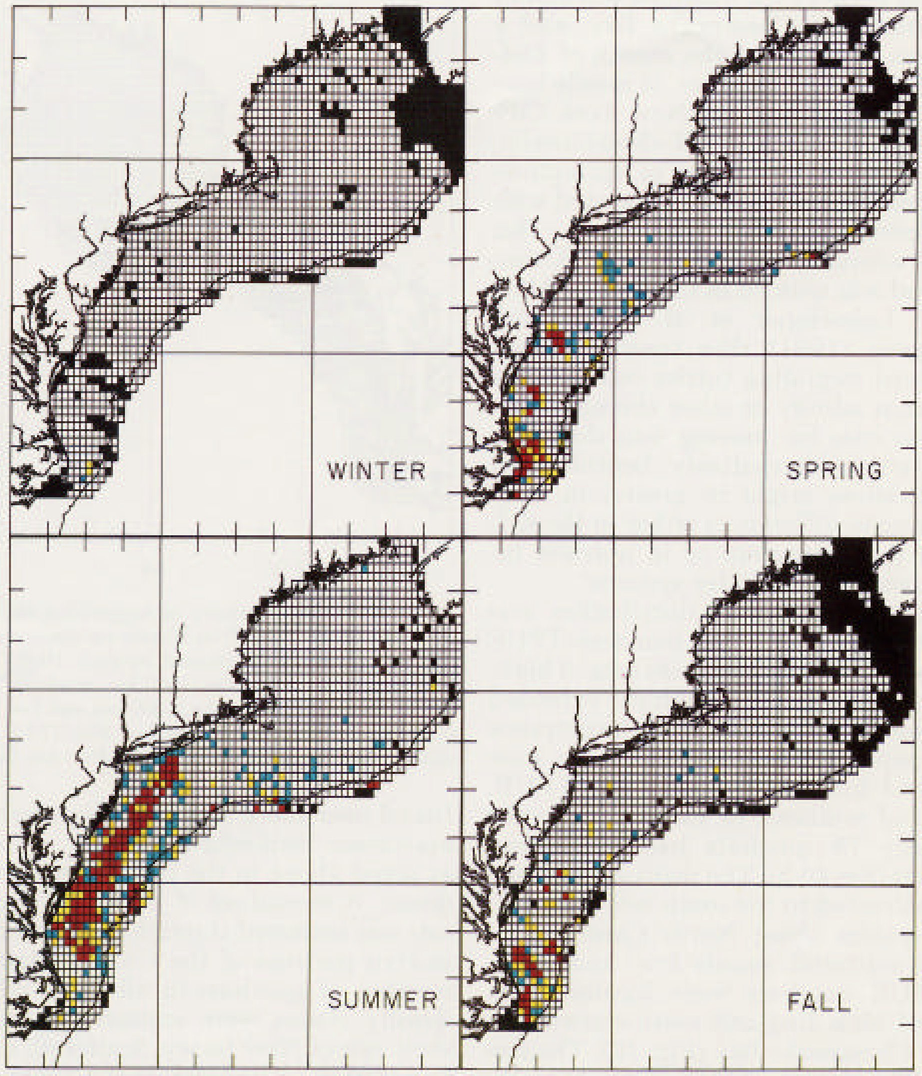

FIG. 10.—Seasonal patterns of loggerhead sea turtle relative density (TPUE) in 10-minute quadrats from CETAP aerial and shipboard surveys. High TPUE (red) was 46.5–590 turtles/1000 km, medium TPUE (yellow) was 15.1–46.4 turtles/1000 km, and low TPUE (blue) was 3.9–15.0 turtles/1000 km. Zero TPUE quadrats are blank, and unsampled quadrats are black.

Figure 15. Seasonal patterns of loggerhead sea turtle relative density (TPUE) in 10-minute quadrats from CETAP serial and shipboard surveys.

5.3.5.10 Status quo

No specific action would be taken in the Scallop FMP, including area rotation, 4-inch rings, or gear modifications, to further reduce non-target catches below current levels or below levels that would occur under other management alternatives chosen from Amendment 10. This alternative could also maintain current management measures as sufficient to reduce the likelihood of sea turtle takes.

Rationale: The existing management program, including day-at-sea allocation, crew limits, and possession limits, have effectively minimized bycatch and bycatch mortality to levels deemed practicable.

5.3.6 Alternatives for Managing Scallop Fishing By Vessels Fishing With a General Category Permit or Fishing for Scallops when Not On a Day-At-Sea

5.3.6.1 Incidental catch permit with a reduced possession limit; General category permit for targeting scallops and enhanced reporting requirements and area-specific or overall TACs

A new general category permit would be issued to vessels that intend to target sea scallops, with enhanced monitoring and reporting requirements and a hard (possibly area-specific) TAC. This permit would also enable the Council to allow vessels to access re-opened, managed scallop fishing areas. Vessels that have this permit may target sea scallops with dredges only on declared trips. Vessels with limited access scallop permits would not be eligible for this new general category permit, because the narrower focus of this permit would allow higher days-at-sea allocations for limited access vessels than if the limited access vessels could fish in both permit categories.

A second permit would enable vessels to retain a smaller amount of scallops as bycatch while targeting other species. The intent is to issue this permit to any vessel that is otherwise permitted to use gears that are capable of catching sea scallops, i.e. mobile gear. Vessels may obtain one or both permits to allow them to target sea scallops during some seasons (if they wish) and to retain a smaller amount of scallop catch that they may encounter while targeting other species. This permit would allow the commercial sale of the scallop bycatch, unlike the present personal use (40 lb.) allowance for vessels without a scallop permit.

5.3.6.1.1 General Category Permit

- Permits may be obtained by any fishing vessel that operates a vessel monitoring system (VMS), except a limited access scallop vessel, but must use one or more legal scallop dredges (including 4-inch rings if required for vessels on a scallop day-at-sea using a dredge) that do not exceed 10½ feet in combined width.

- TACs may be area specific or stock wide and trips may be made only while landings by vessels on a general category trip are less than the specified TACs.

  Preferred option: TACs should be no more than one to five percent (range) of projected total scallop landings that do not exceed the annual fishing mortality target. The fishing year should be the same as the fishing year for limited access vessels. If there is a stock-wide TAC, it could be partitioned into quarters to prevent the seasonal landings from one area filling the TAC and limiting the ability to fish for scallops in another area.

- A possession limit would be specified in the FMP and may be area specific. Preferred option: Increase the scallop possession limit to 400 pounds (a single vessel may land no more than 400 pounds of sea scallop meats in a 24 hour period, not to exceed 400 pounds on trips longer than 24 hours. The general category possession limit would be zero for areas where landings from vessels on declared scallop trips have met the TAC or for areas that are closed by scallop management regulations.

- Area restrictions: Vessels may not be in closed scallop areas during declared scallop trips, unless fishing gear is properly stowed. Vessels would be able to fish in controlled access (i.e. re-opened) areas, unless otherwise restricted by future plan amendments or frameworks. In other scallop management areas (i.e. those open to scallop fishing under general rules), vessels with general category permits or not fishing on a scallop day-at-sea would need special exemptions to target scallops on Georges Bank and in the Gulf of Maine, outside of the existing small dredge exemption area.

- Reporting and compliance requirements: Vessels with a general category permit must operate a VMS and declare into the scallop fishery, enabling the enforcement of possession limits, area closures, and TAC monitoring (landings reports). Fishermen must make trip reports, if the VTR program is continued for limited access vessels, or report landings via VMS if the VTR is discontinued. Landings must be reported by dealers and dealers must have a permit. Vessels with a general category permit may be required by the Regional Administrator to carry an observer.

5.3.6.1.2 Incidental Catch Permit

- Any vessel that has a permit to fish mobile gear in the Northeast Region may obtain an incidental catch permit. Mobile gear includes legal trawls, dredges, beam trawls, or any other gear towed from a vessel and capable of catching sea scallops. Vessels permitted to use only gill nets, lobster traps, or hand line, for example would not have a need for an incidental scallop permit and should not be eligible to receive the permit. Vessels with a general category permit may also obtain this incidental catch permit for trips that do not target sea scallops.

- The possession limit should be consistent with normal bycatch levels while fishing for other species. Preferred option: 100 pounds of meats per day-at-sea, not to exceed 200 pounds on a trip.

- Area restrictions: Vessels may fish and retain scallops in any area that is open to fishing for the target species, potentially including areas that are closed for sea scallop fishing. This is similar to the former restrictions for the Hudson Canyon and VA/NC Areas.

- Reporting and compliance requirements: No changes to present requirements unless required by future amendments to other FMPs.

Rationale: This alternative would allow any vessel to obtain a general category scallop permit, target scallops, and possibly fish in re-opened rotation areas. It would limit the total catch by vessels with general category permits to a reasonable fraction of the overall and area specific TACs.

Except for vessels with a limited access scallop permit, any vessel could obtain a re-defined general category permit, which would be associated with a high possession limit, enhanced reporting requirements (including VMS), and access to re-opened scallop fishing areas. Fishing in some or all areas would be constrained by area-specific or overall hard TACs, which would be taken into account as a source of scallop mortality for setting day-at-sea allocations for limited access vessels. Any vessel could also obtain a new incidental catch permit that would be similar to the existing general category permit, but would have a lower possession limit consistent with customary scallop bycatch.

Increasing the scallop possession limit would allow the fleet of vessels with general category permits to fish more economically and be consistent with the change in scallop biomass. During the early 1990s, when the Council selected the 400 pound limit, limited access vessels were catching up to 1,000 pounds per day. Catches in 2001 were around 1,800 pounds per day-at-sea. On one hand, increasing the possession limit would allow vessels with general category scallop permits to operate economically with the higher reporting requirements and VMS equipment. On the other hand, increasing the possession limit would cause the fleet to reach the TAC quicker.

5.3.6.2 Open access for vessels to obtain either an incidental or general category scallop permit; no TAC would apply except possibly in re-opened scallop management areas; possession limits for each open access permit

Like the above alternative in Section 5.3.6.1, two open access permits would be created: an incidental catch permit with a low scallop possession limit and a newly-defined general category permit for vessels that target sea scallops while not on a scallop day-at-sea.

The new general category permit would be issued to vessels that intent to target sea scallops and vessels with this permit must participate in a call-in system to track fishing activity. The vessel operator would have to call in and report any trip that exceeded the incidental catch possession limit described below. Once the vessel exceeded 45 days of scallop fishing trips under the permit or if the vessel fishes for sea scallops in a re-opened rotation area, the vessel would be required to operate VMS equipment in lieu of the call-in requirement. No TAC would apply to landings by vessels with a general category permit fishing for sea scallops under the call in or VMS program. There may be a TAC set aside in re-opened rotation management areas, however. Depending on the final option chosen by the Council, vessels with a limited access scallop permit may or may not be eligible for this permit.

A second permit would enable vessels to retain a smaller amount of scallops as bycatch while targeting other species. The intent is to issue this permit to any vessel that is otherwise permitted to use gears that are capable of catching sea scallops, i.e. mobile gear. Vessels may obtain one or both permits to allow them to target sea scallops during some seasons (if they wish) and to retain a smaller amount of scallop catch that they may encounter while targeting other species. This permit would allow the commercial sale of the scallop bycatch, unlike the present personal use (40 lb.) allowance for vessels without a scallop permit.

5.3.6.2.1 General Category Permit

- Permits may be obtained by any fishing vessel. Vessels that call in a scallop trip under general category rules must use one or more legal scallop dredges (including 4-inch rings) that do not exceed 10½ feet in combined width.

- Option 1 – Vessels holding a limited access scallop permit at any time during the fishing year would not be eligible for a general category scallop permit or be eligible to target scallops while not on a scallop day-at-sea.
- Option 2 – All vessels would be eligible for a general category scallop permit and limited access scallop vessels would be authorized to fish for and retain up to the possession limit allowed for vessels having a general category scallop permit.

- The Council may by framework adjustment specify a general category TAC for re-opened rotation management areas according to the area's relationship to ports with general category vessels and/or the history of scallop fishing by vessels without limited access scallop permits in such area. Otherwise, a TAC for scallop landings by vessels with general category permits would not apply.

- A possession limit would be specified in the FMP and may be modified by framework action for re-opened rotation management areas.
  Preferred option: Continue the 400-pound possession limit (a single vessel may land no more than 400 pounds of sea scallop meats in a 24 hour period, not to exceed 400 pounds on trips longer than 24 hours. Vessels that exceed 45 days of scallop fishing or that apply to fish in re-opened scallop rotation management areas would be allowed to retain and land a greater amount of scallops, set by future framework that re-opens scallop rotation management areas. The general category possession limit would be zero for areas that are closed by scallop management regulations.

- Area restrictions: Vessels may not be in closed scallop areas during declared scallop trips, unless fishing gear is properly stowed. Vessels that operate VMS equipment would be able to fish in scallop managed (i.e. re-opened) areas, unless otherwise restricted by future plan amendments or frameworks.

- Reporting and compliance requirements: Vessels with a general category permit may not land more than the incidental permit scallop possession limit, unless the vessel operator participated in the general category call-in program to report his intent to fish for scallops. Vessels whose scallop fishing trips reported in the call-in program exceeded 45 days and vessels that fish in re-opened rotation management areas must continuously operate VMS equipment with the same polling frequency that applies to limited access vessels with VMS equipment.

  Fishermen must make trip reports, if the VTR program is continued for limited access vessels, or report landings via VMS if the VTR is discontinued. Landings must be reported by dealers and dealers must have a permit. Vessels with a general category permit may be required by the Regional Administrator to carry an observer.

5.3.6.2.2 Incidental Catch Permit

- Any vessel that has a permit to fish mobile gear in the Northeast Region may obtain an incidental catch permit. Mobile gear includes legal trawls, dredges, beam trawls, or any other gear towed from a vessel and capable of catching sea scallops. Vessels permitted to use only gill nets, lobster traps, or hand line, for example would not have a need for an incidental scallop permit and should not be eligible to receive the permit. Vessels with a general category permit may also obtain this incidental catch permit for trips that do not target sea scallops.

- The possession limit should be consistent with normal bycatch levels while fishing for other species. Preferred option: 100 pounds of meats per day-at-sea, not to exceed 200 pounds on a trip.

- Area restrictions: Vessels may fish and retain scallops in any area that is open to fishing for the target species, potentially including areas that are closed for sea scallop fishing. This is similar to the former restrictions for the Hudson Canyon and VA/NC Areas.

- Reporting and compliance requirements: No changes to present requirements unless required by future amendments to other FMPs.

Rationale: This alternative would allow any vessel to obtain a general category scallop permit, target scallops, and possibly fish in re-opened rotation areas. Requiring less active fishing vessels with general category permits to continuously operate VMS equipment would be inconsistent and inequitable if vessels with occasional limited access permits were not also required to operate VMS equipment.

The enhanced reporting requirements are needed to monitor fishing effort in a re-opened rotation management area and for the more active scallop fishing vessels with a general category permit. Participation in a less-burdensome and costly call-in system would be needed to monitor fishing activity of a vessel and determine when it reaches the activity level that requires VMS operation. A sector TAC would only apply to some re-opened rotation areas and would not create a derby-style fishery in other open fishing areas.

5.3.6.3 Prohibit vessel with limited access scallop permits from targeting scallops under general category rules when not fishing on a scallop day-at-sea

Unless exempted under the state waters exemption program, (50 CFR, §648.54), vessels holding a limited access scallop permit during a scallop fishing year will be subject to the open access sea scallop possession limit (50 CFR, §648.52(b), presently 40 lb. (18.12 kg) of shucked, or 5 US bu. (176.2 L) of in-shell scallops. Thus, 50 CFR §648.52(a) would no longer apply to vessels holding a limited access scallop permit during the fishing year, but the regulation would remain unchanged for all other vessels.

Rationale: An increasing number of limited access scallop vessels have begun targeting scallops while not on a scallop day-at-sea, landing up to 400 lb. of shucked scallop meats. About 2/3^{rds} of the total sea scallops landed in 1999 on trips with less than 400 lbs. originated from vessels having a limited access scallop permit (Table 17; NEFMC 2000). Since all sources of mortality must be taken into account to prevent overfishing, higher landings by vessels not on a day-at-sea would result in lower day-at-sea allocations for all limited access scallop vessels. Thus, it could create a competitive situation where more limited access vessels target sea scallops while not on a day-at-sea to compensate for lower day-at-sea allocations caused by vessels targeting sea scallops while not on a day-at-sea.

Without establishing different permits for vessels targeting sea scallops under general category rules and those landing sea scallop bycatch while targeting other species, it would be difficult to ensure compliance without resorting to a limit as a percentage of the total catch on board. Since scallop bycatch mortality is usually low, it may be far simpler and cost-effective to simply prevent limited access vessels from fishing under general category rules.

Applying this alternative to a vessel that held a limited access permit at any time during the fishing year would prevent vessel owners from frequently converting the permit to a Confirmation of Permit History to target scallops with a general category permit during the same fishing year.

5.3.6.4 Status quo

Any vessel could obtain a general category scallop permit and land up to 400 pounds per day or trip, whichever is less. Vessels with a limited access scallop permit would be eligible to fish for scallops and land up to the scallop possession limit while not on a scallop day-at-sea.

Rationale: The current general category permit provisions, including possession limit and considerations of access to re-opened areas, is sufficient to manage, monitor, and assess the general category portion of the scallop fleet..

5.3.7 Alternatives for Improving Data Collection and Monitoring

5.3.7.1 Adequate observer coverage and funding by day-at-sea or TAC set aside

This alternative would continue the successful practice of providing compensation for industry funded observer coverage and would allocate a portion of the scallop TAC(s) and or DAS in order to allow vessels to recoup the cost of carrying observers. It is intended to help achieve a target level of sampling to yield for a statistically adequate level of coverage, and to determine bycatch with an accuracy appropriate to the scale at which the bycatch information will affect management decisions."

Rationale: Increased observer coverage is necessary to monitor TACs for scallops, to help quantify the amount of finfish bycatch in order to better comply with National Standard 9, and to determine the level of sea turtle takes in the scallop fishery. Because the increase in observers would be costly and may not be entirely within the capabilities of NMFS to pay for such increases, the TAC and/or DAS set-asides would allow compensation to vessel owners and crews which have paid for observers. This program has proven to be successful in limited applications under the Georges Bank Closed Area Exemption Programs in 1999 and 2000 and under the Mid-Atlantic Area Access Program implemented in 2001, 2002.

5.3.7.2 Bag tags and standard bags – Alternative 1

The need for bag tags has arisen with the need to enforce possession limits. Possession limits exist in the scallop fishery in the general category (400 pounds) and possibly in the limited access vessel category as a tool to control removals from special management areas. The bag tag is a means to provide accountability to the scallops after they leave the harvesting vessel until some point of first processing.

In the January 8, 2002 NMFS Enforcement Guidance there was the recognition that enforcement would be enhanced if fish were accountable and traceable throughout the wholesale process. The scallop industry understands and supports this need, and believes that the accountability and traceability must begin on the harvesting vessel. The simplest step would be to require all bags of scallops to be labeled with a tag that identifies the landing vessel and permit number. Additional tag information could include a landing date, unique identifying number, and the meat count. Kevlar tags are available on the market today for about $50/1000. The **primary purpose** of the tag is to maintain accountability after the scallops leave the possession of the harvester until the first point of wholesale processing. Individual bags of scallops, commonly weighing 50 pounds, have a value of about $250.00; a bag of U-10's about $350.00.

A bag tag system that would be utilized for controlling landings may require a standard bag size. A common bag used today is made of a piece of linen cloth, measuring 25 inches by 34 inches, folded over and stitched on two sides to form an open ended bag that will hold 50 pounds of scallops. A specification could be written stating that a bag had to measure no more than 17 x 24 inches between seams and that a standard bag should weigh when filled no more than 50 pounds with a 10% tolerance. The enforcement protocol of a bag measurement should not differ from the enforcement of a mesh size. In practice, it is easier as a filled bag does not need to be measured unless the weight (w/tolerance) is observed to be exceeded; a clear violation. In effect, the bag measurement is secondary to the weight limit.

The weight limit is easy for a vessel crew to comply with as long as crews do not try to play the tolerance too close. Currently, with possession limits there is a tendency for a complying vessel to loose catch if they take a precautionary approach in determining the amount of scallops onboard. In a system with a 10,000 pound possession limit a good crew, trying to insure they are in compliance, will usually land a catch several hundred pounds below the limit. A crew that isn't worried about dockside checking will land several bags (or more) above the limit, record the 10,000 lb landing and move the extra bags over the dock quickly to the cooler. In a bag tag system, a crew knows it can land 200 bags without fearing an overage due to the tolerance. A complying crew may end up landing several hundred pound more than the possession limit due to playing the tolerance conservatively. However, moving the illegal scallops over the dock fast has a much greater chance of being caught because the enforcement agents do not have to be present during the entire unloading sequence; they can arrive late and check coolers, fish boxes, and pick-up trucks. Bag tags should reduce the economic incentive to land illegal scallops.

A bag tag system would require that the tag remain with the scallops until they are re-packaged or consumed. A bag tag system will also have to allow vessels to land a packaged product that differs from the conventional bag.

5.3.7.3 Bag tags and standard bags – Alternative 2

5.3.7.3.1 Background

Amendment #10 may manage with "open areas managed by DAS" and "controlled access to Closed Areas with DAS and trip limits". Amendment #10 should contain measures to increase the level of accuracy of landings and catch monitoring.

It is not clear whether in the long term scallop management will continue solely with DAS management or continue to evolve to a hybrid with special management areas coupled with trip limits. Management by DAS in the long-term means the industry is tied to inefficient methods of harvest and reduces the ability of the industry to make and sustain profits, but it is relatively easy to monitor through DAS reporting by Boatracs. Management by trip or catch limits allows the industry flexibility and enhances safety, without affecting the biological goals of the Scallop plan, thereby enhancing long term profitability and the industry's long term sustainability, but trip limits change the needs of enforcement. Unless trip and catch limits are easily enforceable and NMFS is able to easily monitor a plan based partially on trip limits; the catch limits could easily be violated and the biological goals of the plan thwarted.

NMFS has developed precedents for monitoring catches utilizing outside vendors to provide services to Industry and NMFS in both the Boatracs system and the surf clam / quahogs cage tag system. Annually limited access surf clam and quahog owners receive a NMFS Letter of Authorization permitting them to purchase from an NMFS approved vendor a specific number of pre-numbered and color coded clan cage tags. If the limited access surf clam/quahog owner wishes to harvest he must pay to the vendor for the tags. In the clam industry NMFS specifies that a clam cage must be a standard steel cage 3 feet by

4 feet by 5 feet. Each full cage weighs over 3,000 pounds and is not easily transportable or converted into cash. Scallops are handled in 50-pound bags easily transported and easily turned into cash. It might be much better to monitor scallops through a NMFS authorized standard and pre-marked bag, which by its nature would be standard and would not be able to be reused. Also NMFS currently sets the specifications for vessel tracking, which are provided by an outside Vendor (Boatracs), but whose costs are borne by the Vessel owner and are a condition of the management and enforcement plan. In fact, the Boatracs unit can be integrated into a reporting plan for scallop catches and landings to lower the cost of landing and trip limit monitoring in conjunction with Standard NMFS authorized Scallop Bags.

Goal

Since Amendment #10 may be a hybrid plan of both DAS management and area specific trip limits we should include in Amendment #10 a monitoring system, which will allow managers and enforcement to test whether an effective trip limit could be fully implemented and easily monitored in the Scallop fishery. Since scallops are easily transported in small quantities and easy to turn into cash, the system must be established to thwart cheating. In addition, the costs of the enforcement plan should be primarily borne by the industry with little added costs to NMFS.

Proposal

All fresh shucked scallop meats (other than a maximum of 50 bushels of shellstock per trip or sea-frozen) must be landed only in standard NMFS pre-marked and pre-numbered scallop bags. NMFS will competitively bid for one or more vendors to produce and supply scallop bags to the industry. Limited access scallop vessels can only land scallops in these NMFS specified bags. The Scallop Harvesting Industry must buy their bags only from NMFS approved vendors. The annual specifications for the bags will include:

1) Standard material and size
2) Serial numbering system
3) Different color print for each specific harvest area (i.e. if one year we are allowed to harvest in open areas, Hudson Canyon, and Nantucket Lightship there would be three different color printings to help identify the harvest area).
4) Annually NMFS would provide to each limited access permit holder a letter of authorization permitting them to purchase a fixed amount of pre-numbered bags for each controlled opening of Closed Areas and pre-numbered bags for the open areas.
5) The scallop limited access vessel owner would provide a their letter of authorization to purchase scallop bags to the approved vendors and pay for the bags they receive. It is the vessel owners' duty to protect and take care of their bags.
6) General Category scallop vessels must land all scallops in NMFS authorized bags, but General Category scallop vessel owners can only purchase pre-numbered color-coded bags for the open areas. Only permitted vessels can purchase NMFS Authorized Standard Bags.
7) The approved vendors would periodically (weekly) report to NMFS all bags sold to both Limited Access Scallop Permit holders and to General Scallop permit holders.
8) It is illegal to land any scallops, other than in these standard pre-numbered bags. Catch limits will be issued not in pounds but in total of bags that can be landed from specific areas. (I.e. assuming the standard bags averaged 50 pounds rather than having a catch limit of 30,000 pounds for a specific area or trip the vessel would be approved to purchase and land 600 pre-numbered and color-coded standard scallop bags.)
9) It is illegal for a dealer to purchase scallops from either limited access or general access scallop vessel unless they are in standard issue bags with all serial numbers landed weekly being reported to NMFS by the dealer.

10) All limited access scallop vessels must notify NMFS enforcement by Boatracs Macro message at least 4 hours prior to crossing the demarcation line of the number of and serial numbers of all bags to be landed, the proposed port of landing, and the proposed dock for offloading. This will provide NMFS (and their state enforcement partners) with sufficient opportunity to randomly monitor a small number of landings (5%?). With random monitoring there will be little chance of cheating.
11) All scallop offloading must take place between 7:00 a.m. and 6:00 p.m. Monday through Friday, and may optionally include Saturday and Sunday.
12) Shucked scallops onboard a vessel and stored in a cooler, pen, or below decks must be contained and sealed in standard bags designated for the area where the vessel caught the scallops. Vessels may only have one type of standard bag onboard the vessel. Since in Amendment 19 we will be working on a hybrid system, some of the catches will come from areas with no trip limits (only DAS controls) and some of the catch from Closed Areas with trip limits, it will be illegal to have any other type of scallop bag (other than those pre-numbered and color coded for that trip) on the vessel when it is on the trip and offloading.
13) If a vessel wishes to freeze at sea they must apply for a special permit to freeze at sea. Similar to clam processing at sea they must provide a plan to NMFS specifying standard packaging of the final product. Vessels freezing at sea would be required to contract with an approved NMFS vendor to have each offloading monitored. The cost of this NMFS approved monitoring would be borne by each vessel freezing at sea as part of their approval for their special permit.

5.3.7.4 Require vessels to make daily reports of vessel trip report (VTR) data through the vessel monitoring system (VMS)

All data currently reported through VTRs would be reported on a daily basis through VMS equipment, to enable real-time monitoring. This includes data on the vessel, gear, crew, location fished, and hail weights of amount kept and discarded by species and three-digit area.

Rationale: Reporting by VMS equipment will improve the timliness of data for real time monitoring of TACs. Higher VMS costs could be offset by eliminating the costs associated with vessel trip reports. Failure to make reports can be flagged immediately.

5.3.7.5 Replacement of vessel trip reports (VTR) with effort reporting via VMS, real-time landings reporting by dealers, and discard characterization by enhanced observer coverage.

Vessel, gear, the amount of scallop bags retained, and crew data would be reported for each trip by VMS, which also records location fished. Landings would be reported by dealers, although landings estimates could also be reported through the VMS at the end of trips. Discard estimates would be made from more-reliable sea sampling, enhanced through a TAC/day-at-sea set aside to recompense vessels for their observer expenses.

Rationale: Vessel trip report data collection would be replaced by more efficient and reliable systems, requiring vessels to make reasonable daily reports via VMS equipment. Costs of daily reporting via the VMS could be entirely offset by eliminating costs associated with vessel trip reports. Unreliable discard data would not be collected, since vessels rarely report discards and when it is reported, it is usually incomplete.

5.3.7.6 Require all limited access vessels to operate a vessel monitoring system (VMS)

Vessels with limited access occasional scallop permits would be required to obtain and operate VMS equipment, consistent with the regulations that apply to part-time limited access vessels and to new requirements for vessels with a re-defined general category permit.

Rationale: Only occasional scallop permits are allowed to report limited access scallop trips via call in, rather than operate a VMS. If vessels with general category scallop permits are required to operate VMS equipment, it would be inequitable if other vessels that seasonally target scallops on a day-at-sea were exempt from this requirement. This is especially true, since some fishermen with general category permits decided not to apply for limited access due to the record keeping requirements to prove eligibility, even though some general category vessels might have qualified for an occasional limited access scallop permit.

5.3.7.7 VMS Suppliers

NMFS would be encouraged to secure and certify two or more vendors of vessel monitoring system equipment.

Rationale: Competition among vendors is expected to make pricing competitive and spark innovation. NOAA Fisheries Enforcement is currently evaluating a new VMS unit (Thrane and Thrane (TT) 3026). They are on schedule with our rollout of the SmarTRAC platform and the TT-3026 transponder. The internal system changes required to support Inmarsat-C transponders are also proceeding well. Static testing and general familiarization with the TT-3026 has been completed. Specific setting of the firmware and the deployment plan are in progress but still need to be completed. Final testing of the new unit is expected to be completed by March 2003.

5.3.7.8 Scientific resource surveys conducted with industry vessels and crew, funded by the TAC/day-at-sea set-aside and authorized as scientific research

Cooperative surveys involving scientists and industry could be conducted under a scientific permit, without requiring an experimental fishing permit. Vessels participating in the surveys could be compensated under the rules for the TAC/day-at-sea set-aside program.

Rationale: Industry-funded and supported resource surveys are needed to increase the sampling intensity and support area rotation, especially if many small areas need to be evaluated to close or open rotation management areas.

5.3.7.9 Status quo

No change in the existing reporting requirements for vessels with limited access or general category scallop permits.

Rationale: If area rotation is not adopted, the present amount of reporting and monitoring could be adequate.

5.3.8 Alternatives for Enabling Scallop Research

This section describes how scallop research would be managed in the Scallop FMP, utilizing a set-aside of day-at-sea allocations or a portion of the total allowable catch (TAC). For cooperative research projects funded by the set-aside, the Council would establish priorities in Amendment 10 and through decisions made by the Council's Research Steering Committee (Section **5.3.8.1**) or during the framework adjustment process (Section **5.3.8.2**).

Whether funded by the set aside or by other sources, this section also describes the type of research that may be conducted under an Experimental Fishing Permit, without preparing an Environmental Assessment (EA) or Environmental Impact Statement (EIS). To qualify for this exemption from the normal application procedures, the research must not cause mortality or impacts that differ from that created by normal scallop fishing on a day-at-sea (Section 5.3.8.2.2). Research projects that are not conducted on a day-at-sea (an allocated day or a set-aside day), in areas that are otherwise closed to scallop fishing, or using gear that is otherwise prohibited while fishing for sea scallops would be required to follow the normal application procedures (Section 5.3.8.3).

Nothing in the alternatives in this section is intended to supercede the requirements of the Magnuson-Stevens Act provisions with respect to experimental (exempted) fishing activity. Rather, the alternatives in this section are intended to incorporate the requirements of the Magnuson-Stevens Act provisions into the Amendment 10 process or into future specification or framework processes in order to facilitate future research. Based on the analysis contained herein and associated with a customary scallop fishing day, the applicant may be relieved of preparing an EA or EIS for a research application. If the research is deemed to have greater impacts, however, these procedures may require the applicant to prepare an EA or EIS to be authorized to conduct the research.

5.3.8.1 Process for managing research funded through scallop TAC or day-at-sea set-aside.

5.3.8.1.1 Identification of Research Priorities

The Council's Research Steering Committee would recommend research priorities to be included in Amendment 10. Research priorities should be broad in order to include a sufficient range of potential research proposals, including those related to protected species interactions. These research priorities would be evaluated and modified periodically by the Research Steering Committee and included in the list of desired research when the Council issues a request for proposals (RFP).

5.3.8.1.2 Resource Surveys - #1 Priority in Amendment 10

Resource surveys conducted to determine appropriate areas to close or reopen under Amendment 10's area rotation program would be the #1 research priority in Amendment 10. Resource surveys will be scientific research, although some projects may be considered experimental fishing if the vessels involved land a portion or all of their catch, even though the design of the project is purely scientific. Alternatively, scallops landed during scientific research cruises could be considered also a compensation trip covered by the TAC and/or DAS set-aside. Resource surveys should not be superceded by other types of research. Therefore, the overall research TAC set-aside would contain a portion specifically for the resource surveys that could not be used to compensate any other type of research. The PDT indicated that it favored a pre-determined amount of set-aside, rather than a percentage of the overall TAC/DAS that would change over time.

5.3.8.1.3 Identification of Types of Research, When, Where, and Under What Conditions Research will Occur and Inclusion of Analysis of the Research in Amendment 10

The identification of the type of research, and when, where and under what conditions research will occur in Amendment 10 will provide the ability to include detailed and complete NEPA (and other applicable laws) analyses in the Amendment. This would provide for research to be authorized without the lengthy and difficult separate EFP process. These determinations can be broad if the analyses leave researchers enough flexibility to submit requests for a wide range of projects under a type of research. It should also allow researchers to be flexible in when and where their research would take place as well as in the conditions of their research. Anyone with a proposal that does not fit within the parameters set in Amendment 10 would have to go through the EFP process (and prepare their own analysis of impacts).

5.3.8.1.4 Establishment of Set-asides of Scallop Resource and DAS for Funding Research

Amendment 10 would set aside a portion of the TAC (where TAC is used) and/or DAS for compensating researchers and/or vessels for projects they complete. Amendment 10 would create a pool of $3 million per year (about 1 to 2 percent of the total yield at current biomass levels) to fund compensation for fishing under the set aside and for conducting the approved research. Allocation of the TAC and/or DAS set-asides requires that the selection of researchers to receive compensation is competitive. Currently, the RFP process is the only method that can be used. Amendment 10 should include the RFP process, but the RFP should not wait until Amendment 10 is final. Once the final EIS is in preparation, the RFP should be issued so that there is sufficient time to get proposals in.

5.3.8.2 Alternative Process for setting research priorities

An alternative would be to identify and analyze specific research projects in annual, bi-annual, or other period, adjustments. This process has been proposed in the Mid-Atlantic's Framework 1 action for all of their managed species (except Surf/Clam and Ocean Quahog and Dogfish FMPs). The major difference in the Mid-Atlantic's action is that the Framework set up the process and the first implementation of research set-aside use would come during the first specifications-setting process after the framework is implemented. Because Amendment 10 will need to implement a process that allows research to occur immediately, at least initially the process won't work. However, it could fit in with the annual adjustment process or specification process under Amendment 10.

Amendment 10 would be implemented as described above, with pre-determined research goals, priorities, descriptions of the types of projects, descriptions of where, when and under what conditions research will occur, and full analyses of the impacts of the anticipated research. Applicants would submit proposals under a competitive process (RFP issued well in advance of Amendment 10 approval date) and research period would be from implementation of Amendment 10 through the first adjustment of research priorities etc. that would be required at the first annual framework or specification.

The framework would then be set up as follows (modeled after Mid-Atlantic's Framework 1 to all but dogfish, surf clam and quahog):

- Research Steering Committee, in consultation with the Council's Scallop Oversight Committee, would recommend new research priorities, if necessary. These research priorities, to ultimately be funded via the sea scallop TAC research set-aside, could include but are not limited to the following areas of investigation:

- ❖ Research on scallop biology and scallop fishery social science, including ways to improve benefits to the fishery
- ❖ Research on habitat effects from scallop fishing and identify practicable methods to minimize those impacts
- ❖ Research to identify the extent of and possible remedies to interactions between sea turtles and scallop fishing gear.

- Based on Research Steering Committee and Scallop Committee recommendations, the Council would forward an RFP to NMFS to be published immediately requesting submission of proposals prior to the development of the first framework. Requests for set-asides would be based on pre-determined amount established in Amendment 10. RFP would identify an expected average price of scallops for proposals to be based on. The RFP process would take about two months (30 days for applicants to submit proposals, 30 days to approve at RA level).

- Based on the Council recommendations, the Regional Administrator would approve Experiments/Research proposals to be submitted to NFMS headquarters for grants approval prior to development of the framework document (prior to first framework meeting).

- Council develops framework including research projects recommended by the Regional Administrator for approval under the RFP. Each proposal is analyzed in the framework.

- NMFS publishes final rule for framework implementing new measures and authorizing research and compensation.

The development of a SAFE document would be coordinated within this process to recommend research priorities, or aspects of research (when, where, under what conditions), to the Council. Changes in the TAC set-asides could also be included in the SAFE recommendations. However, the timing of preparing the SAFE to coordinate with this process may be tricky in that it would have to be done with enough time to put out the RFP and have proposals approved by the RA in time for the first framework meeting.

This process would not include resource surveys to determine what areas to open and/or close since these surveys are more likely to remain constant in design, particularly for consistency in data gathering and standardization of scientific methods.

The Mid-Atlantic's version is new and it remains to be seen how effective it will become. In concept though, it would address some major concerns:

- Allows flexibility for research over time - does not lock research into box created in Amendment 10.

- Provides the ability to determine the appropriate amount of research set-aside when adjustments are done.

- Allows Council and NMFS to analyze the impacts of research projects in the adjustment rather than the researcher being tasked to do this.

- RFP process is done well in advance of the implementation of an adjustment so researchers do not have to wait to do research after a framework or amendment is implemented.

- Allows for more diverse research since more proposals could be expected over time.

- In theory establishes a "boiler plate" RFP to expedite future RFPs.

5.3.8.2.1 Other considerations and definitions

Scientific Research versus Experimental Fishing

Scientific research is not considered fishing, as defined by the Magnuson-Stevens Act, and is therefore not subject to the restrictions of the Magnuson-Stevens Act. Scientific research must be conducted by universities (or other accredited educational institutions), foreign governments, U.S. state agencies, Federal agencies, international treaty organizations, or scientific institutions. A scientific research vessel does not have to be a NOAA Research Vessel. However, to be considered a scientific research vessel, a vessel (including fishing vessels) must be under contract with and under the control of a university (or other accredited educational institutions), foreign government, U.S. state agency, Federal agency, international treaty organization, or scientific institution. Scientific research includes survey cruises designed to investigate behavior, disease, aging, growth, migration, recruitment, distribution, abundance, ecology, stock structure, etc. Photographic studies would be considered scientific research, as would sediment sampling and other types of surveys to study a resource's environment. Fishing gear studies are not considered scientific research. *Experimental fishing*, on the other hand, is considered fishing activity and is therefore restricted by the Magnuson-Stevens Act. Experimental fishing may not occur without approval by the National Marine Fisheries Service. Experimental fishing may include such things as market development for a species; gear selectivity studies; and gear efficiency to name a few. Any activity that can reasonably be considered fishing, and that is not an activity designed to further the scientific knowledge of a species and its environment, will be considered experimental fishing. In addition, if a vessel is conducting scientific research, but is also conducting fishing operations (to supplement or "fill time"), or is landing a portion or all of its catch, an EFP may be required to cover these fishing activities.

The Magnuson-Stevens Act allows for compensation trips to cover the expenses of scientific research as well as experimental fishing as seen in Frameworks 13 and 14 to the Scallop FMP. Compensation trips are allowed by NMFS through regulation and generally have to be covered by a letter of authorization. This includes landing of fish for compensation as part of a scientific research trip. Compensation for scientific research and experimental fishing has been a difficult and time-consuming task because it requires authorization by NMFS for a vessel to take a portion of a fishery resource. In turn, this requires that NMFS use grants process to approve compensation trips for research since NMFS is allocating resource (which converts to dollars).

The experimental fishing permit (EFP) process is also time-consuming and difficult, particularly for the applicant. The applicant must allow 60 days for an application to be processed by NMFS, and must consider the impacts of the project on the environment. The probable cumulative effects of experimental fisheries has made it more likely that some larger-scale projects require Environmental Assessments (EA) under NEPA. Most applicants are not familiar with the EA process and requirements. The completion of appropriate analyses and the EFP process can delay the start of a project beyond the applicant's original anticipated start-date.

Goal of Amendment 10 with Respect to Research

In order to provide for compensation of both experimental fishing and scientific research, Amendment 10 should allocate scallop resource through an allocation of scallop biomass and/or DAS dedicated to scallop research. Also, in order to facilitate experimental fishing, Amendment 10 should establish a process to analyze and approve experimental fishing projects under a set of research priorities without needing to go through the EFP process and analysis of impacts for each proposal.

To achieve this goal, the PDT identified the following issues that need to be addressed to facilitate research in Amendment 10:

- Identification of research priorities.
- Resource surveys to base area rotational management decisions #1 priority.
- Identification of types of research to be conducted under Amendment 10 with analysis in SEIS.
- Identification of when, where, and under what conditions experimental fishing will take place.
- Establishment of set-asides of scallop resource and DAS for funding research.
- Identification of a modification of the grants procedure to facilitate approval process [36].
- Provide the ability to modify research priorities, types of research, details of research, analyses of research, and set-aside amounts.

5.3.8.2.2 Research activities (including compensation) that have impacts and mortality no greater than and similar to those caused by a conventional commercial fishing trip using the associated TAC or day-at-sea for normal fishing activities; analysis of impacts of research necessary for supporting area rotation

The Amendment 10 DSEIS analyzes the effects the target scallop mortality rates and of the allocation of day-at-sea, trips, and/or TAC. By definition, a set-aside would reduce environmental impacts below those that are analyzed in the SEIS and any research conducted under the set-aside and complies with the fishery regulations would be within the scope of effects analyzed in the EIS for the FMP. Research projects included are those conducted during a normal scallop fishing trip, during trips taken under set-aside days (see above), or during trips that do not cause additional scallop or bycatch fishing mortality, or have other effects (habitat, economic and social impacts, etc.) beyond that estimated to occur from the fishing effort allocations in the FMP. Researchers could rely on this analysis to justify and report the effects in experimental fishing permit applications for compliant trips.

Types of research activities that would automatically be considered as analyzed by the SEIS are:

- o Research that causes negligible mortality and disturbance of the sea floor, such as video surveys.

- o Research that uses unmodified commercial fishing gear or commercial fishing gear that causes less mortality or disturbance of the sea floor, such as:
  - Paired tow comparisons using gear that complies with existing fishing regulations.

36 There is no other process that is currently available to authorize the allocation of portions of the resource or DAS. The RFP process for TAC set-asides was developed in conjunction with Framework 13 and discussions to use other processes were not productive. This priority is not considered in the discussion of the priorities included in this segment.

- Resource surveys with unmodified commercial dredges or trawls.
- Tagging of animals caught by gear that complies with existing fishing regulations.
- Observation of discard mortality during regular commercial fishing.
- Retention of catches that exceed a possession limit, unless it exceeds the amount associated with a TAC or DAS set aside.

Not included is research that:

- Uses commercial fishing gear that does not comply with existing regulations
- Requires fishing in closed areas
- Requires fishing on a day that exempt from the DAS regulations, except as provided for in a TAC or DAS set aside program.
- Uses liners or other gear that increases retention of scallops or non-target species, unless accounted for by a TAC or DAS adjustment under a set aside program.

Rationale: Impacts of experimental fishing that are no greater than those expected on a standard commercial fishing trip can be estimated, anticipated, and evaluated in the Amendment 10 DSEIS. The various effects of this character of experimental fishing programs would furthermore be accounted for in the mortality controls on the commercial fishery. Experimental fishing proposals that exceeded this level would be difficult to anticipate and hard to analyze in advance, without knowing the details of the proposed experimental fishing activity.

5.3.8.3 Status quo: Research funded through grants and contracts; research proponents may have to prepare an EA or EIS

Research and experimental fisheries that increase fishing mortality or have other effects beyond what is anticipated by the FMP and analyzed in the DSEIS may be authorized through the existing experimental fishery application process or as scientific research. These projects may be required to have an environmental assessment (EA) or environmental impact statement (EIS), depending on the nature of the proposed research. This is the existing process for approving experimental fisheries or scientific research.

Rationale: The existing process is necessary and works sufficiently well to permit some types of experimental fishing permits, especially if an associated environmental impact statement is prepared.

5.3.9 Alternatives for Adjusting Management Measures

The present framework adjustment process is very consuming of time and resources. The frequency of these management actions also introduces considerable uncertainty about the future management effects. The following sections describe several management options to address various issues and problems associated with the current process.

An area action notice (Section 5.3.9.1) would allow for a rapid response to close areas with high abundance of small scallops. This process could occur by itself, initiating a Notice Action to effect a closure or it could be combined with an annual specification or framework adjustment when the timing works out to do that. An annual specification process (Section 5.3.9.2) would allow for minor “corrections” to the level of allocations or other management measures during the “off” year if the framework adjustment process is changed to a two-year cycle. The routine or schedule framework adjustment (Section 5.3.9.3) could remain the same as the present system, but it could be streamlined by changing the fishing year (Section 5.3.9.4) to a time that is more compatible with when the survey data becomes available for analysis.

A framework adjustment cycle that is longer than one year is not new. Amendment 4 initially adopted a three-year framework adjustment cycle, primarily to allow time for new management measures to take effect, be monitored, and be analyzed for the upcoming adjustment. Amendment 7 changed the process to an annual cycle because of considerable uncertainty about the level of allocations needed to meet the new, lower mortality targets. We now seem to have a better understanding and ability to forecast these management needs and the probable effects, possibly allowing a greater time between major plan adjustments.

5.3.9.1 Scallop harvest area action notice to close areas

In-season actions that close rotation areas to scallop fishing, in accordance with a pre-established area rotation policy analyzed in an EIS, could be processed through abbreviated rulemaking. The following procedure is modeled after existing procedures in other FMPs and complies with the Administrative Procedures Act (APA).

Spring action	**Fall action**	**Procedure description**
March 1 - March 7 (7 days)	October 1 - October 7 (7 days)	(a) The Council will request proposals for areas that might be closed to protect small scallops or opened to catch large scallops, based on industry observations, survey results, or other sources of information. Proposals for changes in area management must be submitted by March 1 and October 1 of each year. These proposals will be evaluated by a Scallop Monitoring Committee to determine what areas are good candidates for additional surveys and possible closure. The committee will recommend to the Council within seven days of the above dates what areas should surveyed and evaluated whether they meet the Amendment 10 criteria for closure or opening.
March 10 (3 days)	October 10 (3 days)	(b) The Chair of the Scallop Oversight Committee, upon receiving the Monitoring Committee report, shall determine if the situation warrants further investigation and possible Council action. In making this determination, the Committee Chair shall consider the criteria for closure a scallop harvest area in accordance with the procedures therefore in Amendment 10 to the Atlantic Sea Scallop FMP. If he/she and the Council determine it is necessary, the Council will request the Regional Administrator to conduct supplementary industry or research surveys to accurately determine the amount and size of scallops in areas where further investigation and data collection is warranted. If sufficient funds and vessels are available, the supplemental surveys will be conducted within two weeks of the Council making the request. If supplemental surveys cannot be conducted, the Regional Administrator will summarize the applicable data from the annual research survey that bears on a decision on whether to close areas identified in paragraph (a).

Spring action	Fall action	Procedure description
March 21 (14 days)	October 21 (14 days)	(c) After the surveys had been conducted and the data have been processed, the Regional Administrator will forward the information to the Scallop PDT to determine the condition of the scallop resource to determine the presence of large concentrations of small or spawning scallops, within the deadlines specified in Amendment 10 and provide the technical analysis required by Amendment 10.
April 4 (14 days)	November 4 (14 days)	(d) The NEFMC shall prepare an analysis of the economic impacts of the potential management options under consideration within the deadlines specified in Amendment 10.
April 18 (14 days)	November 18 (14 days)	(e) Copies of the analysis and reports prepared by the (To Be Determined - Regional Administrator, Scallop PDT, or Scallop Monitoring Group) and the NEFMC shall be made available for public review at the NEFMC's office and the Council shall hold a meeting/public hearing, at which time it shall review the analysis and reports and request public comments. Upon review of all available sources of information, the Council shall determine what course of action is warranted by the facts and make a recommendation, consistent with the provisions of Amendment 10 to the Regional Administrator. The Council may delegate the decision for closures to the Scallop Oversight Committee.
April 26 (8 days)	November 26 (8 days)	(f) By the deadline set in Amendment 10 the Regional Administrator shall either accept or reject the Committee's recommendation. If the recommended action is consistent with the record established by the monitoring committee and PDT reports, the impact analysis, and comments received at the public hearing, he/she shall accept the Committee's recommendation and implement it through notification in the Federal Register and by notice sent to all vessel owners holding Scallop permits. The Regional Administrator shall also use other appropriate media, including, but not limited to, notification by Vessel Monitoring System messages, mailings to the news media, fishing industry associations and radio broadcasts, to disseminate information on the action to be implemented.
May 1 (5 days)	December 1 (5 days)	(g) Actions taken under this section will ordinarily become effective upon the date of filing with the Office of the Federal Register. The Regional Administrator may determine that facts warrant a delayed effective date.
Annual adjustment via framework		(h) Once implemented, the Regional Administrator shall monitor the scallop harvest area, in accordance with the procedures in Amendment 10, to determine if the closure is still warranted. If the Regional Administrator determines that the circumstances under which the closure was taken, based on the monitoring committee and PDT report, the NEFMC's report, and the public comments, are no longer in existence, he/she shall terminate the closure and open the scallop harvest area by framework adjustment in accordance with the provisions of §648.55.

Rationale: A mechanism to quickly close areas where small scallops occur is needed to make an area rotation/management system have the desired effects. The following table summarizes a system that could allow area closures to take effect in as little as 2-3 months after detection by survey or reports by fishermen.

A specific, formal procedure (see above table) would enable relatively rapid action to close areas when small scallops are locally abundant. This procedure would be followed to collect detailed information to determine the range of the strong recruitment, to gather information through public input and comment, and to implement the closures via a Notice Action. Based on PDT analysis, it appears that areas could be closed in as little as two months if the FAAS action-like procedure is followed. The PDT recommended that this planned procedure should be initiated on March 1 and October 1 to effect closures on May 1 or December 1, respectively. An environmental assessment (EA), but not an environmental impact statement (DSEIS), would normally be associated with this action.

5.3.9.2 Annual specifications during non-framework years

Standard rule-making processes would be followed to effect changes only in allocations of days-at-sea and TAC setting, and/or zero allocations for new or existing closures. Other management changes would be reserved for the bi-annual framework adjustment process, an existing ad hoc framework adjustment process, or a plan amendment, depending on the nature of the proposed regulatory amendments. An environmental assessment (EA), but not an environmental impact statement (DSEIS), would normally be associated with this action.

Rationale: An substitute process is needed to make routine management adjustments (i.e. day-at-sea and TAC specifications) to make a two-year framework adjustment cycle viable.

5.3.9.3 Two-year cycle framework adjustment process

The present framework adjustment process and monitoring report development would occur every two years, instead of one. This process would remain essentially the same as the present procedure, except that allocations and closures would be specified annually through the annual specification process (Section 5.3.9.2) when a framework adjustment was not considered. A comprehensive SAFE Report and scheduled framework adjustments would occur every two years, rather than every year as now conducted.

New frameworkable measures, supporting area rotation would be added, including:

- Size and configuration of rotation management areas
- Option to apply constraints to units within blocks (e.g. areas of boulder bottom), rather than whole blocks.
- Re-opening seasons.
- Area-specific day-at-sea or trip allocations
- Amount and duration of TAC specifications following re-opening.
- Limits on number of closures.
- TAC or day-at-sea set asides for funding research, for funding research, and for scallop fishing by vessels not on a scallop day-at-sea.
- Priorities for scallop-related research that is funded by a set aside from scallop management allocations.

Rationale: This change would allow the Council and NMFS time to administer a more complicated area rotation management system, as well as time to develop future plan amendments when necessary. An environmental assessment (EA) would normally be associated with this action, but a DSEIS may be prepared with an expansion in the normal framework adjustment process time line to accommodate the more in-depth analysis.

The longer framework adjustment cycle could reduce administrative costs arising from frequent extensive analysis, review, and approval currently associated with framework adjustments. The longer cycle would be adequate to manage the scallop resource and fishery, especially with minor interim annual specifications and/or area action notices to respond to variations in the fishery and the resource.

5.3.9.4 Scallop fishing year

The scallop fishing year would change from March 1 to a date between July 1 to September 1, inclusive. Day-at-sea allocations and area re-openings would occur beginning on July 1 to September 1. New management regulations that are proposed and implemented would also likely begin between these dates. See Table 31 for comparison with the status quo.

The SAFE Report would be developed beginning in October or November **after** the results of the annual resource survey are available. The first framework meeting would be in March, followed by a final framework meeting would be in April or May. A two-month review of the framework adjustment process in June and July would occur for implementation on August 1. If the survey results are routinely available earlier than this, the entire process could be moved up a month or two.

A longer "bridge" year would allow for transition by allocating 16 to 18 twelfths of the normal day-at-sea allocation for full-time, part-time and occasional limited access permits. If for example the fishing year is moved to August 1, a full-time vessel would receive 170 days to fish between March 1, 2003 and July 31, 2004 (17 months, assuming a 120 day-at-sea annual allocation).

Rationale: This alternative would streamline annual adjustments to take into account the most recent Albatross survey data and align the fishing year with the timing of the resource survey. It would reduce the amount of duplicative analyses that are currently required when the annual survey data becomes available in the middle of the annual adjustment review process.

Fishing year options for Amendment 10

Status quo: March 1 to February 28/29

1999 | 2000 (DAS based on 1998 survey) (Access ba

Scallops - March 1: 19 month lag

Cycles	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Fishing year	DAS			Access									DAS			Access
Fishery data				Data												Data
Surveys					Survey				Data							
Assessment				SMC/PDT ------------------>			SAFE								SARC	SARC
Management							Report	1st Fr	2nd Fr	Submit						
Implementation											Review		Implement			

Proposed: August 1 to July 31

1999 | 2000 (DAS base

Scallops - August 1: 12 month lag

(Access based on 1999 survey)

Cycles	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Fishing year	Access		DAS										Access		DAS	
Fishery Data						Data										
Surveys		Survey				Data								Survey		
Assessment						SMC/PDT ------------------>			SAFE							
Management									Report	1st Fr	2nd Fr	Submit				
Implementation										Notice			Review		Implement	

Table 31. Comparison of Framework Adjustment process and Annual Specifications for a fishing year starting on March 1 (status quo) versus August 1 (proposed)

5.3.9.5 Increase the carry over day limit (range: 10-30 days)

The present 10 day carry over for vessels that have 10 or more days-at-sea unused at the end of the fishing year would increase to an amount between 10 and 30 days. Vessels would be eligible to use carry over days for only the following fishing year.

Rationale: This measure is intended to reduce the business risk associated with changing the fishing year to start in mid-summer, if vessels are caught in a situation of not being able to use all of their annual allocations do to weather, equipment failure, or other circumstances.

5.3.9.6 Adjustments for Broken Trips

If the management limits in re-opened rotation management areas rely on trip allocations and day-at-sea tradeoffs (Section 5.3.3), fishing in re-opened rotation management areas involves a risk that may not be adequately balanced by a generous scallop possession limit for the day-at-sea charge. If management limits in re-opened management areas rely on area-specific day-at-sea allocations, however, the procedure in this section would be unnecessary.

This risk of course, varies between vessels and some do not feel that the automatic day-at-sea charge is worth it. The risk from incomplete trips that land much less than the possession limit include equipment failures, medical emergencies, extremely bad weather, or other causes. The mechanism described below would reduce the risk from incomplete trips and encourage more vessels to fish their authorized trips.

If a trip is terminated early and the captain meets the requirements identified in this section below, the vessel will be charged two days-at-sea plus a day-at-sea for each 10 percent of the scallop possession limit (e.g.1,500 pounds of the hailed scallop landings if the scallop possession limit is 15,000 pounds) or portions thereof. If the day-at-sea tradeoff in re-opened rotation management areas is a value other than 10 days, the vessel would be charged two days-at-sea plus 10 percent of the re-opened area automatic day-at-sea charge for each 10 percent of the scallop possession limit (see Table 32)

Actual time will be charged against a vessel's annual day-at-sea allocation for trips that are longer than these amounts, unless a special exemption is granted by the Regional Administrator. The schedule for the day-at-sea charge for early terminations is given in the table below.

Vessels may terminate a trip early for an emergency, poor weather, or any other reason deemed appropriate by the captain and have fewer than 10 days-at-sea charged against the vessel's annual allocation. To terminate a trip and have a reduced day-at-sea charge of a Hudson Canyon or VA/NC Area trip, the Captain must notify NMFS of his intent to terminate the trip before landing; and report the reason for the termination, the hail weight of the scallop catch onboard the vessel, and the intended time and location of offloading and landing.

Table 32. Schedule of day-at-sea charges for trips terminated early by limited access scallop vessels for trips in the Hudson Canyon and VA/NC Areas. This is an example day-at-sea charge schedule if the scallop possession limit is 15,000 or 24,000 pounds and the re-opened area day-at-sea tradeoff is 10 or 14 days.

Proportion of scallop landings to the scallop possession limit	*Example hail weight of sea scallops (meat weight, pounds)*		*Minimum day-at-sea charge37*	
	15,000 pound possession limit	24,000 pound possession limit	10 day-at-sea tradeoff	14 day-at-sea tradeoff
0 percent	Zero	Zero	2 days-at-sea	2 days-at-sea
More than 0 to 10 percent	1 to 1,500	1 to 2,400	3 days-at-sea	3.4 days-at-sea
More than 10 percent to 20 percent	1,501 to 3,000	1,501 to 4,800	4 days-at-sea	4.8 days-at-sea
More than 20 percent to 30 percent	3,001 to 4,500	3,001 to 7,200	5 days-at-sea	6.2 days-at-sea
More than 30 percent to 40 percent	4,501 to 6,000	4,501 to 9,600	6 days-at-sea	7.6 days-at-sea
More than 40 percent to 50 percent	6,001 to 7,500	6,001 to 12,000	7 days-at-sea	9.0 days-at-sea
More than 50 percent to 60 percent	7,501 to 9,000	7,501 to 14,400	8 days-at-sea	10.4 days-at-sea
More than 60 percent to 70 percent	9,001 to 10,500	9,001 to 16,800	9 days-at-sea	11.8 days-at-sea
More than 70 percent	Over 10,500	Over 19,200	10 days-at-sea	13.2 days-at-sea

Rationale: An adjustment to the day-at-sea tradeoff (Section 5.3.3.2) for broken trips is needed to reduce the business risk of fishing in re-opened rotation management areas. This risk, e.g. loosing 10 days-at-sea from a vessels annual allocation without landings a significant fraction of the possession limit, inhibits fishermen from participating in the program. Since the day-at-sea tradeoff reduces fishing effort and mortality in the remaining open areas, it is beneficial to the resource to reduce this risk and encourage scallop fishing where intended according to area rotation management policies. Encouraging more participation by scallop vessels decreases the need and/or size of an in-season adjustment to re-allocate unused trips, which would discourage fishing effort from being concentrated in the less desirable fall season and ensure that the fishery achieves optimum yield. A third effect would be to improve safety. In some cases, fishermen would be less inclined to keep fishing in the face of bad weather if they knew that they wouldn't loose the full 10 day-at-sea charge if they came home early. At present, fishermen are unsure of whether they would be granted an adjustment and could be less prudent in bad weather because of this risk of not landing sufficient scallops to make a 10 day-at-sea charge a profitable swap.

In Framework Adjustment 14, the day-at-sea adjustment for broken trips became a non-preferred alternative because of law enforcement concerns. Although vessels would be required to hail the catch and report the intended time of landing, law enforcement interests thought that this program could create opportunities for abuse. A second factor in the decision was that NMFS believes that an existing program performed satisfactorily and reduced the risk vessels face when fishing in the Hudson Canyon and VA/NC Areas. Under the existing program, vessels can apply for an adjustment to the day-at-sea charge

37 Actual time at sea will be charged against the vessel's annual day-at-sea allocation for trips longer than these amounts, unless a special exemption is granted by the Regional Administrator.

for broken trips. NMFS has granted or denied adjustments on a case-by-case basis for vessels that claim a medical emergency, equipment failure, bad weather, or other legitimate reason to return early to port.

This provision furthermore establishes no guidelines for determining emergency situations or granting day-at-sea adjustments and leaves the provision open for abuse. Due to the opportunity and potential for this abuse, NMFS and the Office of Law Enforcement could not ensure the integrity of the day-at-sea adjustment program. Under the present system, vessels that mistakenly selected a closed area access trip, or that believe that a portion of the day-at-sea charge should be credited for a particular trip, should request a credit based on evidence that the charge was made in error. NMFS reviews each case individually and a determination is made based on a policy enacted by the Regional Administrator. Several vessels have successfully been able to take advantage of this policy due to weather conditions, gear problems and breakdowns that cut trips short or prevented the vessel from entering a closed area despite that they had indicated that they were beginning a closed area access trip.

On the other hand, the amount of fishing activity in the Hudson Canyon and VA/NC Areas in 2001 was significantly below desired amounts and only about ½ of the TAC was landed. Few trips in the Hudson Canyon Area have so far been taken in 2002 also. Part of the reason for the sub-optimal amount of fishing effort (and corresponding mortality reduction in other scallop fishing areas) is because catch rates outside of the Hudson Canyon and VA/NC Areas was around 1,800 pounds per day, reducing the attractiveness of fishing in the Hudson Canyon and VA/NC Areas with an 18,000 pound possession limit and a 10 day-at-sea tradeoff.

Without the risking an automatic 10 day charge for a Hudson Canyon and VA/NC Area trip, it may have been attractive to fish there for the larger, more valuable scallops. For many vessels, the added costs associated with fishing in the Hudson Canyon and VA/NC Areas wasn't worth the marginal increase in revenue from landing larger scallops. Market changes also reduced the premium between the size of scallops in the Hudson Canyon Area and the scallops available elsewhere. In any case, reducing the administrative cost of potential incomplete trips will allow area rotation to work more effectively.

5.3.9.7 Status quo

Monitoring (SAFE) reports and standard framework adjustments would be initiated on an annual basis. A first framework meeting and a second framework meeting would be conducted around September and November, respectively, allowing for implementation of fishing year measures on March 1. The scallop fishing year would remain unchanged. Day-at-sea allocations and new management measures that are approved by framework adjustment would take effect on March 1. The status quo would also retain the current 10 day maximum day-at-sea carry forward provision and the broken trip adjustment process would continue to operate under the discretionary authority of the Regional Administrator.

Unless the survey were moved up a few months, the SAFE Report would contain resource condition information from the previous, rather than current, year. The analysis of management alternatives in the framework adjustment would require an update of the SAFE Report information

Rationale: The review and analysis begins in early July and survey data become available in late August to early October. Depending on the timing of the first framework and associated meetings, the annual survey data may or may not be available during for the first framework meeting.

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5.4 Considered and Rejected Alternatives for Amendment 10

This section describes all other potential management actions (e.g. IFQ) that the Council chose not to pursue further, providing qualitative rationale for its rejection. These measures were rejected based on preliminary analysis and evaluation.

5.4.1 Adaptive area closures with output controls

Instead of allocating area-specific days-at-sea (where the scallop mortality is uncertain because of differences between the nominal day-at-sea allocation day-at-sea use, and fishing power) or authorizing trips with a scallop possession limit and day-at-sea tradeoff (where the use of controlled access trips and actual trip length compared to the day-at-sea tradeoff is uncertain), the FMP would split the area-specific TACs by permit and allocate area-specific pounds or standard scallop bags to each vessel. These allocations may or may not be transferable in Amendment 10.

Rationale: The PDT proposed this alternative for reducing the uncertain relationship between nominal effort allocations and fishing mortality, as well as having favorable economic attributes. It might encourage innovation and reduce capital costs associated with targeting sea scallops in controlled access areas. In addition, the proposal had the potential to achieve greater regulatory compliance with the scallop possession limit. Fishermen would be able to more easily count standard bags than comply with a scallop possession limit described in total meat weight, a measure that is difficult to obtain at sea and does not take into account water uptake while in storage.

The Council rejected this individual quota proposal, with or without transferability, early in the Amendment 10 development process because at the time of discussions, the US Congress had implemented a moratorium on new ITQ management plans, which would prevent adoption of such a plan by the Council.

5.4.2 Upgrade exemption for limited access vessels authorized to use trawls in exchange for a dredge-only permit

A limited opportunity would be offered to vessels with trawl-authorized limited access permits to upgrade their vessels in exchange for a dredge-only limited access scallop permit. Vessels with a trawl-authorized permit could once and only once increase vessel length, horsepower, and/or tonnage, possibly enabling them to use dredges. Once upgraded and a new dredge-only permit had been issued, the vessel would not at any time be authorized to target scallops on a day-at-sea with a trawl. A realistic and practical limit on upgrading would be specified. The vessel could not upgrade after the one-time exemption.

Rationale: At one time, the Council preferred that all scallop fishing should be conducted with dredges, because fishermen using trawls often targeted smaller scallops that were more available to their fishing gear. After scoping in 2000, the Oversight Committee was considering an alternative that would prohibit using a scallop trawl on a day-at-sea, unless by the time of implementation experiments identified ways to improve the scallop size selectivity of trawls.

In lieu of this drastic measure, the PDT proposed an alternative that would allow scallop trawl vessels to equip their vessels to use dredges, even if it required vessel changes that did not meet the FMP's vessel upgrade limits. The Council considered and rejected this alternative because it would open a loophole for vessels to upgrade even when they were originally capable of fishing with scallop dredges.

In addition, the FMP currently allows vessels with trawl-authorized permits to use dredges, and even upgrade their day-at-sea allocations if they convert to a small dredge permit, as many began doing as the resource improved in 2000, 2001, and 2002.

5.4.3 Alternatives for allocating effort among vessels with limited access scallop permits

Individual vessel owners or groups of owners forming harvest cooperatives could permanently or temporarily re-allocate their day-at-sea allocations among other vessels. Harvest cooperatives might or might not be able to negotiate exchanges of area-specific days with other cooperatives, or might re-allocate their member's vessels.

Rationale: These discussions were also early in the development of Amendment #10 and focused on 'capacity reduction' since the total fleet had significantly greater harvesting capacity than the total of all day-at-sea allocations. The Council rejected this option since the impact of rotational management could not at that time be known until the full development of Amendment #10. When Amendment #10 was initiated it was anticipated it would be adopted quickly. At that time, the Council felt that the issues associated with rotational management were relatively simple, while the issues associated with allowing capacity reduction (also know as consolidation of effort) could have been drawn-out and complex. The Council decided at that time to reject the inclusion of consolidation of scallop fishing effort since it was the goal of the Council to adopt Amendment 10 quickly for the specific purpose of protecting juvenile scallops and increasing yields from the scallop fishery. Discussions of capacity reduction and consolidation were then 'tabled' take place after implementation of Amendment 10.

Recently potential impacts of Amendment 10 to the Scallop Management Plan, Amendment 13 to the Groundfish Management Plan, expiration of the Congessional moratorium on new ITQs, coupled with the continued delays in adoption of Amendment 10 caused some scallop industry groups to again raise the issue of capacity reduction in the scallop fleet. Due to the extended development period for Amendment 10, the Council has decided that Amendment 10 should only focus on rotational management and habitat issues, delaying discussion and implementation of a Scallop capacity reduction plan to a later amendment. This approach makes sense, since the harvestable capacity of the resource is dictated by the benefits of the adopted area rotation system and the size and location of proposed habitat closures.

5.4.4 Habitat research areas (Alternative#14)

Amendment 10 would identify and possibly close to fishing and/or other activities small areas dedicated for habitat research. These special management areas would be identified based on comment from the public and academia for the purposes of promoting and enabling habitat research that cannot be conducted under the usual fishery regulations and/or marine activities.

Rationale: At present, it is difficult for scientists to propose research that requires constraints on fishing activity because doing so would require a sometimes lengthy process of Council approval and/or plan amendment or framework adjustment. Establishing these areas through Amendment 10 could promote and enable habitat research that might otherwise be difficult or impossible to conduct.

This alternative was removed from further consideration at the March 2002 Council meeting. The Council conducted a set of workshops in 2000 with academia and the fishing industry to explore the need and desire for habitat research closed areas. The result of the workshops showed that there is a great deal of interest in having dedicated closed areas in which research could take place. Additionally, the workshops concluded that the best location(s) for such a closed area would be within existing closed areas to minimize the impacts to the fishing industry. Since the location of long-term closed areas are currently in flux due to the development of Amendment 13 to the multispecies FMP, it was determined that further consideration of habitat research closed areas should wait until Amendment 13 either retains current closures, or implements new closed areas. Therefore, this alternative is rejected for further analysis at this time. However, the Council will be considering a Dedicated Habitat Research Area program as part of the Habitat Omnibus Amendment 2 that will be initiated in the late spring of 2003.

5.4.5 An incentive program to allocate more days-at-sea or allow special area access to vessels using habitat-sensitive gear (Alternative #15)

Similar to the large mesh limited access permit in the Multispecies FMP, vessels would be able to opt for a permit or exemption that would authorize extra day-at-sea allocations or a higher possession limit in exchange for the mandatory use of a gear or gear modification that lessened the impacts on habitat. Other changes in fishing practices or methods might also be considered in this program.

Rationale: The concept behind this rejected alternative was that it would encourage fishermen to explore new gear designs and/or fishing methods that lessened the impacts on habitat and/or had other beneficial qualities for the environment. This alternative was removed from further consideration at the March 2002 Council meeting, however. The Council was concerned that this approach would open up potential loopholes for permit holders to gain special compensation for gear modifications that were already in use. Additionally, a permit holder could be using some sort of gear that they claim has fewer habitat impacts and therefore they should be given additional DAS or access when they are not actually conducting research. The Council also felt that if a gear modification or type is identified as being habitat sensitive or reduced impact scallop gear, the entire fishery would be required to use this gear.

5.4.6 Habitat closures based on areas identified for in other FMPs for special habitat restrictions in the Mid-Atlantic region (Alternative #16)

Areas that are presently closed year around to bottom-tending mobile fishing gear and areas proposed for year-around closure in developing plans and amendments would be considered as potential long-term, indefinite habitat closures.

Rationale: At the time that the Council rejected this alternative, the final action in Amendment 13 to Summer Flounder, Scup and Black Seabass FMP had not been finalized, but did not include year round closed areas for habitat protection. The current amendment to the Surf Clam and Ocean Quahog FMP has not been finalized and contains the same recommended closures as in the Summer Flounder Plan. However, it may be unlikely that these measures get selected and it is not wise to depend on another Council for providing habitat protection to a New England Council managed species' EFH. The Council felt that it would be less effective habitat protection to close these areas to gears used in NEFMC regulated fisheries without reciprocation by the MAFMC.

5.4.7 Reduce the maximum dredge width to 13 feet (Alternative #17)

Limited access scallop vessels currently may use two dredges, each up to 15 feet wide. This regulation would require limited access scallop vessels to use no more than two dredges, each up to 13 feet wide, or 26 feet in total width. Implementation would be delayed for one year after implementation of the amendment. If necessary, day-at-sea allocations would be adjusted to compensate for the reduced area swept, but at current biomass levels would remain at the same amounts as for a 15-foot dredge because of the effects of crew limitations on shucking.

Rationale: Since fewer scallops would be caught per unit time, it is highly likely that fishermen would compensate by making longer tows in order to catch the same number of scallops as a 15 ft dredge would catch. This alternative would therefore not reduce total bottom time. 13 ft dredges would be lighter, but this is unlikely to reduce habitat impacts because scallop dredges are towed at high speeds (about 5 knots) so that they "skim" over the bottom regardless of how heavy they are.

5.4.8 Georges Bank controlled access alternatives

There variations on the alternative that is being considered for the controlled access program would alter the order and intensity of access. One option would allow access to only Closed Area II South (GB14). Another option would allow for equal, constant fishing in the portions of the there groundfish closed areas that were open for scallop fishing during the 2000 fishing year. A third option would also allow for equal, constant fishing in any portion of the groundfish closed areas that were not designated as a habitat closure or HAPC. All three options would have a TAC set to achieve a fishing mortality rate at 0.20.

Rationale: The Council rejected these options based on the current level of analysis, with the preferred alternative allowing sufficient access to support the fishing industry over the next few years, while refining the shape and location of potential habitat closures. Therefore, a future framework adjustment or amendment might be needed to allow controlled access to other areas of the groundfish closed areas if they are not chosen as habitat closures.

5.4.9 Fixed initial area rotation boundaries

This applies only to the initial, interim measures described in Section 5.3 in the DSEIS, which described and summarized the preferred alternative in the DSEIS[38]. The initial configuration of rotation management area boundaries would be fixed based on the current analysis, using the RV Albatross scallop survey data, either the same as or with slight modifications to the areas shown in Map 7.

Rationale: The Council rejected the PDT recommendation to initially use the fixed area boundaries and asked that the PDT more finely identify initial rotation closures based on the survey and other information. The Council believed that the proposed fixed area boundaries were too large and restricted access to more area than would be necessary to protect the 2001 and 2002 year classes in 2004 and 2005.

5.4.10 Day-at-sea accounting for controlled access area trips

Instead of counting days-at-sea from the present monitoring line, declared controlled access trips would begin accruing day-at-sea charges when the vessel crossed the boundary of a controlled access area. This modification would cause an adjustment in how the day-at-sea tradeoff was treated in estimating the annual day-at-sea allocations for limited access scallop vessels.

Rationale: The adjustment would encourage more fishing in controlled access areas by vessels from distant US ports and have fewer community impacts. Instead of calling out of the fishery and steaming to the nearest point of land, a vessel from a distant port could steam directly to the controlled access area and have the same day-at-sea charges as vessels that originated from closer ports.

[38] This section does not appear in the FSEIS, being replaced with the description and summary of the proposed action.

The Council rejected this alternative because the present day-at-sea allocations and tradeoffs account for and include the total time fishing and traveling to and from port. With this alternative, the annual day-at-sea allocations would be reduced to account for the increase in the proportion of a day-at-sea allocations where fishing is actually occurring. While it would benefit vessels that fished far from port and might induce them to return to their originating port to offload their scallops, the alternative could hurt vessels that fish closer to port because they would receive fewer days-at-sea. Under either the present system or under this alternative, there could be shore-side and community impacts associated with the controlled access program when this would apply. Also, it might cause a safety concern because it could induce vessels that might not be equipped for travel to distant controlled access areas, but would need to do so if their day-at-sea allocations were affected by this measure.

6.0 Compliance with National Standards and Required Provisions of the Magnuson Act

6.1 National Standards

6.1.1 National Standard 1: Overfishing and Optimum Yield

"Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry. "

The Council has determined that continuation of the status quo overfishing definition, with re-estimated reference points using new data and a higher minimum biomass threshold complies with National Standard 1 guidelines. Unlike prior analysis, the updated reference point values for the Georges Bank and Mid-Atlantic regions are much closer than they have been in earlier estimates. The new values are 4.94 kg/tow for Georges Bank and 6.18 kg/tow for the Mid-Atlantic region. Since these values have become closer to one another and because the primary management measures that apply resource wide to the scallop fleet, the Council has chosen to apply one set of biological reference point using the status quo overfishing definition, in lieu of two, as it had done in past actions and analyses.

Advice from the NMFS Northeast Fisheries Science Center suggests that a single overfishing definition for the aggregate sea scallop resource can be expressed as a weighted sum of the properties of the sea scallops on Georges Bank and in the Mid-Atlantic. That is, the proxy for the target biomass (B_{max}) for the overall resource can be calculated as a weighted average (by size of area) of the separate B_{max} proxy values for Georges Bank scallops and for Mid-Atlantic scallops. As is presently the case, these proxies are expressed in terms of average weight (kg) per tow in the NMFS sea scallop research vessel survey. If the overfished state is assumed to be ½B_{MSY} then sea scallops would be considered to be overfished when the overall index in any year was less than ½ of the weighted B_{max} value.

The determination of overfishing is more difficult as it depends on a model-based estimate of F that is consistent with the age-specific partial recruitment pattern used to derive Fmax. The aggregate spatially-averaged F reference point proxy can be estimated by weighting the Georges Bank and Fid-area-specific F_{max} values by their respective target biomass levels. A contemporary estimate of the spatially averaged F can be obtained as an index biomass-weighted average of Fs for Georges Bank and the Mid-Atlantic.

By using the usual criteria for overfishing definitions, overfishing would occur when the current spatially-averaged F is greater than the aggregate F_{MSY}. The F target is set at 80% of F_{MSY}.

The status quo overfishing definition was originally developed by the Scallop PDT for Amendment 7, which implemented changes required by the Sustainable Fisheries Act. This overfishing definition was reviewed by the Council's Overfishing Definition Review Panel (Applegate et al. 1998) and found to be consistent with National Standard 1 and new guidelines. The Review Panel concluded that seven components were needed in an overfishing definition to meet the requirements of the Act and of the National Standard 1 guidelines: Status determination criteria, a maximum fishing mortality threshold, a minimum biomass threshold, a biomass target, a specification of maximum sustainable and optimum yield, a maximum rebuilding time period specification, and a control law or fishery mortality management strategy.

Status Determination

Status determination consists of a rate of removals from the stock and a biomass estimate. The first determines whether overfishing is occurring by comparing this rate with a maximum fishing mortality threshold. The second determines whether the stock is overfished by comparing the value with the minimum biomass threshold.

The rate of removals, or fishing mortality rate, is determined from a variety of models and methods that measure the percent of the stock removed by fishing. Often, this estimate is computed by measuring the rate of decline of sequential annual catches from a year class, or cohort. In the case of sea scallops, until recently, too few year classes have remained in the commercial catch long enough to get a reliable estimate of the size of the cohort to compute fishing mortality. Most importantly, however, is that commercial catches are rarely aged, because the fleet typically shucks scallops at sea and discards the part of the scallop that might be used to age the catches. In lieu of this, the Northeast Fishery Science Center employed a modified DeLury model to estimate fishing mortality, using the numbers caught by the research survey in two age classes, or bins. Thus fishing mortality can be estimated for any part of the resource that is surveyed in successive years for the number of scallops in the two age groups. This fishing mortality estimate has been reviewed by the Stock Assessment Review Committee and found to be consistent with and comparable to F_{max}, estimated by a Thompson-Bell yield-per-recruit analysis.

Sea scallop stock biomass is measured more directly by the survey, but it does not measure total biomass. Instead the mean stratified weight per tow is compared with B_{max}, a value calculated to occur under equilibrium conditions when fished continuously at F_{max}, or the fishing mortality rate that produces maximum yield-per-recruit. If scallop recruitment occurs at the time series median value, and the stock is fished at F_{max}, the number of recruits observed by the survey would grow to a biomass index represented by B_{max}, expressed as a mean weight per tow. Changes in recruitment from this median value or changes in fishing mortality relative to F_{max} would cause the biomass to change relative to B_{max}. The biomass estimate and its comparison to B_{max} has also been reviewed by the Stock Assessment Review Committee and found to be consistent with and comparable to B_{max}.

Thus, for all surveyed areas of the scallop resource, the status of the stock can be measured against a biological reference point to determine whether overfishing is occurring or whether the stock is overfished, meeting the criteria in §600.310(d)(2) and with §600.310(d)(5).

Maximum Fishing Mortality Threshold

The sea scallop overfishing definition specifies a maximum fishing mortality threshold equal to F_{max}, or the fishing mortality rate that maximizes yield-per-recruit. Since no stock-recruitment relationship has been found over the range of observed stock size (from about 15 to 100% of B_{MSY}), this fishing mortality rate is a suitable and valid proxy for F_{MSY}. The maximum fishing mortality threshold is defined as a continuous function of biomass and defines a constant level of annual escapement, associated with F_{MSY}. Below the target biomass, the maximum fishing mortality threshold declines according to the sea scallop stock's ability to regenerate to target biomass within 10 years. Below one-half of the biomass target, the maximum fishing mortality threshold declines according to the ability to regenerate to target biomass within five years. Below the target biomass, this continuous function may be replaced by a rebuilding plan, should one become necessary.

Under the status quo overfishing definition, the stock-wide average fishing mortality rate should not exceed F_{max} and the level associated with the MSY control rule, therefore the status quo overfishing definition complies with §600.310(d)(2)(i).

Minimum Biomass Threshold

Although sea scallops have been estimated to be highly productive and have exhibited remarkable recovery potential, the Council is adjusting the minimum biomass threshold from ¼ Bmsy to ½ Bmsy, because the old minimum biomass threshold was never intended to be used to define a point in which rebuilding should be started. It was originally defined as a low biomass value to avoid and the MSY control rule was designed to do that. Since there is a measurable criterion to determine whether the scallop stock is overfished and it represents a level where spawning has not been adversely affected by low spawning stock size, the overfishing definition thus complies with §600.310(d)(2)(ii).

Biomass Target

"If the stock or stock complex is overfished, the purpose of the action is to rebuild the stock or stock complex to the MSY level within an appropriate time frame." §600.310(e)(3)(i).

Although not explicitly described in the National Standard 1 guidelines, a biomass target defines a stock level that is consistent with MSY and a benchmark for determining when rebuilding has been achieved. While biomass may vary around this reference point, it is desirable to keep stock biomass around this value – both to prevent the stock from approaching an overfished level and to maximize yield, subject to various environmental, ecological, economic, and social factors.

For the sea scallop resource, the biomass target is Bmax, associated with the production of maximum yield when recruitment is at the time series median value. Thus the overfishing definition includes and complies with the specification of an "MSY stock size" as defined by §600.310(c)(iii).

Maximum Sustainable (MSY) and Optimum Yield (OY)

MSY is defined by the average amount of scallops that can be removed from the resource with a fishing mortality rate equal to F_{max}. Coincidentally, this corresponds to the product of the biomass per recruit calculated to occur when fishing at Fmax, the median annual recruitment of sea scallops, and the Fmax fishing mortality rate. This value is sensitive to actual recruitment and to the size selectivity of the fishery. Thus, the specification of MSY in the overfishing definition is a formula that allows the fishery to "remove a constant fraction of the biomass in each year, where this fraction is chosen so as to maximize the resulting long-term average yield", in compliance with §600.310(c)(2) of the National Standard guidelines.

Likewise, the Council's overfishing definition includes a specification of OY that is the yield from the scallop resource that would result from applying a target fishing mortality that is 80% of Fmax. In Amendment 7, the Council chose to set the target as a fraction of Fmax to account for uncertainty in the Fmax estimate. Coincidentally, setting fishing targets 20% lower than Fmax also helps to reduce the fluctuations in annual catches caused by periodic episodes of fishing above the average resource productivity represented by Fmax. Thus OY also addresses some economic and social factors by applying a risk-adverse target. The status quo overfishing definition, therefore complies with §600.310(i)(6) of the National Standard guidelines. The actual yield for any single year, however, will vary from the average OY, however, in response to changes in stock size, size frequency, and availability of sea scallops to the fishery.

The above criteria are sufficient to protect the overall resource form overfishing and from the population falling below B_{MSY}. However, they are insufficient by and of themselves to ensure attainment of optimum yield, unless the Council's future management decisions are sufficiently constrained based on the condition of the resource. This is because the maximum fishing mortality threshold and the optimum yield target are calculated as if all scallops in the resource are or will be available to the fishery, when in fact substantial fractions of the stock are and will be with permanently closed areas, either for groundfish rebuilding, habitat conservation, or both. Conversely, scallops in closed rotation management areas will become available to the fishery and localized TACs and fishing mortality targets will achieve maximum yield from the scallops found there, albeit at a later time when the scallops attain a desired size.

Thus, when permanently closed areas exist, fishing at OY for the entire resource would not achieve MSY from scallops that are or will be available to fishing, if the result is to fish at levels exceeding Fmax on those scallops. If, for example, 50% of the scallop resource is contained within permanent closures, then a stock-wide fishing mortality target of 0.2 (17% exploitation rate) increases to 0.4 (32% exploitation rate) on scallops that are or will become available to the fishery. Thus, the applied fishing mortality rate to available scallops will exceed Fmax and fail to achieve MSY, unless other management objectives in the FMP come into play. Such management mechanisms are embodied in the bi-annual framework adjustment process (Section 5.1.9), which specifies that the annual framework adjustment, "will achieve optimum yield and prevent overfishing on a continuing basis"

The basis for this conclusion that the overfishing definition does not assure achievement of OY, and a solution to the problem, was described and included in the Regional Administrator's September 8, 2003 letter. The process by which the Council's future decisions would be constrained, as described in the Regional Administrator's letter, was subsequently adopted by the Council. The presence of high-density populations within closed areas can be sufficient to drive the region-specific abundance indices to levels that meet the biomass target. In these instances, setting F at the whole-stock fishing mortality target will not achieve optimal yield from the areas open to fishing. To ensure that yields approach maximum values in the presence of long-term closures, it will be necessary to reduce effort to levels below the aggregate F_{MSY} level. This strategy would be consistent with the principle of structuring fishery regulations to obtain the optimal yield per recruit from areas open to fishing.

The Council adopted an adaptive strategy to maximize yield from the scallop resource, using area rotation and area-specific mortality controls. The Council furthermore incorporated that goal into its framework adjustment process (Section 5.1.9), to set area-specific annual mortality targets and allocations.

The US scallop fishery is capable of harvesting 100% of OY and at this point or at any point in recent history 100% of the annual ABC. Domestic processing capabilities are furthermore fully capable of processing the domestic sea scallop landings. Therefore, following the specification process for §600.310(f)(7) of the National Standard guidelines, DAP = DAH = OY. Therefore, JVP, or the amount of scallops available for joint ventures is zero.

Maximum Rebuilding Time Period

For overfished stocks, §600.310(e)(4)(ii) requires the Council to "specify a time period for rebuilding the stock or stock complex." NMFS has determined that the scallops in the Georges Bank and Mid-Atlantic regions are not overfished and furthermore that the stock biomass was near the existing biomass targets. Changes in the biological reference points will not change this conclusion, making rebuilding unnecessary.

Although rebuilding is unnecessary, the overfishing definition control rule (see below) from the status quo overfishing definition implies rebuilding strategies that do not exceed 10 years and therefore the maximum rebuilding time period is in compliance with the National Standard guidelines and with §600.310(e)(4)(ii). The Council may, if rebuilding again becomes necessary, modify the default rebuilding strategy in the control law to achieve FMP objectives and maximize net benefits, as long as the rebuilding plan is consistent with §600.310(e)(4)(ii)(B)(2) of the National Standard guidelines.

Control Law Or Fishery Mortality Management Strategy

The status quo overfishing definition includes an MSY control rule or fishing mortality management strategy that when followed assures that overfishing does not occur and that provides guidance to achieve a fishing mortality rate that has a 50% probability of rebuilding stock biomass to the target within the specified time period, whether required by an official overfished determination or not.

This control law specifies slight reductions in the maximum fishing mortality threshold whenever the stock biomass is below the target, Bmax, to recover to the target biomass within 10 years when biomass is between 50 and 100% of Bmax. At lower stock biomass, the status quo overfishing definition control law applies a risk adverse management strategy and specifies further reductions in fishing mortality to achieve quicker rebuilding. Between 25 and 50% of Bmax, the control rule provides guidance to reduce mortality to a level that would rebuild the scallop stock within 5 years. At stock biomass below 25% of Bmax, the control rule provides guidance to reduce mortality to as close to zero as practicable to rebuild stock biomass as quickly as possible.

Thus, the MSY control rule in the status quo overfishing definition complies with §600.310(c)(2), which allows the FMP to vary fishing mortality as a continuous function of stock size, and with §600.310(f)(5), requiring a precautionary approach and specifically required a reduction in the fishing mortality rate when the stock is below a biomass that would produce MSY.

6.1.2 National Standard 2: Best Available Science

"Conservation and management measures shall be based upon the best scientific information available."

The Council uses best available data collected by the NMFS and other sources to evaluate the efficacy of its plans and potential impacts of its amendments or framework actions. For the Sea Scallop FMP and Amendment 10, the Council relied on data summarized in the table below. Various models and statistical summaries were prepared by scientific experts to evaluate the status of the resource, the performance of the plan, and potential effects of alternatives proposed in Amendment 10. Statistical summaries using these data were also provided and discussed in the Affected Environment section (Section 7.0).

These analyses rely on published literature (for example estimates of dredge efficiency and non-catch scallop mortality) or independently-peer reviewed methods (for example the scallop assessment and projection model). Assumptions are documented and analytical methods are explained in Appendix IV.

In addition, the data and analyses are reviewed by several technical committees, comprised of a stable of qualified experts to provide scientific advice to the Council. Members of these committees include qualified scientists from the NMFS, from coastal state marine fisheries divisions, and from universities involved in marine science research. These committees met numerous times throughout the development of Amendment 10, providing technical advice to the Council, and include:

- Scallop Plan Development Team
- Habitat Technical Team
- Science and Statistical Committee
- Social Sciences Advisory Committee

Table 33. Data sources used in Amendment 10 to analyze impacts from proposed management alternatives or to describe the affected environment.

Data	Time series	Source	Usage in Amendment 10 analysis
Dealer reports and landings	1880 - 2002	Northeast Fishery Science Center (NEFSC), NMFS	Characterize trends and assess the stock
Vessel trip reports	1994 - 2001	NEFSC	Analysis of fishing activity by general category vessels
Vessel monitoring system reports	1998 - 2000	NMFS Law Enforcement Division	Analysis and projections of fishing effort distribution
DAS effort reports	1994 - 2002	NMFS Law Enforcement Division	Analysis of trends in DAS utilization and permit activity
Sea sampling observer program reports	1992 - 2001	NEFSC Sea Sampling Observer Program	Estimates of total bycatch by species; Analysis of seasonal and geographic patterns of bycatch on scallop trips
Annual scallop resource surveys	1982 - 2002	NEFSC	Assess the scallop stock and estimate recruitment characteristics
Other resource surveys	1999 - 2003	School for Marine Science & Technology, Univ. Mass. (SMAST)	Scallop density and TAC estimation for controlled access area allocations; Distribution of small scallops for rotation area management closures Comparison and validation of Poppe et al.(1989) sediment data for surveyed areas
Fishery research	Various	VA Inst. Mar. Sci. (VIMS)	Comparative dredge performance; estimates of non-catch mortality;
Finfish surveys; index of abundance by life stage	1963 - 1998	NEFSC	Determination of EFH designations from abundance data
Sediment data	About 1979 - 1989	Poppe et al. 1989	Analysis of fishery impacts relative to substrate type
Finfish surveys; index of species biomass	1995 – 2001	NEFSC	Guild, species assemblage, and benthic species metrics
Data supplied on permit applications	1994 - 2002	Northeast Regional Office, NMFS	Analysis of vessel characteristics, vessel activity, and trends
Scallop ex-vessel price data	1982 - 2002	http://www.st.nmfs.gov/st1/commercial/index.html	Estimation of price equation to evaluate future revenues and economic benefits.
Quantity, value and unit price of scallop imports	1982 - 2002	http://www.st.nmfs.gov/st1/trade/index.html	Estimation of price equation to evaluate future revenues and economic benefits.
Consumer price index (CPI)	1982 - 2003	http://www.bls.gov/cpi/	Estimation of inflation adjusted domestic and import prices of scallops
Per capita disposable income and GDP implicit deflator	1982 - 2002	http://www.bea.doc.gov/beahome.html.	Estimation of price equation to evaluate future revenues and economic benefits.

Data	Time series	Source	Usage in Amendment 10 analysis
Operating costs and fixed costs for the scallop vessels	1983 - 1993 1998	Gautam and Kitts (1996) Georgianna, et al. (1999)	Estimation of fixed and variable costs for limited access scallop vessels to evaluate producer surplus

The economic impacts of the rotation, access and habitat alternatives are evaluated by combining economic model with the biological projections. The economic model includes an ex-vessel price equation, a cost function and a set of equations describing the consumer and producer surpluses, and net economic benefits. These equations and the methods used in estimating them are presented in detail in Appendix IV (Economic Model). The ex-vessel price equation is used in the simulation of the ex-vessel prices, revenues and consumer benefits along with the landings and average meat count from biological projections. The cost function is used for projecting harvest costs and thereby for estimating the producer benefits as measured by the producer surplus. The data sources for the variables used in the price and cost equations, cost/benefit analyses, and economic analyses of vessels impacts are as follows:

- Vessel characteristics, such as tonnage and length were obtained from the permit database maintained by NMFS, Northeast Regional Office.
- DAS-used by limited access scallop permit holders was obtained from NMFS VMS and call-in data.
- Scallop landings, revenues and price by count are obtained from dealer's database. Ex-vessel prices were obtained from by dividing total scallop revenues by scallop landings. Annual and monthly scallop landings and revenues were provided at the Fisheries Statistics and Economics, NOAA Fisheries website at http://www.st.nmfs.gov/st1/commercial/index.html (Personal communication from the National Marine Fisheries Service, Fisheries Statistics and Economics Division, Silver Spring, MD).
- Quantity and value, and unit price of sea scallop imports were obtained from the Fisheries Statistics and Economics, NOAA Fisheries website at http://www.st.nmfs.gov/st1/trade/index.html. (Personal communication from the National Marine Fisheries Service, Fisheries Statistics and Economics Division, Silver Spring, MD)
- Ex-vessel and import prices are corrected for inflation and expressed in 1996 prices by deflating current levels by consumer price index (CPI) for food. CPI was obtained from the Bureau of Labor Statistics website at http://www.bls.gov/cpi/.
- Forecasted landings, average meat count, LPUE and DAS-used were obtained from the biological model simulations provided to the Council staff by scientists at NMFS Science Center at Woodshole (work by Dvora Hart).
- Per capita disposable income is also expressed in 1996 dollars by deflating nominal values with the GDP implicit deflator. Both of these variables were obtained from the U.S. Department of Commerce, Bureau of Economic Analysis website at http://www.bea.doc.gov/beahome.html.
- Operating costs and fixed costs for the scallop vessels were estimated with data collected by the Economic and Social Science Branch of Northeast Fisheries Science Center (Gautam, A.B. and A.Kitts. 1996. Documentation for the cost-earnings data base for the Northeast United States commercial fishing vessels. NOAA Memorandum NMFS-F/NEC). The cost data collected by D. Georgianna et all was also used in comparing fixed costs of vessels (Georgianna, Daniel and Alan Cass and Peter Amaral. 1999. The Cost of Fishing for Sea Scallops in Northeastern United States. Cooperative Marine Education and Research Program, National Marine Fisheries Service).
- Information on vessels activity, catch and revenue by port and state are obtained from vessel logbooks.

Habitat analyses relied on EFH metrics data and scallop effort data that are identified in the table above and analyzed using methods described in Appendix IV. These analyses and EFH evaluations were conducted or reviewed by a team of experts that are members of the Council's Habitat Technical Team. The EFH analysis examined the degree of overlap of various habitat closure alternatives and EFH metrics, including EFH designations, distributions of abundance of species by trophic guilds, and sediment type. Species and substrates were characterized as being vulnerable,

The analysis of habitat impacts relied on published reports and available survey data. Inferences drawn from and analyses of these sources of information were reviewed by technical experts. A special Gear Effects Evaluation Workshop was held in the region to assess the relative impacts of fishing gears used in the Northeast Region on the habitat found here. The panel consisted of recognized experts from other regions as well as local experts in the field. To the extent possible, more detailed information (multi-beam sonar and video data) on the substrates and qualities of the seabed were used to assess impacts, but the analysis had to rely on older, less detailed substrate analysis to assess region-wide impacts. The analyses also relied on survey data to provide a region-wide distribution of abundance by species and life-stage to assess potential impacts, making an inference that areas with higher abundances over the time series had the highest habitat suitability for that species and life-stage.

The protected species stock descriptions and the assessments of the potential impacts of scallop fishing on those species were developed using the best available scientific information as well as commercial fisheries data and information provided by Council staff and advisors. The majority of this information is described in the Literature Cited (Section 12.0). The protected species analyses focused on the sea turtle species found in the Mid-Atlantic. The background information used on the range-wide status of those species can be found in a number of published documents, including sea turtle status reviews (NMFS and USFWS 1995, Marine Turtle Working Group - TEWG, 1998, 2000) and biological reports (USFWS 1997), recovery plans for the Kemp's Ridley sea turtle (USFWS and NMFS 1992), Atlantic green sea turtle (NMFS and USFWS 1998a), leatherback sea turtle (NMFS and USFWS 1992), and loggerhead sea turtle (NMFS and USFWS 1998b).

Periodically and in preparation for a regular framework adjustment, the Council prepares a SAFE Report to describe the past, present, and possible future condition of the stocks, marine ecosystems, and fisheries under plan management or in related fisheries that are affected by the Scallop FMP. These reports, which the Council plans to prepare for each bi-annual framework adjustment, contain data and analysis of biological, economic, and social trends and characteristics, consistent with the guidance in §600.315 of the National Standard guidelines.

6.1.3 National Standard 3: Management Unit

> *"To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination."*

The management unit is all sea scallops of the species *Placopecten magellanicus* found in US waters, although management measures vary within the management unit. The overfishing definition applies to the entire scallop resource throughout the management unit, even though there may be two or more stocks and even though there is insufficient data to presently determine the status of scallops in the Gulf of Maine.

Area-specific management measures will apply to discrete areas within the management unit to ensure that the FMP achieves optimum yield and does not produce an average annual catch that exceeds MSY. Some areas may furthermore close to scallop fishing to protect EFH and/or achieve FMP objectives. Area-specific regulations and allocations may also apply to take advantage of regional differences in stock status, growth, and natural mortality, to improve the FMP's ability to produce MSY from the resource as a whole.

Under a special exemption program, the States of MA, NH, and ME may establish separate regulations that pertain to federally permitted scallop vessels while fishing in state waters. This FMP also does not regulate vessels without federal fishing permits that fish exclusively in state waters. The proportion of the scallop resource in state waters are a very small proportion of the total stock and does not affect recruitment. State regulations therefore do not jeopardize the capacity of the stock to produce MSY.

The scallop resource furthermore extends into Canada, on and around Georges Bank. There is no direct or indirect scallop management coordination with Canada through treaties or cooperative agreements, although the Council believes that US and Canadian management is not inconsistent. Although Canadian scallops on Georges Bank contribute to recruitment in US waters, there is sufficient spawning capacity in US waters that this source of recruitment plays a minor role in determining the productivity of the entire resource. Being relatively sedentary in the adult stage also implies that Canadian management does not affect the achievement of optimum yield from adult scallops in US waters. Canadian scientists participate in the US scallop stock assessment process and vice versa.

According to the NMFS Northeast Fisheries Science Center, it is unlikely that biologically important genetic differences exist between sea scallops on Georges Bank and in the Mid-Atlantic. Differences in characteristics that do occur are most likely shaped by environmental variables. Variability in growth rates and timing of reproduction are apparent, but variations (induced, for example, by depth) within areas typically exceed differences between areas. Recruitment and settlement within geographic zones tend to be coherent but these traits are probably due to differential oceanographic retention patterns between ye3ars – rather than the biological properties of the resource itself. Difference in average recruitment rates between areas and expected biomass levels under optimum fishing, once thought to differ by a factor of two, now appear to be nearly equal on Georges Bank and in the Mid-Atlantic.

6.1.4 National Standard 4: Fairness and equity

> *"Conservation and management measures shall not discriminate between residents of different States. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges."*

The Sea Scallop FMP has implemented limited access since 1994 as a means to control fishing effort and to protect the interests of scallop fishermen that had historically been active in the fishery. Initially, three permit classes were created (full-time, part-time, and occasional) based on a vessels level of fishing activity during 1985 - 1990[39]. Since that time, the FMP has implemented several restrictions in a vessel's fishing effort (measured as days-at-sea, or DAS), but the part-time and occasional allocations remained a fixed percentage of a full-time allocation, although under a special small-dredge program a vessel in a part-time or occasional category could (and many have) moved up one DAS category. According to the FMP, part-time vessels have received 40% of the full-time DAS allocation and occasional vessels have received 1/12th of a full-time DAS allocation, rounded off to the nearest DAS.

[39] The original control date for Amendment 4, which implemented limited access.

There were no restrictions on where the DAS could be used and many vessels fished on the scallop resource offshore of their ports. Most scallop fishermen use large, sea-worthy boats that are capable of fishing scallops that are considerably distant, however. The Scallop FMP prohibits businesses and individuals from possessing more than 5% of the limited access permits, thereby preventing an entity from acquiring an excessive share of fishing privileges.

Beginning with Framework Adjustment 11, in 1999, the FMP has made a special allocation to limited access permit holders to fish in controlled access areas. These areas re-opened to scallop fishing after being closed several years and had special provisions to prevent local scallop depletion, market gluts, excessive finfish bycatch, unacceptable habitat impacts, and gear conflict. Vessels that were allocated the controlled access fishing privileges could fish in the re-opened area, or use its DAS to fish in regular, open fishing areas elsewhere. Therefore a vessel was not necessarily at a disadvantage because it could not fish in a remote controlled access area, although its profits per DAS might be less fishing in open fishing areas closer to the homeport. Equal number of trips were allocated to all limited access scallop vessels, but part-time and occasional vessels could not take all the controlled access area trips that were allocated, because each trip costs 10 DAS and vessels may not have sufficient DAS allocations to take all trips. One of the difficulties, particularly during 2001-2003, has been to establish a scallop possession limit/DAS charge (called a tradeoff) that was sufficiently attractive for vessels to fish in controlled access areas where the tradeoff applied. Raising the scallop possession limit was not an option because vessels would become unable to catch and process the possession limit within the 10 DAS that was charged for the trip. On a per day charged basis, the catch rates were higher in the regular, open fishing areas.

This program had desirable characteristics, but too many vessels were using their DAS allocations to fish in regular, open fishing areas rather than within the controlled access areas. This reaction caused fishing mortality to remain chronically high in regular, open fishing areas and has prevented the FMP from achieving OY because fishing mortality exceeded F_{MSY} for open area scallops. Conversely, OY was not being achieved because the target fishing mortality rate in controlled access areas was not being met, either.

Amendment 10 offered two solutions to this dilemma. One was an overfishing definition that would establish area-specific mortality targets to achieve OY from each area. This is an important feature for scallop management, because scallops don't move very far and total yield is dependent on when and where fishing effort occurs. One feature of this alternative overfishing definition was that it reduced the resource-wide fishing mortality target due to the effect of permanent or long-term closures, a feature the Council and public found unacceptable.

A second alternative approach that the Council approved instead was to continue using the status quo overfishing definition, but make area-specific DAS and trip allocations to distribute effort where provides the best benefits and achieve OY. Unlike the existing allocation mechanism, limited access scallop vessels would have to use controlled access DAS and trip allocations only in controlled access areas, and could not use these DAS allocations in regular, open fishing areas.

The Council selected two provisions that will maintain fairness and equity: pooling and exchanges. Even though their use in regular, open fishing areas would be prohibited, the controlled access areas allocations could be used in any controlled access area, up to the limit on the number of trips that a limited access may make in that area. For example, a vessel might be authorized to make 3 controlled access area trips. The maximum number of trips might be 3 in the Hudson Canyon Area and 2 in the Nantucket Lightship Area. A vessel with 3 controlled access area trips, might take all three in the Hudson Canyon Area, or 2 in the Nantucket Lightship Area and 1 in the Hudson Canyon Area. For the most part, the pooling benefits part-time and occasional vessels because they are allocated and likely to use less trips than might be authorized for a given area.

The other procedure to mitigate the effects of area-specific allocations and achieve fairness and equity are a provision for one-to-on exchanges. In this procedure, a vessel may exchange area-specific trip allowances with another limited access vessels to obtain a better geographical distribution of its trip allocations. This procedure might enable a VA vessel to fish all of its controlled access area trips in the Hudson Canyon Area, rather than being forced to fish in Closed Area I and Nantucket Lightship Area, for example, by exchanging controlled access area trips with a MA vessel. Since a vessel cannot accrue more total controlled access area trips than another under this exchange procedure, it avoids allowing an entity or individual from receiving an excessive share of the allocation.

One other change is that part-time and occasional vessels will now receive a different amount of controlled access areas trips as a full-time vessel. Although a part-time or occasional vessel couldn't actually take as many controlled access area trips as a full-time vessel, the difference now is that the controlled access trips must be taken in a controlled access area and DAS must therefore be allocated in 12 DAS blocks to be consistent with the DAS tradeoff and automatic DAS charge for controlled access area trips.

As a result, unless there were 12 controlled access area trips, the FMP cannot make a 40% allocation to part-time a $1/12^{th}$ allocation to occasional vessels. Instead, the FMP will allocate 40% and $1/12^{th}$ of a full-time controlled access area allocation to part-time and occasional vessels, rounded down to the nearest trip, but no less than one controlled access area trip may be allocated if controlled access areas are open for limited access scallop fishing. In some cases, this allocation method sometimes disfavors part-time and occasional vessels and sometimes favors them.

By pooling controlled access area trips and DAS allocations, the FMP is able to minimize the effect of rounding the controlled access allocations to the nearest trip and DAS block, while promoting conservation of scallops on controlled access areas and encouraging a rational, more easily managed use of the resource. Other options such as having different scallop possession limits and/or DAS tradeoffs for part-time and occasional scallop vessels would have been administratively complex, difficult to enforce, and create new (but different) inequities.

The DAS allocations for regular, open fishing areas will remain proportionally the same as they had been in the past.

A primary objective of Amendment 10 is to introduce a formal, but adaptive area rotation management system, which inherently implies periodic area closures. At times, these area closures may be close to the ports in a state, but limits on the size and configuration of these rotation management area closures limit the effect on local ports, especially given the relative mobility of the large-boat scallop fleet. Rotation management area closures could affect customary fishing characteristics of smaller boats, many with general category scallop permits. The flexible boundary rotation area management system that the Council approved is able however to take these considerations into account when rotation management area closures will be close to shore.

Although periodic rotation area management closures could have local effects that disadvantage fishermen from a given state, these effects will be temporary in nature and these same fishermen will likely benefit from the closure when it re-opens under controlled access rules. The purpose of a rotation area management closure is to promote conservation and achieve OY in terms of the size, value, market price, and economic and social benefits.

Lastly, Amendment 10 will prohibit limited access vessels from fishing for scallops under general category rules while not on a DAS. Because it is only economic to fish on 400 lb. per trip on near shore scallop resources, this measure could affect vessels from states where scallops are close to the coastline, particularly NJ, MA, and ME.

Nonetheless, this management measure was needed to close a loophole that exists in no other fishery and that threatened a control on fishing mortality through DAS allocations. There is no other fishery that allows limited access vessels to continue fishing for commercial sale on the managed resource when not fishing under limited access rules. Secondly, increasing effort by limited access vessels while not on a DAS had the potential to undermine the conservation tools, if more and more limited access vessels began fishing under general category rules. Although this measure could disadvantage limited access scallop vessels from certain states, these same vessels will benefit from maintaining a higher DAS allocation than might be possible if the general category catches increase.

6.1.5 National Standard 5: Efficiency

"Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose."

Amendment 4 to the FMP implemented limited access, which facilitates mortality control, monitoring, and enforcement. Limited access vessels will be allocated area-specific trips and/or DAS which must be tracked to ensure compliance to achieve the fishing mortality objectives and achieve OY. As a result of limited access, vessels have become considerably more profitable and consumers have benefited from lower scallop prices as landings have increased, both benefiting the nation. Especially important for area-specific DAS monitoring, a substantial majority of limited access scallop vessels are required to use vessel monitoring system (VMS) equipment, facilitating the use of DAS allocations to manage the fishery and enforcement of the regulations. VMS effort data have also become very useful for analysis of effort patterns with respect to other marine resources and coastal activities.

On the other hand, the FMP limits the amount of crew that vessels may have onboard with on a scallop DAS trip and requires vessels to shuck all but 50 US bushels of scallops at sea. At times of high abundance, it would be more efficient for vessels to carry more crew to shuck the scallops, but that would increase the mortality associated with a DAS. Raising the crew limit to achieve greater onboard efficiency and use of capital per DAS would require the FMP to reduce the DAS allocations or force vessels from the limited access fishery to rectify another type of inefficiency.

Measures which promote efficiency are DAS allocations, common scallop possession limits, and rotation management areas with linear boundaries. The limited access DAS allocations promote efficiency because unlike fleet-wide quota management, it does not force vessels to invest more capital to catch scallops more quickly than the next vessel. Vessel owners have and will invest capital to make the vessel more efficient and productive per DAS, for example by reducing the time that crew handles gear and moves scallops on deck, but this investment increases efficiency because more scallops are caught per DAS.

Although the catch rates vary by area, the possession limits are the same for all controlled access areas. This promotes compliance by making the rule easy to understand, widely-known, and enforceable. Thus the costs associated with enforcing a trip limit are reduced compared with enforcing different possession limits for each controlled access area.

Another management measure that promotes efficiency is a provision in the flexible boundary rotation area management system to use linear boundaries along lines of latitude and longitude. Although the scallop resource does not follow nice and neat boundaries, using linear boundaries promotes compliance and eases law enforcement burden.

6.1.6 National Standard 6: Variations and Contingencies

"Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches."

Atlantic sea scallops are a very dynamic and variable resource. The historic variation in landings, particularly since 1957 when it appears that scallop fishing began to expand and cause a shrinking of the age structure (see Section 7.1) attests to this variability. Several strong year classes in the last 40 years have driven landings and supported the fishery.

The FMP and Amendment 10 will not stabilize the wide variation in recruitment exhibited by the scallop stocks, but rotation area management will allow the Council and NMFS to respond to changing environmental and biological conditions. In fact, rotation area management is expected to take advantage of the strong year classes and abundant recruitment when it occurs to boost average yield and minimize adverse impacts on the environment by focusing fishing effort where it most efficiently captures yield from the resource. Although rotation area management appears to increase variability in landings, the Council has selected several adaptive strategies to mitigate this higher variability, including adaptive management of controlled access areas to stabilize landings through time-averaged mortality targets and/or adjustments that will take into account the near-term outlook of the resource.

The FMP and Amendment 10 uses all four National Standard 6 approaches to establish a suitable conservation buffer: reducing OY, establishing a reserve, adjusting management techniques, and highlighting habitat conditions that have a bearing on the health and reproduction of the scallop resource. Moreover, Amendment 10 introduces a more adaptive management system using rotational closures through the FMPs framework adjustment process to respond to unpredictable events. The rotation area management system includes criteria to act as guidelines for managing the scallop resource that allow the Secretary to open and close fishing grounds through the Council's adaptive framework adjustment process.

The overfishing definition provides guidance and incorporates a risk-adverse annual fishing mortality target to account for scientific uncertainty. The target OY is derived from a target fishing mortality rate that is 80% of the F_{MSY} proxy. The F_{MSY} proxy is F_{max}, which is estimated to maximize yield-per-recruit, but there is uncertainty in this value due to variations in growth, mortality, and size selectivity by the fishery. Also, the DAS allocations are derived to achieve this annual fishing mortality target, but changes in DAS utilization, changes in fishing power per DAS, and activity by vessels with general category permits all add uncertainty about whether the management plan achieves the target and prevents overfishing (i.e. does not exceed a fishing mortality rate that truly maximizes yield-per-recruit). Another factor is that F_{max} does not achieve MSY due to a stronger stock-recruitment relationship than current data predict. The Council therefore reduced OY to 80% of F_{max} in response to scientific and management uncertainty.

The FMP and Amendment 10 rotation area management establish reserves in two ways. First, rotation area management involves a series of periodic closures targeting concentrations of small scallops. This action protects scallops from fishing where the benefits are greatest, i.e. where the biomass will grow quickest from a closure. Second, Habitat Alternative 6 which will close parts of the Georges Bank groundfish closures to scallop fishing to preserve sensitive and complex habitat also contains significant areas of scallop productivity. While it does not appear that the scallop resource is spawning-limited, especially when the stock is above ½B_{MSY}, these areas may offer a buffer against stock collapse, either through continued spawning activity of the larger scallops in the long-term habitat closures or through special access programs if equivalent habitat can be preserved in other areas.

Both area rotation and the DAS tradeoff inherently allow the Council to change the management techniques to respond to changing environmental and resource conditions. If stock biomass declines or recruitment increases, the FMP could respond by changing the amount and location of rotation area management closures. Also, if the controlled access programs are not achieving the desired results, the FMP could change the DAS tradeoff in response and guard against drastic changes in fishing patterns, allocations, or practices. Lastly, management of the controlled access areas includes setting annual, area-specific fishing mortality targets that vary over time. To guard against drastic changes in effort allocations and landings, the Council could vary these annual targets. If more effort and landings are needed in the short-term, the FMP would allow the Council to increase the fishing mortality targets for controlled access areas in the short-term and lower them toward the end of the controlled access period. An example of this strategy would be to set a constant fishing mortality target for a 3-year controlled access period (e.g. annual fishing mortality targets of 0.4, 0.4, and 0.4). An alternative strategy might be employed when landings and effort increases are not needed in the short-term, but are needed further in the future to balance rotational closures. An example of this strategy would be to set an increasing annual fishing mortality target for a 3-year controlled access period (e.g. annual fishing mortality targets of 0.32, 0.40, and 0.48, or 0.2, 0.4, and 0.6).

Lastly, the FMP and Amendment 10 highlight types of environmental conditions that are known to be adverse to scallop reproduction, settlement, and growth. Section 7.2.1 describes these conditions as those that cause a degradation in water clarity, and increase in sedimentation, or thermal shock. At this time, there are no such problems thought to exist, but coastal activities near scallop beds such as dredge disposal, sand mining, and other large-scale seabed activities could pose a risk.

6.1.7 National Standard 7: Cost and Duplication

"Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication."

The Atlantic Sea Scallop FMP has managed the scallop fishery since 1982 and successfully rebuilt the resource, increasing biomass in 1994 by five-fold to the target. Scallops are a very valuable marine resource, contributing substantial economic benefits to fishing communities, coastal states, and the nation.

In 2002, the scallop fishery was the fifth most valuable fishery in the nation ($203.7 million) and the second most valuable fishery in the Northeast region (Van Vorhees and Pritchard 2003), following the American lobster fishery ($293.3 million). The scallop fishery also was a major contributor to the national ranking of Northeast region ports, including New Bedford, MA ($169 million, ranked 1st), Hampton Roads Area, VA ($67.8 million, ranked 3rd), Cape May, NJ ($35.3 million, ranked 13th), and Point Pleasant, NJ ($19.7 million, ranked 35th).

Now that the scallop stocks have rebuilt to the biomass targets, the FMP is needed to maintain stock biomass near the targets and produce optimum yield. Without active federal management, fishing effort would rapidly increase and would probably cause a fairly rapid decline in stock biomass and long-term yield. Net benefits would be diluted by the extra capital that would enter the fishery, scallop prices would decline from a rapid but short term increase in landings, average scallop size would decline, and long-term benefits would be sacrificed. With the exception of coastal scallop populations in ME, there are no state plans or regulations that would replace the FMP. Therefore the benefits of managing the fishery with a federal FMP greatly outweigh the costs.

Adaptive rotation area management with flexible boundaries increase administrative, monitoring and enforcement costs. Just as important, closures of areas to protect small scallops will be a burden on fishermen that customarily fish those areas and nowhere else. Also the allocation of area-specific DAS allocations will restrict the ability of a limited access scallop vessel to fish in various areas.

The Council considered other types of rotation management that do not require the level of monitoring by cooperative industry surveys or enforcement of fixed straight boundaries that would be required by the proposed action. Funding for cooperative industry surveys will be available through TAC and DAS set asides, but this funding comes at a cost – it reduces the allocations that would have occurred without the set asides. Simpler area rotation management strategies that could be supported by existing resource surveys were analyzed and found to have positive biological and economic benefits (see Sections 8.2.1.3 and 8.7.3). The simplest strategy using mechanical rotation of fixed boundaries would have the least cost, but higher benefits could be achieved through adaptive management strategies that are event driven. Because the existing scallop surveys are somewhat course measures of regional or stock-wide abundance and biomass, the survey could not be used to administer the proposed alternative using smaller, flexible boundaries. Based on a statistical analysis of recruitment distribution patterns, the PDT estimated that use of flexible boundaries could increase yield by about 5% of that achieved by fixed, pre-set boundaries having straight borders. Depending on the extensiveness of the cooperative industry survey program, targeted samples of a defined area could allow definition of smaller areas containing small scallops at a modest cost, fully or partially supported by a portion of the research TAC and DAS set-asides. Although a quantitative analysis was not possible, the Council considered these tradeoffs and decided that fully-adaptive rotation area management with flexible boundaries would have net positive benefits over the alternative forms of area management.

To achieve the conservation objectives using area rotation, closures are a necessary evil. Other methods of reducing mortality on small scallops (for example, increasing ring size more than recommended or lowering crew limits) to change fishing behavior and avoid areas of small scallops could require measures that have greater costs to industry and could have negative net benefits. Therefore to achieve the yield gains associated with reducing mortality on well-defined beds of small scallops, targeted area closures based on ad hoc intensive industry-based surveys achieves the highest benefits at the lowest burden to fishermen.

To some extent, increasing the ring size to a 4” minimum diameter could reduce the need for rotation closures and mitigate impacts on fishermen that customarily fish where these future closures might occur.

To capture the benefits of area rotation, area-specific DAS allocations were needed to focus fishing effort where it would be most efficient in capturing large scallops, although catch rates for smaller scallops may be higher elsewhere. This allocation mechanism will increase the burdens on vessels that are ill-suited to fish in distant scallop grounds, but one-to-one exchanges are expected to alleviate this type of burden.

Gains from the proposed alternatives include economic gains from capturing more yield with less fishing activity, and from reducing adverse impacts on bycatch and habitat. These gains are estimated and discussed in Section 8.7, including a formal benefit-cost analysis comparing the alternatives with no action and the status quo (Section 8.7.2.1). Gains that are realized in other fisheries will result from reductions in bottom contact and fishing time, as wells as required changes in gear (twine top mesh and minimum ring size) and closures that encompass areas with concentrations of sensitive and complex habitat. Reducing adverse impacts on bycatch and EFH is expected to produce benefits from other managed fisheries, but these gains are difficult to quantitatively predict. An evaluation of the effects of scallop management measures on bycatch is provided in Section 8.3 and on habitat in Section 8.5.

6.1.8 National Standard 8: Communities

> *"Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities."*

The characteristics and participation of fishing communities involved in the scallop fishery are discussed in Section 7.1.1.3 and impacts of the proposed and non-preferred alternatives are evaluated in Section 8.8. Both large and small fishing ports depend on scallop fishery revenue and activity for a substantial part of their fishery income. These ports range from New Bedford/Fairhaven, MA; Cape May, NJ; and Hampton Roads area, VA. Smaller ports include Chatham/Provincetown, MA; Stonington, ME; and Wanchese, NC.

Primarily, the proposed alternatives are expected to benefit these communities by increasing yield to the fishery, but closures could have a localized impact. Section 8.8 includes an evaluation of the impacts of various management measures on fishing communities and their social structure. Habitat closures, which may have the greatest local impacts on specific communities were analyzed in Section 8.5.4.14.2. The economic impacts associated with habitat closure alternatives were estimated for each community with scallop landings, assuming that scallop fishing vessels in that community would continue to fish without the closures as they had in the past. Alternatives that would have greater impacts in particular communities were ranked lower than those that spread the impacts more evenly across communities, a factor that was considered in evaluating various habitat closure alternatives.

6.1.9 National Standard 9: Bycatch

> *"Conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch."*

In addition to reducing fishing mortality on scallops and rebuilding the scallop resource, scallops management in the last decade has also significantly reduced bycatch. While DAS use had been halved from levels prevalent in the early 1990's, fishing time (measured as bottom contact time or area swept), has decline by around 80 percent. Because bycatch amounts are directly related to the amount of fishing time, selectivity by the fishing gear, and where and when the fishery occurs, bycatch has also declined substantially since Amendment 4 when the Council initiated limited access and DAS management.

Recent management of the other two factors, gear and location fished, has also favored reductions in bycatch. Since the 1994 implementation of Amendment 4, minimum ring size has increased from 3 to 3 ½ inches and is slated to rise to a minimum 4" ring size by September 1, 2004 if Amendment 10 is approved. Research on the characteristics and effectiveness of dredges outfitted with 4" rings has also collected data on finfish and invertebrate bycatch. For most species, bycatch with a dredge using 4" rings is substantially lower than with a dredge outfitted with 3 ½ inch rings that the commercial fishery currently uses (Section 8.2.8).

Over the same period, the FMP has also increased the minimum twine top mesh which allows escapement of many species, especially of smaller, unmarketable sizes. Since discard mortality of many species is high, escapement through larger twine top mesh and/or larger ring spacing is an important management component to minimize bycatch and bycatch mortality. During the recent decade, the minimum twine top mesh has risen from 5 ½ inches, to 6 inches, and to 8 inches. Amendment 10 will increase the minimum twine top mesh in all scallop dredge gear to 10 inches, because research has shown that substantial reductions of bycatch for many finfish species can be achieved with larger twine top, if installed in a way that does not mitigate the effects of larger mesh size.

Why hasn't the FMP implemented 10 inch twine top mesh earlier? Large twine top mesh also allows escapement of scallops. When smaller scallops (i.e. 70 – 90 mm shell height, 30 to 50 count) predominate, a larger twine top mesh decreases gear efficiency for these size classes, which were the predominant scallop sizes available to the fishery in the early to mid-1990's. If the larger 10-inch twine tops and 4" rings had been required at that time, greater amounts of fishing time would have been required to catch scallops – mitigating the effects of the larger mesh and rings, possibly even increasing the bycatch of larger finfish species.

As the scallop resource has rebuilt, particularly since 1998, larger scallops (i.e. > 100 mm) have become more abundant and available to the fishery, particularly in formerly closed scallop rotation and special access areas. Even in the regular, open fishing areas, scallop biomass and size have increased in the last five or so years, because fishing mortality has declined. Particularly if Amendment 10 implements rotation area management to reduce fishing on smaller scallops and focus fishing in areas where larger scallops exist, a 10-inch minimum twine top mesh will minimize bycatch and bycatch mortality without increasing fishing time.

Quantitative assessments of bycatch changes in response to management have not been possible, primarily due to a lack of data. Sampling frequency by the Sea Sampling Observer Program have been low due to a lack of funding and belief that interactions with marine mammals and turtles were rare. Sea sampling funding is greater for fisheries that have higher levels of interactions with marine mammals and turtles, because the funds are more readily available for monitoring protected species. Vessel trip report (VTR) data are less than useful for this purpose because fishermen rarely report discards (only 9% of 2001 VTRs from the scallop fishery reported discards of any species, including scallops) and with such low reporting rates the data may be biased by area, time, or type of vessel.

Two issues became more important in recent years and have caused the FMP and NMFS to increase sea sampling in the scallop fishery: finfish bycatch in the groundfish closed area access programs and interactions with sea turtles in the Hudson Canyon Area and other parts of the Mid-Atlantic region. Because the Georges Bank closed areas were in place to reduce groundfish catches and enhance rebuilding, it was important to NMFS and the Council to carefully monitor bycatch by increasing sea sampling. In 1999, the FMP provided funds for more sea sampling activity through a TAC set-aside. Part of the target TAC for Closed Area II was set-aside to provide a mechanism and funds for vessels to pay for observers on their vessels, and recapture some of the observer cost from the TAC set-aside. Vessels fishing in Closed Area II and carrying mandatory observers were authorized to land more than the scallop possession limit, and the proceeds from the extra landings allowed the vessel to recover some or all of the observer cost. As a result of this program, over 20 percent of the trips were monitored, but due to training issues and the focus on yellowtail flounder catches, the initial program recorded only the scallop and yellowtail flounder catches.

In 2000, this TAC set-aside program was continued and expanded to all controlled access areas, including Closed Areas I and II, and the Nantucket Lightship Area, recording the catches and discards of all finfish species. This was the first year that relatively reliable bycatch estimates were available and the expanded estimates are provided in Section 7.2.4.1.1. These bycatch estimates, however, apply only to the controlled access areas that were open in 2000, and are not representative of bycatch in other open fishing areas. Three reasons that these estimates are not applicable to other areas are that the geographical distribution of species in the bycatch varies especially with respect to the groundfish closed areas, the amount of time fished per DAS was much different in the controlled access areas than in other open fishing areas, and the FMP required vessels fishing in the controlled access areas to use 10-inch, rather than 8-inch minimum twine top mesh. Ideally, a comparative sample in open fishing areas would have provided data to analyze the effects on bycatch from the management measures discussed above.

In 2001 to 2003, the FMP continued the TAC set-aside and enhanced Sea Sampling Observer Program sampling frequency for the area access program, but the groundfish closed areas were no longer open and this program applied to the Hudson Canyon and VA/NC Areas, which had been closed in 1998 to protect small scallops. Although groundfish catches were much less of an issue, the Council wanted to continue the observer TAC set-aside program to improve bycatch data collection. These Hudson Canyon and VA/NC Areas data are used in this document (Section 7.2.4.1.1) to estimate and characterize finfish bycatch amounts, but again these data can not be extrapolated to other areas, even in the Mid-Atlantic region.

One of the surprises that the Hudson Canyon and VA/NC Areas observer program revealed was that interactions with sea turtles were higher than anticipated, particularly in the Hudson Canyon Area. No one knew whether the high sea turtle interaction rates were due to anomalous sea turtle distribution during 2001, due to the effect that the more intense fishery in the Hudson Canyon Area had on sea turtles that might be attracted to animals that feed on discarded scallop viscera, or due to differences in vessel activity when they stopped fishing to allow the crew's scallop shucking to catch up with the scallop catches.

As a result of this surprising observation from the 2001 Sea Sampling Observer Program, NMFS expanded the sea sampling activities aboard scallop vessels fishing during the late summer and early fall in the Mid-Atlantic region. Observed trips funded by the protected species observer program, however, may not have time to identify and record finfish discards, since the program may not allow observers to spend time recording finfish bycatch in lieu of observing interactions with protected species.

Because of this data gap and concerns about bycatch in the scallop fishery, Amendment 10 proposes to expand the set-aside program to include trips that occur in controlled access and regular, open fishing areas. To do this, Amendment 10 will continue a one-percent TAC set aside to help defray the costs of mandatory observers in controlled access areas, including the groundfish closed areas access and the Hudson Canyon Area access program. A new program, to set-aside one percent of the DAS use targets, before allocating limited access DAS, will allow more trips to be observed in regular, open fishing areas.

Therefore to comply with National Standard 9, the FMP and Amendment 10 will enable the development of an improved bycatch data base to evaluate the effectiveness of management to minimize bycatch and bycatch mortality. Section 8.3 assesses the effects on the amount and type of bycatch and bycatch mortality, although quantitative measures are not available at this time, except where relevant research exists or through inference from data collected in the controlled area access program. In addition, Amendment 10 proposes implementation of management alternatives that are expected to have a very favorable effect on minimizing bycatch and bycatch mortality. With greater Sea Sampling Observer

Program coverage, provided by the TAC/DAS set asides, future SAFE Reports will include better monitoring and analysis of bycatch.

6.1.10 National Standard 10: Safety

"Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea."

The last analysis of at-sea casualties in the sea scallop fishery was completed for the 2000 SAFE Report (NEFMC 2000). This analysis, prepared by USCG staff and in consultation with industry advisors, noted that commercial fishing is a relatively dangerous profession, but there were no discernable adverse safety trends associated with scallop industry conservation measures. The one problem that was identifiable; gear stowage regulation, was promptly revised when it became apparent that the regulation was a hazard to fishermen. Casualty statistics show a general downward trend in casualties in the scallop fleet. This might be due to a smaller scallop fleet, less time each vessel spends at-sea, increased fleet profitability, and commercial fishing vessel safety initiatives. However, we have noticed that personal injuries in the scallop fleet were more serious (broken bones, amputations) than in other sectors of the fishing industry, most likely due to the type of gear used (heavy dredges, shucking knives) and the overall nature of the scallop fishery.

These conditions remain in place and are probably having a favorable effect on safety. One issue however remains a concern and warrants careful monitoring. Since 1998, scallop catches have risen substantially and in some open areas and nearly all controlled access areas the catches are exceeding the vessel and crew's ability to shuck scallops. As a result, vessels must often slow down fishing while the on-board processing catches up, an action that has a favorable effect on conservation. It reduces fishing power per DAS and induces vessels to seek out larger, more easily shucked scallops, which in turn improves size selectivity and yield. Nonetheless, some crews are working long watches and shucking scallops nearly 24 hours a day, with shorter than normal breaks for sleep and food. Many vessels have added a shucking cabin by the bridge that the master often uses to shuck scallops. This can present a hazard by virtue of the fact that a proper look-out may not be posted. Casualty statistics do not reflect a significant increase in casualties due to this management measure, however.

Several management measures in the FMP and in Amendment 10 help alleviate this concern. First and foremost, the DAS tradeoff system allows a vessel to operate at a more deliberate pace, because most crews would be able to shuck 18,000 lbs. of scallops in less than 12 DAS. As a result, a vessel on a controlled access area trip can take longer breaks and keep more normal watches without exceeding the automatic DAS charge. Even if the vessel exceeds 12 DAS on a controlled access area trip, it would still be charged 12 DAS under Amendment 10 rules.

Secondly, there are three management measures that help to reduce the vessel's catch rates and keep it in balance with the shucking capacity: increasing the minimum ring size, increasing the twine top mesh, and the small dredge exemption program. A dredge with 4" rings is more efficient at catching large scallops, but also reduces the catch of smaller scallops (i.e. < 110 mm). As a result, fishing in areas with mixed scallop sizes with a dredge having 4" rings is expected to reduce the amount of culling needed when the gear comes aboard. This time-consuming (and back-breaking) culling process can affect shucking capacity and fatigue. Research has shown that a dredge outfitted with 4" rings also catches considerably less benthic invertebrates, often referred to as "trash" by fishermen. Retained scallops must be picked from the pile on deck and the less "trash" and small scallops exist in the pile, the easier it is to cull the scallops and discard the remaining catch. A larger minimum twine top mesh is also expected to reduce the catches of certain species of finfish, which may also favorably affect culling time. Nothing suggests that a 4-inch minimum ring size will become a safety issue.

Although not required by regulations, some scallop vessels have begun using smaller dredges which are lighter and can help save fuel. A smaller dredge also catches less per hour and can help balance the catch with the crew's shucking ability in areas with high scallop biomass. As an added incentive which some vessels have taken advantage of, part-time and occasional limited access scallop vessels may opt to use a "small dredge" having a total width of no more than 10 ½ feet, and would be bumped up to the next DAS allocation category. This provision coupled with higher catches have made this conversion lucrative for the vessel and may have mitigated crew fatigue, although no statistics verify this potential result.

Another management measure that has a favorable effect on safety is the DAS system itself. Unless required by conservation objectives to minimize bycatch, there are no restrictions on when a limited access scallop vessel can fish. This avoids forcing scallop vessels from fishing when conditions are not suitable, unless the captain chooses to do so.

One related problem has been the ability for a vessel to return early from a controlled access area trip. Up until Amendment 10, vessels that terminated a trip early had to apply for an adjustment of its DAS charges for a broken trips and criteria for granting this adjustment have been rather stringent. Some vessels have decided to continue controlled access area trips during adverse conditions, and other vessels have decided not to take controlled access area trips because of the risk of loosing DAS on a broken trip.

Amendment 10 introduces a new system that will allow a vessel to receive a DAS adjustment based on the amount of scallops landed on the broken trip. At a minimum, a vessel would be charged 2 DAS and would loose 3,000 lbs. of scallop landings from controlled access area trips to prevent inappropriate use of this provision, but the measure reduces the risk of loosing DAS compared to the existing program. Thus vessels facing inclement weather or other adverse conditions that might compromise safety may be able to make a decision that favors a safer course of action. This is a better concept than the existing one, but from a safety perspective it is not as effective as no punitive action for valid trip terminations. If the trip is terminated for valid external reasons, fishermen should not be punished; the perceived punishment may lead to safety misjudgments on the part of fishermen.

Another similar measure that has favorable effects on safety will continue. Limited access scallop vessels are and will be able to carry forward up to 10 unused DAS into the next fishing year. Thus nearing the end of a fishing year, a captain or vessel owner will not feel obligated to make an end of the year trip or loose DAS. Thus inclement weather or other adverse conditions at the end of a fishing year might be avoided.

Finally, another factor that has a positive impact on safety is the management of scallops in controlled access areas without a hard scallop TAC or quota. Under the area-specific DAS allocation system, an area closure to avoid exceeding the scallop TAC is unnecessary. In some cases, area-specific finfish TACs may apply, but the DAS tradeoff system allows vessels time to explore areas or modify fishing behavior to avoid bycatch that would close areas to scallop fishing. These controlled access area measures help to reduce the potential for a derby-style fishery and therefore have a favorable effect on safety.

6.2 Required Provisions

6.2.1 Foreign Fishing Measures

"Contain the conservation and management measures, applicable to foreign fishing and fishing by vessels of the United States, which are—

(A) Necessary and appropriate for the conservation and management of the fishery to prevent overfishing and rebuild overfished stocks, and to protect, restore, and promote the long-term health and stability of the fishery;
(B) Described in this subsection or subsection (b), or both; and
(C) Consistent with the national standards, the other provisions of this Act, regulations implementing recommendations by international organizations in which the United States participates (including but not limited to closed areas, quotas, and size limits), and any other applicable law."

The Scallop FMP and Amendment 10 implements management measures that are needed to promote conservation (prevent overfishing, minimize bycatch, minimize habitat impacts) and achieve OY from the scallop resource. These management measures are in compliance with the National Standards (see Section 6.1). Since the domestic fishery is capable of catching and processing the allowable biological catch (ABC), there is no total allowable level of foreign fishing (TALFF) and foreign fishing on sea scallops is not permissible at this time.

6.2.2 Fishery Description

"Contain a description of the fishery, including, but not limited to, the number of vessels involved, the type and quantity of fishing gear used, the species of fish involved and their location, the cost likely to be incurred in management, actual and potential revenues from the fishery, any recreational interest in the fishery, and the nature and extent of foreign fishing and Indian treaty fishing rights, if any."

The fishery and fishery participation is described in Section 7.1.

6.2.3 Maximum Sustainable Yield and Optimum Yield

"Assess and specify the present and probable future condition of, and the maximum sustainable yield and optimum yield from, the fishery, and include a summary of the information utilized in making such specification; Assess and specify—

(A) The capacity and the extent to which fishing vessels of the United States, on an annual basis, will harvest the optimum yield specified under paragraph (3),
(B) The portion of such optimum yield which, on an annual basis, will not be harvested by fishing vessels of the United States and can be made available for foreign fishing, and
(C) The capacity and extent to which United States fish processors, on an annual basis, will process that portion of such optimum yield that will be harvested by fishing vessels of the United States."

The present and probable future condition of the resource and estimates of MSY and OY are given in Section 8.2.2.2. The US fishery is expected to harvest 100% of OY and domestic processors are expected to be able to process 100% of OY. Current domestic landings and processing capabilities are around 50 million lbs., while OY is around 45 million lbs.

6.2.4 Pertinent Fishery Data

> *"Specify the pertinent data which shall be submitted to the Secretary with respect to commercial, recreational, and charter fishing in the fishery, including, but not limited to, information regarding the type and quantity of fishing gear used, catch by species in numbers of fish or weight thereof, areas in which fishing was engaged in, time of fishing, number of hauls, and the estimated processing capacity of, and the actual processing capacity utilized by, United States fish processors."*

The FMP and existing regulations specify the type of reports and information that scallop vessel owners and scallop dealers must submit to the NMFS. These data include, but are not limited to, the weight of target species and incidental catch which is landed, characteristics about the vessel and gear in use, the number of crew aboard the vessel, when and where the vessel fished, and other pertinent information about a scallop fishing trip. Dealers must report the weight of species landed by the vessel, the date of landing, and the ex-vessel price for each species and/or size grade. Important information about vessel characteristics, ownership, and location of operation is also required on scallop permit applications. Dealers are also surveyed for information about their processing capabilities.

The substantial majority of scallop limited access vessels also are required to operate vessel monitoring system (VMS) equipment to record the location of the vessel for monitoring compliance with DAS regulations. In addition these vessel location data are used to identify when and where aggregated scallop fishing occurs[40], which has been very important for stock assessment and for analysis of bycatch and habitat impacts.

Section 5.1.8.1 proposes collecting additional fishing data by placing at-sea observers on scallop vessels to record more detailed information about the catch, including size frequency data, the quantity of discards by species, detailed gear data, and interactions with protected species. In particular, vessels that fish in controlled access areas must notify NMFS of their intent to take a controlled access area trip so that an observer may be place on the vessel if selected by the Regional Administrator. Some data about the characteristics of the vessel, related to its capability to carry an observer, is required.

6.2.5 Temporary Adjustments for Safety

> *"Consider and provide for temporary adjustments, after consultation with the Coast Guard and persons utilizing the fishery, regarding access to the fishery for vessels otherwise prevented from harvesting because of weather or other ocean conditions affecting the safe conduct of the fishery; except that the adjustment shall not adversely affect conservation efforts in other fisheries or discriminate among participants in the affected fishery."*

Three management measures in the FMP address this safety-related issue. First, the DAS allocations, under most circumstances, allow a vessel to choose when to fish. There are no restrictions on trip length and vessels that return to port early due to adverse conditions may continue fishing at another time without penalty. Furthermore, if a vessel must return from a trip early at the end of a fishing year, it

[40] Fishing location data is aggregated over many vessels and individual vessel information is not identifiable.

may carry up to 10 unused DAS into the next fishing year, essentially an automatic DAS adjustment to address this requirement.

Finally, Amendment 10 includes a revised broken trip exemption process that reduce the business risk of making a controlled access trip caused by a vessel being forced home by adverse conditions. Instead of a case-by-case determination of whether to adjust an automatic DAS charge for vessels retuning early from a controlled access area trip, the new procedure would allow an automatic adjustment, based on the amount of scallops landed. Thus if a vessel has less than the possession limit onboard and has to return early, it may continue the trip at a later time with a modest 3,000 lb. penalty to prevent mis-use. Many vessels under the existing system were ineligible for an adjustment because the vessel had small amounts (up to a few thousand pounds) of scallops that were landed. Thus vessels that began fishing in controlled access areas were often reluctant to return to port in the face of adverse conditions due to the potential to use the entire DAS tradeoff without landing a suitable amount of scallops.

6.2.6 Essential Fish Habitat

> *"Describe and identify essential fish habitat for the fishery based on the guidelines established by the Secretary under section 305(b)(1)(A), minimize to the extent practicable adverse effects on such habitat caused by fishing, and identify other actions to encourage the conservation and enhancement of such habitat."*

The EFH Provisions of the SFA (50 CFR Part 600.815) require the inclusion of the following components of FMPs. The Council has fully met these obligations as detailed below each mandatory component.

(A) Identify and description of EFH
(B) Fishing activities that adversely affect EFH
   i. Evaluation of potential adverse effects
   ii. Minimizing adverse effects
(C) Identification of non-Magnuson-Stevens Act fishing activities that may adversely affect EFH
(D) Identification of non-fishing related activities that may adversely effect EFH.
(E) Cumulative impacts analysis
(F) Identification of conservation and enhancement actions.
(G) List the major prey species and discussion the location of the prey species' habitat
(H) Identification of habitat areas of particular concern
(I) Recommendations for research and information needs
(J) Review and revision of EFH components of FMPs.

<u>Identify and description of EFH</u>

EFH for the management unit of the Atlantic sea scallop FMP has been identified and described in Amendment 10. The Council plans to update these EFH designations through an omnibus amendment that will be initiated in early 2004 and will become Amendment 11 to the Atlantic sea scallop FMP.

<u>Fishing activities that adversely affect EFH</u>
Evaluation of potential adverse effects

The EFH Final Rule (50 CFR Part 600) provides guidance to the Regional Fishery Management Councils for identifying fishing activities that adversely impact essential fish habitat (EFH). In addition to the EFH Final Rule, guidance provided by the Habitat Conservation Division (HCD) headquarters office in the form of a memo dated October 2002 was followed in the preparation of this section of Amendment 13. This evaluation should primarily include the impacts of activities associated with the fishery that is the subject of the management action, as well as other federally-managed and state-managed fishing activities. Based on the guidance provided by the EFH Final Rule and the HCD office, this determination focuses on the effects of fishing activities in the Altantic sea scallop fishery on EFH. It also includes information on the effects of other federally-managed fishing activities on scallop EFH, and identifies gears used in state-managed fisheries that could affect scallop EFH. Most of the information needed to complete this determination is provided in more detail in previous sub-sections of the Gear Effects Evaluation Section 7.2.6.2 and Adverse Impacts Determination Section 7.2.6.3.

Appendix VI describes commercial fishing gears used in the Northeast region of the U.S. and the geographic distribution and use of the principal bottom-tending gears in three broadly-defined habitat types. It also evaluates the effects of bottom trawls and dredges on benthic marine habitats in the region. Most of this information is derived from the NMFS, NEFMC and MAFMC-sponsored Gear Effects Workshop that evaluated the effects of fishing gears used in the Northeast region on mud, sand, and gravel habitats (NREFHSC 2002) and from an extensive review of relevant gear effects studies (Stevenson et al. 2003). Additional sources of information include work done by the NEFMC Habitat Technical Team and NEFMC and NMFS staff, and a National Research Council report on the Effects of Trawling and Dredging on Seafloor Habitat (NRC 2002). The information in this section serves as the basis for evaluating which gear types, if any, are most likely to have an adverse impact on essential fish habitat for federally-managed species in the NE region.

Section 7.2.6.2 evaluates the vulnerability of all 37 federally-managed species' to gear types found to have potential adverse impacts on EFH. Vulnerability was evaluated according to four broad categories: none (0); low (L); moderate (M); and high (H), based upon a matrix analysis of habitat function, habitat sensitivity and gear use. Results are summarized by species and life stage.

Specifically, species and life stages were ranked according to the vulnerability of their EFH to the effects of mobile, bottom-tending gear. EFH for those ranked as moderately or highly vulnerable were included in this adverse impacts evaluation. For this determination, fishing activities are interpreted to mean fishing gears, since there is not enough information available to support a more detailed determination based on different fishing practices used with each gear type. Adverse impacts associated with each gear type are assessed for specific habitat types that make up EFH. Only benthic habitats are considered, since the gears used to catch scallops are bottom-tending gears. Habitat type is based on type of substrate, and, to some extent, depth and degree of exposure to natural disturbance. These simplifications were made in order to allow maximum use of the information available and to provide an evaluation that encompasses as broad a range of the relevant fisheries and affected habitats as possible.

EFH for those ranked as moderately or highly vulnerable were included in this adverse impacts evaluation. For the purposes of this action, EFH vulnerability that is ranked as low is considered to have a potential adverse effect to EFH that is minimal and temporary in nature. Therefore, the Council will eliminate from further consideration any EFH that has a low vulnerability to scallop dredges, otter trawls and clam dredges. Refer to Section 7.2.6.2.5 for a detailed look at the vulnerability rankings based on shelter, food, reproduction, habitat sensitivity, habitat rank, gear distribution and gear rank. Background on how vulnerability was determined in this exercise is useful for understanding how EFH could be adversely affected as a result of fishing with different gear types. Vulnerability was divided into four broad categories, including: none (0); low (L); moderate (M); and high (H), based upon a matrix analysis of habitat function, habitat sensitivity and gear use. Several criteria were qualitatively evaluated for each life stage based upon existing information. Each evaluation consisted of a score based upon a predefined threshold. The criteria used and the key describing what each ranking stands for is described in Section 7.2.6.2.5. Depth range and substrates that are included in the EFH designations for those species that have been determined to be adversely impacted indicate that, as a group, they occupy a wide range of depths and bottom types.

Section 7.2.6.3 summarizes the results and findings of this section, identifying the potential adverse impacts of the three principal mobile, bottom-tending gears on three principal bottom types in the region. These results serve as the basis for analyzing proposed alternatives to minimize the adverse impacts of these gears on EFH.

Fishing activities that adversely affect EFH

Minimizing adverse effects

The EFH Final Rule also stipulates that "each FMP must minimize to the extent practicable the adverse effects of fishing on EFH that is designated under other federal FMPs". Federally-managed species that could be affected by the Atlantic sea scallop fishery are listed in Section 7.2.6.3.4. In order to minimize and mitigate the adverse effects of the fishery on EFH the Council will implement the following measures to minimize the potential adverse effects of fishing on EFH in Amendment 10:

- Habitat Alternative 2 (Benefits of other Amendment 10 alternatives) which will further mitigate the adverse effects of the fishery on EFH.
- Alternative 6 (Habitat Closures Consistent with the Framework 13 Closed Area Access Program) which will prohibit scallop dredge from fishing in vulnerable areas containing the above benthic habitat types.
- Habitat Alternative 11 which will increase the dredge ring size to 4 inches throughout the range of the fishery.
- Habitat Alternative 12 which will direct a portion of the TAC set-aside to conduct habitat-related research.

The proposed action is further described in Section 5.1.6 and the environmental consequences and practicability analysis of these alternatives can be found in Section 8.5.4. The Council has determined that the combination of these gear restrictions, effort reductions and area closures minimizes, to the extent practicable, the adverse effects of fishing on EFH. This includes the adverse effects of the scallop fishery on all federally-designated EFH.

Identification of non-Magnuson-Stevens Act fishing activities that may adversely affect EFH

Section 7.2.6.4 addresses the requirement of this component. This section will be thoroughly updated in the upcoming omnibus habitat amendment (to be Amendment 11 to the Atlantic sea scallop FMP).

Identification of non-fishing related activities that may adversely effect EFH.

Section 7.2.6.5 addresses the requirements of this component. This section will be thoroughly updated in the upcoming omnibus habitat amendment (to be Amendment 11 to the Atlantic sea scallop FMP).

Cumulative impacts analysis

Section 8.1.9 addresses the requirement of this component.

Identification of conservation and enhancement actions.

Section 7.2.6.6 addresses the requirement of this component. This section will be thoroughly updated in the upcoming omnibus habitat amendment (to be Amendment 11 to the Atlantic sea scallop FMP).

List the major prey species and discussion the location of the prey species' habitat

Section 7.2.6.7 addresses the requirement of this component. This section will be thoroughly updated in the upcoming omnibus habitat amendment (to be Amendment 11 to the Atlantic sea scallop FMP).

Identification of habitat areas of particular concern

Section 7.2.6.9 addresses the requirement of this component. This section will be thoroughly updated in the upcoming omnibus habitat amendment (to be Amendment 11 to the Atlantic sea scallop FMP).

Recommendations for research and information needs

Section 7.2.6.8 addresses the requirement of this component. This section will be thoroughly updated in the upcoming omnibus habitat amendment (to be Amendment 11 to the Atlantic sea scallop FMP).

Review and revision of EFH components of FMPs.

Section 7.2.6.10 addresses the requirement of this component. This section will be thoroughly updated in the upcoming omnibus habitat amendment (to be Amendment 11 to the Atlantic sea scallop FMP).

6.2.7 Nature and Extend of Scientific Data

> *"In the case of a fishery management plan that, after January 1, 1991, is submitted to the Secretary for review under section 304(a) (including any plan for which an amendment is submitted to the Secretary for such review) or is prepared by the Secretary, assess and specify the nature and extent of scientific data which is needed for effective implementation of the plan."*

Section 5.1.8 describes the nature and type of data that will be needed to administer and manage rotation area management. Other data, already collected include fishery dependent data described in Section 6.2.4 and fishery-independent resource surveys that provide an index of scallop abundance and biomass.

6.2.8 Fishery Impact Statement

"Include a fishery impact statement for the plan or amendment (in the case of a plan or amendment thereto submitted to or prepared by the Secretary after October 1, 1990) which shall assess, specify, and describe the likely effects, if any, of the conservation and management measures on--

(A) Participants in the fisheries and fishing communities affected by the plan or amendment; and

(B) Participants in the fisheries conducted in adjacent areas under the authority of another Council, after consultation with such Council and representatives of those participants."

The effects on fisheries and fishing communities are estimated and described in Section 8.8. The Council consults with other Councils in areas that overlap the management boundaries of this FMP by having members of those Councils participate on the Scallop Oversight Committee and by having a member of the Mid-Atlantic Fishery Management Council attend the this Council's meetings as a liaison.

6.2.9 Objectives to Prevent Overfishing

"Specify objective and measurable criteria for identifying when the fishery to which the plan applies is overfished (with an analysis of how the criteria were determined and the relationship of the criteria to the reproductive potential of stocks of fish in that fishery) and, in the case of a fishery which the Council or the Secretary has determined is approaching an overfished condition or is overfished, contain conservation and management measures to prevent overfishing or end overfishing and rebuild the fishery."

Overfishing reference points describing targets and thresholds for biomass and fishing mortality are presented and explained in Section 5.1.1. These reference points were chosen as a proxy for our best estimate of levels that will produce MSY and prevent an overfished condition (that will threaten spawning potential) from developing. These reference points were derived based on median recruitment data from 1982 – 2002 and yield-per-recruit analyses conducted by SARC 32 (NMFS 2000). The basis for using these reference points as a proxy for MSY are given in Section 3.4.2 based on analysis conducted by Applegate et al. (1998).

6.2.10 Standard Reporting Methodology

"Establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery, and include conservation and management measures that, to the extent practicable and in the following priority--

(K) Minimize bycatch; and

(L) Minimize the mortality of bycatch which cannot be avoided."

The FMP relies on a standard data collection program, the Sea Sampling Observer Program, and provides a funding mechanism to increase the level of sampling (Section 5.1.8.1). These data will improve and be used for assessing the amount and type of bycatch occurring in the scallop fishery.

6.2.11 Recreational Catch and Release

"Assess the type and amount of fish caught and released alive during recreational fishing under catch and release fishery management programs and the mortality of such fish, and include conservation and management measures that, to the extent practicable, minimize mortality and ensure the extended survival of such fish."

Recreational fishing for sea scallops is rare and immaterial to the success of the FMP.

6.2.12 Description of Fisheries

"Include a description of the commercial, recreational, and charter fishing sectors which participate in the fishery and, to the extent practicable, quantify trends in landings of the managed fishery resource by the commercial, recreational, and charter fishing sectors."

A description of the fishery and a summary of trends in landings by the commercial fishery is given in Section 7.1. Recreational fishing for sea scallops is rare and there is no charter fishing for sea scallops.

6.2.13 Fair and Equitable Distribution Amongst Fishery Sectors

"To the extent that rebuilding plans or other conservation and management measures which reduce the overall harvest in a fishery are necessary, allocate any harvest restrictions or recovery benefits fairly and equitably among the commercial, recreational, and charter fishing sectors in the fishery."

The proposed action does not affect recreational fishing for sea scallops (should it occur), there is no charter fishing for sea scallops, and the commercial fisheries will benefit from any short-term reduction in harvest. The allocations amongst these fishing sectors is therefore fair and equitable.

6.3 DISCRETIONARY PROVISIONS

6.3.1 Permits

Require a permit to be obtained from, and fees to be paid to, the Secretary, with respect to--

(A) Any fishing vessel of the United States fishing, or wishing to fish, in the exclusive economic zone [or special areas,] or for anadromous species or Continental Shelf fishery resources beyond such zone [or areas]*;*

(B) The operator of any such vessel; or

(C) Any United States fish processor who first receives fish that are subject to the plan."

The FMP requires dealer and vessel permits for participants in the scallop fishery. Any vessel landing more than 40 lbs. of scallop meats must obtain a general category permit from the NE Regional Office and any vessel landing more than 400 lbs. of scallop meats must obtain a limited access scallop permit.

6.3.2 Management Zones

"Designate zones where, and periods when, fishing shall be limited, or shall not be permitted, or shall be permitted only by specified types of fishing vessels or with specified types and quantities of fishing gear."

The FMP introduces rotation area management which implicitly means that defined areas will have specific limits on the vessel that may fish and the types and quantities of fishing gear that may be used. Future framework adjustments may change the boundaries of areas or designate new areas that apply according to rotation area management guidelines (Section 5.1.3.2).

The amendment also proposes habitat closures (Section 5.1.6.2) that where fishing with certain gears would be prohibited to protect and allow recovery of complex and sensitive habitats. Under Amendment 10, these areas would be closed to fishing with scallop dredges and trawls, but could also apply to other bottom-tending mobile fishing gear through developing or planned Council actioins in other plan amendments.

A proactive protected species framework adjustment (Section 5.1.7) could also invoke new management zones to reduce interactions with sea turtles and/or other protected species. When unacceptable sea turtle interactions are observed, the Council would initiate a framework adjustment to proactively respond to the problem. These management zones may seasonally prohibit the use of certain gear types or require certain gear modifications in specified areas.

6.3.3 Catch Limits

"Establish specified limitations which are necessary and appropriate for the conservation and management of the fishery on the--

(A) Catch of fish (based on area, species, size, number, weight, sex, bycatch, total biomass, or other factors);
(B) Sale of fish caught during commercial, recreational, or charter fishing,
(C) Consistent with any applicable Federal and State safety and quality requirements; and
(D) Transshipment or transportation of fish or fish products under permits issued pursuant to section 204."

Controlled access areas will have a TAC target that is used to allocate trips and area-specific DAS to limited access scallop vessels. Scallops landed in the shell have a minimum size under existing regulations. Existing regulations specify how scallops may be transported at sea, but do not regulate scallop transshipments once landed at a dealer.

6.3.4 Gear Limits

"Prohibit, limit, condition, or require the use of specified types and quantities of fishing gear, fishing vessels, or equipment for such vessels, including devices which may be required to facilitate enforcement of the provisions of this Act."

Gear size and amounts are regulated by permit category. In addition, most limited access vessels are required to operate VMS equipment to facilitate enforcement of closed areas, controlled access areas, and possession limits.

6.3.5 Coastal State Regulations

"Incorporate (consistent with the national standards, the other provisions of this Act, and any other applicable law) the relevant fishery conservation and management measures of the coastal States nearest to the fishery."

Only ME, NH, and MA regulate scallop fishing in state waters and the FMP accommodates those regulations under a special state-exemption provision. Vessels fishing exclusively in state waters of ME, NH, and MA for sea scallops are not regulated by DAS restrictions or scallop possession limits under the FMP. Due to the marginal nature of these fisheries with respect to the main scallop resource, this does not present a conservation problem at this time.

6.3.6 Limited Access

"Establish a limited access system for the fishery in order to achieve optimum yield if, in developing such system, the Council and the Secretary take into account--

(A) Present participation in the fishery,
(B) Historical fishing practices in, and dependence on, the fishery,
(C) The economics of the fishery,
(D) The capability of fishing vessels used in the fishery to engage in other fisheries,
(E) The cultural and social framework relevant to the fishery and any affected fishing communities, and
(F) Any other relevant considerations."

The FMP has had a limited access system in place since 1994, which originally took these considerations into account. Amendment 10 does not implement new limited access requirements or criteria.

6.3.7 Dealer Reports

"Require fish processors who first receive fish that are subject to the plan to submit data (other than economic data) which are necessary for the conservation and management of the fishery."

The FMP currently requires fish dealers that land scallops or other seafood from vessels with scallop permits to submit reports describing the products landed and the amount of landings, as well as the ex-vessel price paid for the landings.

6.3.8 At-sea Observers

"Require that one or more observers be carried on board a vessel of the United States engaged in fishing for species that are subject to the plan, for the purpose of collecting data necessary for the conservation and management of the fishery; except that such a vessel shall not be required to carry an observer on board if the facilities of the vessel for the quartering of an observer, or for carrying out observer functions, are so inadequate or unsafe that the health or safety of the observer or the safe operation of the vessel would be jeopardized."

Amendment 10 expands the amount of sampling by onboard observers and provides funding through a set-aside program. The Regional Administrator may choose vessels and trips where the vessel is required to carry an observer. Vessels making controlled access area trips are also required to notify the Regional Administrator so that an observer may be arranged for the trip. This notification includes a description of the vessel and an assessment of whether the vessel's facilities are suitable for the safe conduct of the observer.

6.3.9 Effect on Spawning Anadromous Fish

"Assess and specify the effect which the conservation and management measures of the plan will have on the stocks of naturally spawning anadromous fish in the region."

Since the scallop fishery mainly takes place offshore, no effects on anadromous fish are anticipated.

6.3.10 Harvest Incentives to Reduce Bycatch

"Include, consistent with the other provisions of this Act, conservation and management measures that provide harvest incentives for participants within each gear group to employ fishing practices that result in lower levels of bycatch or in lower levels of the mortality of bycatch."

Amendment 10 provides a mechanism and incentive (Section 5.1.8.3) for fishermen to engage in experimental fishery research that may result in lower levels of bycatch or bycatch mortality. If successful, these techniques or modifications may be considered in future management actions.

6.3.11 Set-aside for Scientific Research

"Reserve a portion of the allowable biological catch of the fishery for use in scientific research."

The proposed action includes a 2% set-aside (Section 5.1.8.3) to support and help fund scientific research that among other things could reduce bycatch, enhance habitat conservation, or improve scallop yield.

6.3.12 Other Conservation Measures

"Prescribe such other measures, requirements, or conditions and restrictions as are determined to be necessary and appropriate for the conservation and management of the fishery."

The proposed action and the FMP specify limits on the amount of time vessels may fish, on the locations where they may fish, the type and amount of gear they may use, and crew limits. Regulation of these factors control total fishing effort and the fishing power of vessels targeting sea scallops, thus preventing fishing mortality from exceeding an amount that will produce MSY.

7.0 DESCRIPTION OF AFFECTED ENVIRONMENT (EIS); Human Environment and Fishery Impact Statement

7.1 Description of the fishery

7.1.1 Fishing practices

Fishing is conducted by vessels using dredges or trawls. Eighty to ninety percent of the landings are made by vessels using two 15-foot dredges, composed of a bail, a ring bag, a club stick and a twine top. The bail of the dredge forms the mouth and the towing apparatus, ending forward with an upturned nose and a roller to avoid hangs and improve handling. The frame includes a sloping pressure plate which helps keep the dredge on the bottom and a cutting bar that helps lift the scallops from the bottom by hydraulic action. The dredge bags are made from steel rings, 3.5 inches in diameter, held to each other by two steel links. The bag terminates in a rigid “club stick” which is used for dumping the contents of the dredge onboard (Posgay 1957a, Bourne 1964). The twine top is sewn into the top of the dredge and is composed of 8-inch twine mesh. This gear reduces the weight of the dredge and allows escapement of fish and other debris without significantly reducing scallop catches. This gear is used by about 250 vessels in the limited access fleet while fishing on a day-at-sea. Vessels in the Mid-Atlantic may also use this gear while fishing under general category rules and a 400-pound/40 US bushel scallop possession limit.

Caddy (1973) reported that dredging lifts fine sediments into suspension, buries gravel below the surface, overturns large rocks, and appreciably roughens the bottom. It is known to cause some non-catch mortality of scallops and other organisms, as well as attracting predatory fish and crabs in the dredge path. In addition, dredge vessels also catch rocks and organisms which are shoveled overboard after culling the scallop catch. In some areas, these incidental catches can be appreciable and in other areas, the scallop catches are relatively ‘clean’. Some organisms (some skates, for example) exhibit few ill effects from being caught, while others (monkfish, for example) experience lethal effects. A more complete description of the effects of scallop dredges on habitat is given in Section 7.2.6.2.

These vessels often make extended trips, shucking scallops at sea. Fishing occurs year-around, with the unusual exception of extreme weather. Most vessels carry the maximum crew of seven men, which effectively limits fishing power per day-at-sea when stock abundance is high. It also induces the fishing crew to seek out beds of larger scallops, since the crew can shuck more pounds per day of larger scallops than of smaller scallops (NEFMC 1994). When the catches exceed the crew’s shucking capacity, the vessel must stop fishing or raise the cull size to compensate. This effectively reduces fishing time per day-at-sea and/or improves size selectivity when scallop abundance is high.

Fishing revenue is split amongst the vessel owner and crew by a “lay” system. The lay system sometimes varies from vessel to vessel, but is relatively standard across the fleet. Usually, 60 percent of the revenue goes to the crew who pays from it expenses for ice, fuel, food, and other items. The owner usually receives 40 percent of the revenue and pays for capital costs and major repair and maintenance. This system is very similar to the one in place in the 1970’s (Altobello et al. 1977), when there was a 62/35 split, with the remaining 3.5 percent going to a fishermen’s pension fund (New Bedford only). The crew shares are divided amongst the fishermen according to job function and seniority.

Another five percent of landings comes from smaller vessels using single dredges, limited by regulation to no more than 10.5 feet in total width. The rest of the dredge is the same as described above, but the twine top is made of 5½ to 6-inch mesh, depending on where fishing takes place. These vessels are only regulated by gear restrictions and a 400-pound/40 US bushel scallop possession limit. Some vessels shuck scallops at sea while others may return with in-shell scallops to be shucked later. There are about 200 more vessels that fish for scallops with this smaller gear, but most fish seasonally when other species are not available. In some areas, fishermen only target sea scallops with the smaller vessels when scallops are abundant close to port.

The remaining 10 percent of landings comes from vessels using scallop trawls, mainly in the Mid-Atlantic region. Fishing by these vessels often occurs during the summer when other species (summer flounder) are not available to the fishery. The gear is basically a modified flatfish net having 5½-inch mesh, with additional chafing gear on the bottom of the net. These nets do not typically hold right on the bottom and therefore target intermediate and smaller scallops that "swim" into the water column in front of the net. Tickler chains may be used to enhance this behavior before the net arrives.

The effects of scallop trawls are similar to those of dredges, but have different level of impacts because of the relative weight of the gear and the locations where it is used. In general, scallop trawls have less effect on bottom organisms. They also tend to be used in flat, sandy areas and thus have fewer effects on complex, hard bottoms. Although data are scant, scallop trawls could have higher bycatch levels because the net is basically a modified flatfish net and has a much wider mouth than a dredge which does not 'herd' fish in front of the gear. A more complete description of the effects of scallop trawls on habitat is given in Section 7.2.6.2.

Typically, crews shuck the adductor muscles, or meats, into buckets and then wash them of sand or other debris in iced wash tubs. When cleaned, the meats are packed into white linen bags made for this purpose, which hold 40 to slightly more than 50 pounds of meats. The weight of scallops in a full bag varies due to density and water content of the scallop meats and the size of the bags. The bags are stored in the iced vessel hold until landing, when they are unloaded and individual bags are weighed by the dealer. The bagged scallops are sometimes repacked by the dealers or shipped as is to markets, depending on demand.

7.1.1.1 The scallop fleet

Amendment 4 created the limited access scallop permit. Fulltime, part-time, and occasional limited access vessels are regulated through Days at Sea (DAS) controls, while general category vessels may land up to 400 lbs of meat or 50 bushels of shell stock per trip. There were 314 limited access and 2343 general category permits issued in fishing year 2001, which runs from March 2001 through February 2002. The limited access fleet consists mainly of large, full-time dredge vessels (Table 34 and Table 35), while the general category vessels are predominantly small vessels under 50 ft in length (Table 36). During 1994-2001, there were 426 unique vessels with limited access permits, of which 206 retained a scallop permit in the same category for the whole period and 155 retained the same category but did not hold a permit every year. Of the 65 category changes, 28 (43%) changed from net to dredge, 13 (20%) changed from dredge to net, 14 (22%) changed between DAS category within the dredge boats, 6 (9%) changed between DAS category within the net boats, and 4 (6%) changed from dredge to net back to dredge. By DAS category, 42 saw no change, 16 changed upwards (e.g. part-time to fulltime), 5 downwards, and 2 were mixed.

Table 34. Vessel Characteristics by Category, 1994-2001. Source: NE Permit Data.

Limited Access Category		1994	1995	1996	1997	1998	1999	2000	2001
Full-Time	Number of Vessels	229	227	217	201	203	213	220	224
	% of Total Vessels	62.2	64.5	65.4	64.4	68.8	73.2	73.3	71.3
	Average Length	82.6	83.9	83.6	83.9	84.3	83.6	83.4	83.5
	Average GRT	156.8	158.2	158.5	159.9	161.4	160.2	159.6	160.0
Part-Time	Number of Vessels	27	22	19	16	11	12	16	14
	% of Total Vessels	7.3	6.3	5.7	5.1	3.7	4.1	5.3	4.5
	Average Length	77.5	77.4	76.5	77.9	77.8	78.6	72.6	74.2
	Average GRT	128.3	133.0	129.1	134.3	137.7	143.4	124.0	124.4
Occasional	Number of Vessels	6	3	3	2	3	4	4	5
	% of Total Vessels	1.6	0.9	0.9	0.6	1.0	1.4	1.3	1.6
	Average Length	57.5	63.3	58.3	56.0	56.0	56.0	56.0	51.5
	Average GRT	62.5	95.0	68.3	64.0	58.0	62.5	62.5	46.0
Full-Time Small Dredge	Number of Vessels	6	4	5	3	2	1	3	13
	% of Total Vessels	1.6	1.1	1.5	1.0	0.7	0.3	1.0	4.1
	Average Length	66.3	59.8	65.2	59.0	56.0	44.0	63.7	63.3
	Average GRT	91.2	75.0	80.8	54.7	58.5	37.0	79.3	84.2
Part-Time Small Dredge	Number of Vessels	11	7	8	9	7	3	4	6
	% of Total Vessels	3.0	2.0	2.4	2.9	2.4	1.0	1.3	1.9
	Average Length	50.4	53.9	52.4	53.4	51.4	50.7	54.5	60.3
	Average GRT	37.5	41.0	38.0	41.4	35.4	41.0	48.0	72.0
Full-Time Net	Number of Vessels	30	32	28	27	23	16	17	16
	% of Total Vessels	8.2	9.1	8.4	8.7	7.8	5.5	5.7	5.1
	Average Length	78.7	77.6	78.8	76.4	75.6	73.5	74.3	74.4
	Average GRT	139.8	135.4	136.3	130.6	126.4	114.5	119.0	118.4
Part-Time Net	Number of Vessels	31	30	27	30	27	22	20	18
	% of Total Vessels	8.4	8.5	8.1	9.6	9.2	7.6	6.7	5.7
	Average Length	70.8	70.5	70.5	71.0	71.1	72.2	70.9	71.2
	Average GRT	101.5	97.4	99.0	101.4	103.4	104.8	104.7	103.4
Occasional Net	Number of Vessels	28	27	25	24	19	20	16	18
	% of Total Vessels	7.6	7.7	7.5	7.7	6.4	6.9	5.3	5.7
	Average Length	68.0	68.1	67.4	67.7	68.1	68.0	67.2	67.8
	Average GRT	93.4	93.3	91.5	91.7	91.6	93.9	93.8	93.7
TOTAL	*NUMBER VESSELS*	*368*	*352*	*332*	*312*	*295*	*291*	*300*	*314*

Table 35. Length and Tonnage of limited access vessels, 1994-2001. Source: NE Permit Data.

	1994		1995		1996		1997		1998		1999		2000		2001	
Length	Vessels	%	Vessels	%	Vessels	%	Vessels	%	Vessels	%	Vessels	%	Vessels	%	Vessels	%
Less than 50 ft.	17	4.6	10	2.8	10	3.0	9	2.9	8	2.7	7	2.4	8	2.7	11	3.5
50-70 ft.	64	17.4	55	15.6	56	16.9	52	16.7	43	14.6	40	13.7	43	14.3	47	15.0
Greater than 70 ft.	287	78.0	287	81.5	266	80.1	251	80.4	244	82.7	244	83.8	249	83.0	256	81.5
Total	*368*	*100.0*	*352*	*100.0*	*332*	*100.0*	*312*	*100.0*	*295*	*100.0*	*291*	*100.0*	*300*	*100.0*	*314*	*100.0*
Tonnage	Vessels	%	Vessels	%	Vessels	%	Vessels	%	Vessels	%	Vessels	%	Vessels	%	Vessels	%
0-50 GRT	28	7.6	18	5.1	17	5.1	15	4.8	12	4.1	9	3.1	11	3.7	13	4.1
50.1-100 GRT	49	13.3	48	13.6	50	15.1	48	15.4	41	13.9	38	13.1	35	11.7	42	13.4
100.1-150 GRT	125	34.0	123	34.9	111	33.4	106	34.0	98	33.2	100	34.4	108	36.0	109	34.7
gt 150 GRT	166	45.1	163	46.3	154	46.4	143	45.9	144	48.8	144	49.5	146	48.7	150	47.8
Total	*368*	*100.0*	*352*	*100.0*	*332*	*100.0*	*312*	*100.0*	*295*	*100.0*	*291*	*100.0*	*300*	*100.0*	*314*	*100.0*

Table 36. Length and Tonnage of general category vessels, 1994-2001. Source: NE Permit Data

	1994		1995		1996		1997		1998		1999		2000		2001	
Length	Vessels	%	Vessels	%	Vessels	%	Vessels	%	Vessels	%	Vessels	%	Vessels	%	Vessels	%
Less than 50 ft.	1274	64.0	1370	66.1	1325	66.2	1317	65.8	1318	68.0	1456	69.5	1602	70.8	1667	71.1
50-70 ft.	401	20.1	396	19.1	383	19.1	385	19.2	363	18.7	379	18.1	388	17.1	389	16.6
Greater than 70 ft.	317	15.9	308	14.9	295	14.7	300	15.0	258	13.3	261	12.5	273	12.1	287	12.2
total	*1992*	*100.0*	*2074*	*100.0*	*2003*	*100.0*	*2002*	*100.0*	*1939*	*100.0*	*2096*	*100.0*	*2263*	*100.0*	*2343*	*100.0*
Tonnage	Vessels	%	Vessels	%	Vessels	%	Vessels	%	Vessels	%	Vessels	%	Vessels	%	Vessels	%

	1994		1995		1996		1997		1998		1999		2000		2001	
0-50 GRT	1421	71.3	1515	73.0	1468	73.3	1465	73.2	1454	75.0	1597	76.2	1750	77.3	1812	77.3
50.1-100 GRT	245	12.3	238	11.5	229	11.4	226	11.3	218	11.2	223	10.6	233	10.3	241	10.3
100.1-150 GRT	213	10.7	209	10.1	203	10.1	197	9.8	169	8.7	172	8.2	172	7.6	178	7.6
gt 150 GRT	113	5.7	112	5.4	103	5.1	114	5.7	98	5	101	4.8	104	4.6	108	4.6
total	*1992*	*100.0*	*2074*	*100.0*	*2003*	*100.0*	*2002*	*100.0*	*1939*	*100.0*	*2093**	*99.9*	*2259***	*99.8*	*2339***	*99.8*

*3 vessels did not provide tonnage information; ** 4 vessels did not provide tonnage information

While total DAS used by the fleet and within the fleet categories increased between 2000 and 2001, the average DAS by a vessel increased for dredge vessels but decreased for net, and increased for full-time and part-time vessels, but decreased for occasional vessels (Table 37). Full-time vessels were allocated 120 DAS in 2000 and 2001, and the majority (88.9% in 2000 and 92.2% in 2001) used at least half of their allocation (Table 38). Part-time scallop vessels were allocated 48 days, and most (72.5%, 86.9%) used at least 30 of these days. Most occasional vessels (90.0%, 77.3%) showed no DAS use in 2000 or 2001.

Table 37. Average and Total DAS used by Limited Access Vessels, by Gear and DAS category. Source: NE Permit and Enforcement Data.

	1994		1995		1996		1997		1998		1999		2000		2001	
	Ave. DAS	Total DAS	Ave. DAS	Total DAS	Ave. DAS	Total DAS	Ave. DAS	Total DAS	Ave. DAS	Total DAS	Ave. DAS	Total DAS	Ave. DAS	Total DAS	Ave. DAS	Total DAS
Dredge	155.1	31329.4	149.6	29617.1	152.6	30513.9	143.5	27257.8	121.2	23641.8	96.5	20463.3	97.1	22130.5	100.6	24750.4
Trawl	125.2	3755.3	92.7	3428.9	92.3	3877.4	87.0	3131.5	82.9	3066.3	69.5	2224.7	74.4	2528.9	69.5	2571.4
Total DAS		*35084.8*		*33045.9*		*34391.3*		*30389.3*		*26708.2*		*22688.0*		*24659.4*		*27321.8*
Full Time	157.3	34454.8	150.1	31965.5	155.6	32365.3	145.4	29077.5	124.7	25679.9	100.0	21592.2	101.5	23341.8	105.6	25762.0
Part Time	51.9	623.0	51.9	985.2	62.9	1887.3	54.2	1300.4	41.9	1006.8	41.3	1074.7	43.2	1294.6	44.6	1515.9
Occasional	7.0	7.0	31.8	95.3	34.7	138.8	5.7	11.4	10.7	21.5	10.5	21.1	11.5	23.1	8.7	43.7
Total DAS		*35084.8*		*33045.9*		*34391.3*		*30389.3*		*26708.2*		*22688.0*		*24659.4*		*27321.8*

Table 38. DAS use in Fishing Years 2000 and 2001 by DAS and Gear Category of Limited Access Vessels. Source: NE Permit and Enforcement Data.

	Full Time Dredge				**Full Time Net**				**Part Time Dredge**				**Part Time Net**				**Occasional**			
	2000		2001		2000		2001		2000		2001		2000		2001		2000		2001	
DAS	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0	9	4.0	9	3.8	1	5.9	0	0.0	6	30.0	2	10.0	4	20.0	2	11.1	18	90.0	17	77.3
-10	0	0.0	1	0.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	5.0	4	18.2
-20	2	0.9	0	0.0	0	0.0	0	0.0	1	5.0	0	0.0	0	0.0	1	5.6	1	5.0	1	4.5
-30	5	2.2	0	0.0	0	0.0	0	0.0	1	5.0	1	5.0	0	0.0	1	5.6				
-40	6	2.7	3	1.3	0	0.0	0	0.0	5	25.0	6	30.0	4	20.0	0	0.0				
-50	1	0.4	3	1.3	0	0.0	0	0.0	5	25.0	6	30.0	7	35.0	10	55.6				
-60	3	1.3	4	1.7	0	0.0	0	0.0	2	10.0	4	20.0	5	25.0	4	22.2				
-70	3	1.3	5	2.1	0	0.0	0	0.0			0	0.0								
-80	4	1.8	4	1.7	0	0.0	0	0.0			1	5.0								
-90	11	4.9	8	3.4	0	0.0	1	6.3												
-100	31	13.9	23	9.7	4	23.5	1	6.3												
-110	60	26.9	58	24.5	2	11.8	3	18.8												
-120	69	30.9	86	36.3	6	35.3	7	43.8												
-131	19	8.5	33	13.9	4	23.5	4	25.0												
Total	*223*	*100%*	*237*	*100%*	*17*	*100%*	*16*	*100%*	*20*	*100%*	*20*	*100%*	*20*	*100%*	*18*	*100%*	*20*	*100%*	*22*	*100%*

7.1.1.1.1 General Category – vessels targeting scallops while not on a day-at-sea

Two groups of vessels sometimes target sea scallops with small dredges while not on a day-at-sea. In addition to vessels with general category scallop permits, described above and authorized to possess and land up to 400 lbs. of scallop meats per trip or 24-hours, vessels with limited access scallop permits are also authorized to fish under these regulations while not on a day-at-sea. Both fishing sectors are described and compared below.

The 2000 SAFE Report (NEFMC 2000) summarized scallop landings from trips that were not on a scallop day-at-sea. Although the proportion of landings from this fishing activity was small, relative to landings from trips on a limited access scallop day-at-sea, there was concern that the fishing activity by over 2,200 vessels with a general category scallop permit could rapidly increase and defeat the mortality controls in place. The rapidly rising scallop biomass and high prices made profitable day trips landing 400 pounds of scallop meats.

As a result of this concern, the Council started keeping a more watchful eye on this sector of scallop fishing effort and analyzed the fishery during 1999 in the 2000 SAFE Report. The summaries given below and in Table 39 to Table 48 update this information for the 2000, 2001, and 2002 fishing year. The data for the 2002 fishing year is available only through December 31, 2002, being preliminary with two months remaining in the fishing year. The discussion below will therefore primarily focus on the 2001 fishing year, summarized in Table 40 and Table 43, and Table 46.

There were 371 scallop vessels involved in trips landing 400 pounds of scallops or less during the 2001-2002 fishing year. The number of vessels increased by 70 vessels (23%) from the 1999 fishing year. However, the distribution of vessels by permit category was similar to previous fishing years. These 371 vessels conducted a total of 5,004 trips that landed no more than 400 pounds of scallops. This represents an increase of 147% (2,986 trips) from the 1999 fishing year. The scallop landings of this sector were 1,188,935 pounds, valued at about $5 million. Unlike in 1999, aver 80 percent of the landings and scallop revenue were landed by vessels with a general category scallop permit. Landings by vessels with limited access scallop permits and not fishing on a scallop day-at-sea contributed to less than 20 percent of the total. Scallop landings were much higher than the previous fishing years, mostly due to the larger scallop biomass and higher fishing activity.

Despite this rapid increase, total landings of scallops by trips not on a scallop day-at-sea were less than two percent of total scallop landings, a modest rise from about one percent in the prior two years. Preliminary indications through December indicate that the proportion of total landings from this fishing activity fell back around one percent, partly due to the average price falling below $4.50 per pound. In 1999, the average price was around $6.50 to $7.00 per pound, falling to around $5.80 per pound in 2000. This price decline coupled with a fixed 400-pound possession limit made these day trips less profitable, especially for larger vessels that typically have a limited access scallop permit.

7.1.1.1.1.1 By Permit Category

Of the 371 vessels, those under the open access permit category dominated the sector with 274 vessels, accounting for 74% of the total (Table 40); followed by the full-time limited access permit category, 63 vessels (17%); the part-time limited access permit category, 26 vessels (7%), and the occasional limited access permit category, 8 vessels (2%).

The open access permit category predominated these trips with a total of 4,301 trips accounting for 86% of the 5,004 of trips; followed by full-time category (352 trips, 7%), the part-time category (322 , 6%), and the occasional permit category (29 trips, 1%) in descending order.

The portion of total scallop landings by full-time permit vessels was 9%, open access vessels landed 82% of the scallop landings, 9 % by part-time permit vessels, and 0% by occasional permit vessels. As noted above, these proportions are in stark contrast with the 1999 and 2000 fishing years when limited access vessels landed a greater share of scallops for vessels not fishing on a scallop day-at-sea.

In terms of species other than scallops, the open access category had a clearly predominate share of the landings in both quantity and revenue for most of the species. The open access permit vessels accounted for 95% of monkfish landings, 51% of squid, 95% of regulated multispecies, 39% of summer flounder, and 91% of other species (Table 40).

Generally speaking, vessels with general category permits fish for monkfish and groundfish when they land scallops as a bycatch, compared to vessels with a limited access scallop permits which appear to target black sea bass, squid, and summer flounder when landing scallops as a bycatch.

When using dredges (presumably to target scallops while not on a day-at-sea[41]), limited access vessels landed only 33,323 lbs. of finfish and squid (14% of total trip landings including scallops), primarily summer flounder (Table 46). In contrast, vessels with general category scallop permits using dredges landed 1,174,647 lbs. of fish and squid (64% of total trip landings including scallops), primarily ocean quahog (1,156,880 lbs.)

7.1.1.1.1.2 By Gear Sector

Dredge and otter trawl vessels predominated in this fishing sector, which other gear types represented by a small number of vessels. During the 2001 fishing year, there were 180 dredge vessels (43%), 230 trawl vessels (55%), and 8vessels used other gear types (2%), for a total of 371 vessels participating in this fishing sector.

In terms of trips, the number of dredge trips exceeded other gear types, with 3,485 trips (69%) of the 5,004 total trips (Table 43). The trawl sector had 1,507 trips (30%), and there were 29 trips by vessels using other types of gear (1% of total trips).

The majority of the scallop landings and scallop revenue were by scallop dredge vessels. Of a total 1,188,935 pound of scallop meats and total revenue of $5.28 million, the dredge vessels landed 869,591 pounds of scallop meats (73% of total) valued at $4.04 million (76% of total). The scallop landings by trawl gear were 313,852 pounds (26%), and the landings by other gear types were 5,492 pounds (<1%).

Unlike the scallop landings, the landings for species other than scallops were primarily landed by trawl gear vessels. For example, the trawl gear sector landed 182,791 pounds of monkfish (97% of total), 333,171 pounds of squid (100% of total), 4.1 million pounds of multispecies (100% of total), 550,960 pounds of summer flounder (96% of total), and 990,521 pounds of other species (98% of total; see Table 48 for a list of species observed in the landings and categorized as ‘other’). The balance of the landings for each of these species was mostly landed by the dredge sector, while landings of these species is very small for the vessels using other gear types. The revenue for these species followed a similar pattern to landed quantity as described above.

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41 Some vessels occasionally use a modified scallop dredge to target monkfish when liver prices are high, but the Monkfish FMP now requires them to use a scallop day-at-sea to do so. Therefore the FMP has been very effective in stopping fishermen from using scallop dredges to target monkfish, because the revenue generated from scallop fishing has been higher than if it had been used to target monkfish.

Total landings of all species was predominately by trawl gear vessels with 6.7 million pounds (76% of total) valued at $7.0 million (60% of total). Number of vessels, number of trips, and catch distribution by gear sector were similar to that of the previous fishing years.

Although targeting various species by gear sector differs, the average scallop landings per trip is relatively similar. Vessels using dredges on trips that are not using a day-at-sea averaged 250 pounds of scallop meats per trips, while the average for trips using trawls was 208 pounds per trip (Table 43). This similarity can be explained from differences in trip length. Many of the dredge vessels targeting sea scallops are making short trips, of two days or less. Vessels using trawls to pursue other species have a broader range of trip lengths, often staying at sea for several days to a week or more.

7.1.1.1.1.3 By Permit Category and Gear Sector

The data are also available for further breakdown by permit category/ gear sector, as shown in Table 46. During the fishing year, three permit category/ gear sectors were very important in this fishing sector: full-time dredge, open access dredge, and open access trawl categories. The full-time dredge category accounted for 10% of vessels, 6% of the trips, and 8% of the scallop landings. The open access dredge category accounted for 30% of the vessels, 58% of the trips, and 56% of the total scallop landings. The open access trawl category was particularly important in landings of species other than scallops. This category accounted for 42% of the vessels, 28% of the trips, <1% of the scallop landings, and over 70% of the monkfish, squid, multispecies, other species, and all species landings.

Table 39. Summary of trips by permit category that landed less than or equal to 400 pounds of sea scallops, March 2000 through February 2001.

		Limited Access Permit Category			Open Access	All
		Full Time	Part Time	Occasional	General Category	Permits
Vessels	#	72	19	5	194	290
	% of row total	25%	7%	2%	67%	
Trips	#	342	279	17	1,590	2,228
	%	15%	13%	1%	71%	
Scallops	Lbs.	108,448	94,317	1,892	198,991	403,648 [1]
	%	27%	23%	<1%	49%	
	$	647,696	547,094	8,622	1,154,457	2,357,869
	%	27%	23%	<1%	49%	
Monkfish	Lbs.	6,654	4,913	619	165,430	177,616
	%	4%	3%	<1%	93%	
	$	15,579	8,954	1,282	369,910	395,725
	%	4%	2%	0%	93%	
Squid	Lbs.	114,325	6,156	631	172,570	293,682
	%	39%	2%	<1%	59%	
	$	31,911	2,722	418	102,135	137,186
	%	23%	2%	<1%	74%	
Multispecies[2]	Lbs.	101,862	1,228	104	3,357,326	3,460,520
	%	3%	<1%	<1%	97%	
	$	131,986	1,011	100	3,444,004	3,577,101
	%	4%	<1%	<1%	96%	
Summer Flounder	Lbs.	109,788	115,221	27,206	139,950	392,165
	%	28%	29%	7%	36%	
	$	122,586	142,113	42,505	183,734	490,938
	%	25%	29%	9%	37%	
Other Species[3]	Lbs.	77,831	17,100	5,254	1,702,556	1,802,741
	%	4%	1%	<1%	94%	
	$	24,914	5,256	3,862	796,449	830,481
	%	3%	1%	<1%	96%	
All Species	Lbs.	518,908	238,935	35,706	5,736,823	6,530,372
	%	8%	4%	1%	88%	
	$	974,672	707,150	56,789	6,050,689	7,789,300
	%	13%	9%	1%	78%	

Source: NMFS dealer and vessel permit data bases.

[1] Trips landing less than or equal to 400 lbs. of scallops, that were landed by unknown vessels have been excluded, and amount to 17,222 lbs.
[2] Includes the 10 regulated large mesh groundfish species.
[3] Includes skate, ocean quahog, lobster, whiting, dogfish, black sea bass, and others.

Table 40. Summary of trips by permit category that landed 400 pounds or less of sea scallops from March 1, 2001 through February 28, 2002.

		Limited Access			Open Access	Total
		Full Time	Part Time	Occasional	General	
Vessels[1]	#	63	26	8	274	371
	%	17%	7%	2%	74%	
Trips[1]	#	352	322	29	4,301	5,004
	%	7%	6%	1%	86%	
Scallops[2]	Lbs.	109,254	105,829	3,651	970,201	1,188,935
	%	9%	9%	0%	82%	
	$	510,728	536,235	15,614	4,218,513	5,281,090
	%	10%	10%	0%	80%	
American Lobster	Lbs.	0	78	0	27,334	27,412
	%	0%	0%	0%	100%	
	$	0	251	0	102,615	102,866
	%	0%	0%	0%	100%	
Black Sea Bass	Lbs.	23,217	14,390	5,063	47,309	89,979
	%	26%	16%	6%	53%	
	$	27,100	18,013	6,631	58,502	110,246
	%	25%	16%	6%	53%	
Bluefish	Lbs.	2,719	1,507	1,673	13,579	19,478
	%	14%	8%	9%	70%	
	$	646	463	335	5,269	6,713
	%	10%	7%	5%	78%	
Herring	Lbs.	30	0	0	0	30
	%	100%	0%	0%	0%	
	$	3	0	0	0	3
	%	100%	0%	0%	0%	
Monkfish	Lbs.	5,400	3,840	545	179,405	189,190
	%	3%	2%	0%	95%	
	$	7,007	4,556	788	267,958	280,309
	%	2%	2%	0%	96%	
Northeast Multi-Species[3]	Lbs.	114,570	84,657	7,647	3,925,770	4,132,644
	%	3%	2%	0%	95%	
	$	153,704	94,937	10,019	4,014,465	4,273,125
	%	4%	2%	0%	94%	
Ocean Quahog	Lbs.	0	0	0	1,156,880	1,156,880
	%	0%	0%	0%	100%	
	$	0	0	0	653,961	653,961
	%	0%	0%	0%	100%	
Scup	Lbs.	35	148	10	38,902	39,095
	%	0%	0%	0%	100%	
	$	14	98	3	15,340	15,455
	%	0%	1%	0%	99%	
Spiny Dogfish	Lbs.	0	0	0	7,488	7,488
	%	0%	0%	0%	100%	
	$	0	0	0	1,960	1,960
	%	0%	0%	0%	100%	
Squid/Mackerel/Butterfish	Lbs.	33,652	130,176	981	168,781	333,590
	%	10%	39%	0%	51%	
	$	17,450	75,227	626	123,981	217,284
	%	8%	35%	0%	57%	
Summer Flounder	Lbs.	168,418	143,238	37,694	226,893	576,243
	%	29%	25%	7%	39%	
	$	140,316	120,002	47,821	280,093	588,232
	%	24%	20%	8%	48%	
Tilefish	Lbs.	0	0	0	147	147
	%	0%	0%	0%	100%	
	$	0	0	0	111	111
	%	0%	0%	0%	100%	
Other Species[4]	Lbs.	80,635	7,243	55	924,020	1,011,953
	%	8%	1%	0%	91%	
	$	30,503	1,132	20	250,842	282,497
	%	11%	0%	0%	89%	
All Species	Lbs.	537,930	491,106	57,319	7,686,709	8,773,064
	%	6%	6%	1%	88%	
	$	887,471	850,914	81,857	9,993,610	11,813,852
	%	8%	7%	1%	85%	

Source: NMFS dealer weighout and vessel permit databases.

[1] This total represents a unique count. Vessels may have used more than one gear type.
[2] Trips landed by unknown vessels have been excluded
[3] Includes the 10 regulated large mesh groundfish species.
[4] Includes all species listed in Table 4

Table 41. Summary of trips by permit category that landed 400 pounds or less of sea scallops from March 1, 2002 through December 31, 2002, preliminary.

		Limited Access			Open Access	Total
		Full Time	Part Time	Occasional	General	
Vessels[1]	#	48	16	7	270	341
	%	14%	5%	2%	79%	
Trips[1]	#	119	178	23	3,158	3,478
	%	3%	5%	1%	91%	
Scallops[2]	Lbs.	29,394	63,155	3,763	660,234	756,546
	%	4%	8%	0%	87%	
	$	123,407	279,383	16,721	2,994,612	3,414,123
	%	4%	8%	0%	88%	
American Lobster	Lbs.	1,835	0	22	14,662	16,519
	%	11%	0%	0%	89%	
	$	8,291	0	81	62,782	71,154
	%	12%	0%	0%	88%	
Black Sea Bass	Lbs.	4,615	939	364	12,838	18,756
	%	25%	5%	2%	68%	
	$	6,760	1,151	527	20,206	28,644
	%	24%	4%	2%	71%	
Bluefish	Lbs.	1,467	264	833	11,597	14,161
	%	10%	2%	6%	82%	
	$	1,099	105	245	4,247	5,696
	%	19%	2%	4%	75%	
Monkfish	Lbs.	28,180	3,072	1,373	164,633	197,258
	%	14%	2%	1%	83%	
	$	31,096	3,308	1,122	225,714	261,240
	%	12%	1%	0%	86%	
Northeast Multi-Species[3]	Lbs.	95,105	107,211	14,303	2,142,191	2,358,810
	%	4%	5%	1%	91%	
	$	102,973	120,837	6,930	2,381,849	2,612,589
	%	4%	5%	0%	91%	
Scup	Lbs.	283	10	433	5,744	6,470
	%	4%	0%	7%	89%	
	$	283	4	139	5,568	5,994
	%	5%	0%	2%	93%	
Spiny Dogfish	Lbs.	0	0	0	1,500	1,500
	%	0%	0%	0%	100%	
	$	0	0	0	249	249
	%	0%	0%	0%	100%	
Squid/Mackerel/Butterfish	Lbs.	181	11,859	9,818	477,479	499,337
	%	0%	2%	2%	96%	
	$	153	8,519	7,974	226,127	242,773
	%	0%	4%	3%	93%	
Summer Flounder	Lbs.	127,894	53,473	52,807	320,410	554,584
	%	23%	10%	10%	58%	
	$	124,739	63,612	59,401	402,277	650,029
	%	19%	10%	9%	62%	
Tilefish	Lbs.	0	0	11	196	207
	%	0%	0%	5%	95%	
	$	0	0	14	208	222
	%	0%	0%	6%	94%	
Other Species[4]	Lbs.	17,883	1,558	663	494,344	514,448
	%	3%	0%	0%	96%	
	$	5,612	962	488	155,272	162,334
	%	3%	1%	0%	96%	
All Species	Lbs.	306,837	241,541	84,390	4,305,828	4,938,596
	%	6%	5%	2%	87%	
	$	404,413	477,881	93,642	6,479,111	7,455,047
	%	5%	6%	1%	87%	

Source: NMFS dealer weighout and vessel permit databases.

[1] This total represents a unique count. Vessels may have used more than one gear type.
[2] Trips landed by unknown vessels have been excluded
[3] Includes the 10 regulated large mesh groundfish species.
[4] Includes all species listed in Table 8

Table 42. Summary of trips by gear category that landed less than or equal to 400 pounds of sea scallops, March 2000 through February 2001.

		All Categories (Limited Access and Open Access			
		Dredge	Trawl	Other	Total
Vessels	#	119	200	10	290 [1]
	% of row total	41%	69%	3%	
Trips	#	1,188	1,019	54	2,228 [1]
	%	53%	46%	2%	
Scallops	Lbs.	270,466	124,539	8,643	403,648 [2]
	%	67%	31%	2%	
	$	1,639,292	678,513	40,064	2,357,869
	%	70%	29%	2%	
Monkfish	Lbs.	6,367	168,963	2,286	177,616
	%	4%	95%	1%	
	$	15,603	376,973	3,149	395,725
	%	4%	95%	1%	
Squid	Lbs.	0	293,675	7	293,682
	%	0%	100%	<1%	
	$	0	137,179	7	137,186
	%	0%	100%	<1%	
Multispecie	Lbs.	1,147	3,454,444	4,929	3,460,520
	%	0%	100%	<1%	
	$	887	3,571,443	4,771	3,577,101
	%	<1%	100%	<1%	
Summer Fl	Lbs.	2,386	389,724	55	392,165
	%	1%	99%	<1%	
	$	3,990	486,804	144	490,938
	%	1%	99%	<1%	
Other Spec	Lbs.	832,434	967,907	2,400	1,802,741
	%	46%	54%	<1%	
	$	361,201	467,465	1,815	830,481
	%	43%	56%	<1%	
All Species	Lbs.	1,112,800	5,399,252	18,320	6,530,372
	%	17%	83%	<1%	
	$	2,020,973	5,718,377	49,950	7,789,300
	%	26%	73%	1%	

Source: NMFS dealer and vessel permit data bases.

[1] This total represents a unique count. Vessels may have used

[2] Trips landing less than or equal to 400 lbs. of scallops, that were

[3] Includes the 10 regulated large mesh groundfish species.

[4] Includes skate, ocean quahog, lobster, whiting, dogfish, black sea bass, and others.

Table 43. Summary of trips by gear category that landed 400 pounds or less of sea scallops from March 1, 2001 through February 28, 2002.

		All Categories (Limited Access and Open Access)			
		Dredge	Trawl	Other	Grand Total
Vessels[1]	#	180	230	8	371
	%	43%	55%	2%	
Trips[1]	#	3,485	1,507	29	5,004
	%	69%	30%	1%	
Scallops[2]	Lbs.	869,591	313,852	5,492	1,188,935
	%	73%	26%	0%	
	$	4,040,032	1,217,553	23,505	5,281,090
	%	76%	23%	0%	
American Lobster	Lbs.	27	27,371	14	27,412
	%	0%	100%	0%	
	$	88	102,718	60	102,866
	%	0%	100%	0%	
Black Sea Bass	Lbs.	0	89,979	0	89,979
	%	0%	100%	0%	
	$	0	110,246	0	110,246
	%	0%	100%	0%	
Bluefish	Lbs.	1,046	18,432	0	19,478
	%	5%	95%	0%	
	$	236	6,477	0	6,713
	%	4%	96%	0%	
Herring	Lbs.	0	30	0	30
	%	0%	100%	0%	
	$	0	3	0	3
	%	0%	100%	0%	
Monkfish	Lbs.	5,988	182,791	411	189,190
	%	3%	97%	0%	
	$	9,576	270,171	562	280,309
	%	3%	96%	0%	
Northeast Multi-Species[3]	Lbs.	885	4,129,482	2,277	4,132,644
	%	0%	100%	0%	
	$	785	4,270,028	2,312	4,273,125
	%	0%	100%	0%	
Ocean Quahog	Lbs.	1,156,880	0	0	1,156,880
	%	100%	0%	0%	
	$	653,961	0	0	653,961
	%	100%	0%	0%	
Scup	Lbs.	0	39,095	0	39,095
	%	0%	100%	0%	
	$	0	15,455	0	15,455
	%	0%	100%	0%	
Spiny Dogfish	Lbs.	0	7,488	0	7,488
	%	0%	100%	0%	
	$	0	1,960	0	1,960
	%	0%	100%	0%	
Squid/Mackerel/Butterfish	Lbs.	419	333,171	0	333,590
	%	0%	100%	0%	
	$	298	216,986	0	217,284
	%	0%	100%	0%	
Summer Flounder	Lbs.	21,328	550,960	3,955	576,243
	%	4%	96%	1%	
	$	17,525	560,028	10,679	588,232
	%	3%	95%	2%	
Tilefish	Lbs.	0	147	0	147
	%	0%	100%	0%	
	$	0	111	0	111
	%	0%	100%	0%	
Other Species[4]	Lbs.	21,397	990,521	35	1,011,953
	%	2%	98%	0%	
	$	10,886	271,595	16	282,497
	%	4%	96%	0%	
All Species	Lbs.	2,077,561	6,683,319	12,184	8,773,064
	%	24%	76%	0%	
	$	4,733,387	7,043,331	37,134	11,813,852
	%	40%	60%	0%	

Source: NMFS dealer weighout and vessel permit databases.

[1] This total represents a unique count. Vessels may have used more than one gear type.
[2] Trips landed by unknown vessels have been excluded
[3] Includes the 10 regulated large mesh groundfish species.

Table 44. Summary of trips by gear category that landed 400 pounds or less of sea scallops from March 1, 2002 through December 31, 2002.

		All Categories (Limited Access and Open Access)			
		Dredge	Trawl	Other	Grand Total
Vessels[1]	#	180	205	5	341
	%	46%	53%	1%	
Trips[1]	#	2,430	1,035	16	3,478
	%	70%	30%	0%	
Scallops[2]	Lbs.	518,962	236,500	1,084	756,546
	%	69%	31%	0%	
	$	2,436,205	970,379	7,539	3,414,123
	%	71%	28%	0%	
American Lobster	Lbs.	2,580	13,939	0	16,519
	%	16%	84%	0%	
	$	11,783	59,371	0	71,154
	%	17%	83%	0%	
Black Sea Bass	Lbs.	0	18,756	0	18,756
	%	0%	100%	0%	
	$	0	28,644	0	28,644
	%	0%	100%	0%	
Bluefish	Lbs.	0	14,066	95	14,161
	%	0%	99%	1%	
	$	0	5,639	57	5,696
	%	0%	99%	1%	
Monkfish	Lbs.	30,796	166,357	105	197,258
	%	16%	84%	0%	
	$	35,311	225,836	93	261,240
	%	14%	86%	0%	
Northeast Multi-Species[3]	Lbs.	2,477	2,355,647	686	2,358,810
	%	0%	100%	0%	
	$	2,963	2,608,813	813	2,612,589
	%	0%	100%	0%	
Scup	Lbs.	0	6,470	0	6,470
	%	0%	100%	0%	
	$	0	5,994	0	5,994
	%	0%	100%	0%	
Spiny Dogfish	Lbs.	0	900	600	1,500
	%	0%	60%	40%	
	$	0	159	90	249
	%	0%	64%	36%	
Squid/Mackerel/Butterfish	Lbs.	0	499,337	0	499,337
	%	0%	100%	0%	
	$	0	242,773	0	242,773
	%	0%	100%	0%	
Summer Flounder	Lbs.	76	554,508	0	554,584
	%	0%	100%	0%	
	$	149	649,880	0	650,029
	%	0%	100%	0%	
Tilefish	Lbs.	0	207	0	207
	%	0%	100%	0%	
	$	0	222	0	222
	%	0%	100%	0%	
Other Species[4]	Lbs.	15,758	498,690	0	514,448
	%	3%	97%	0%	
	$	5,199	157,135	0	162,334
	%	3%	97%	0%	
All Species	Lbs.	570,649	4,365,377	2,570	4,938,596
	%	12%	88%	0%	
	$	2,491,610	4,954,845	8,592	7,455,047
	%	33%	66%	0%	

Source: NMFS dealer weighout and vessel permit databases.

[1] This total represents a unique count. Vessels may have used more than one gear type.

[2] Trips landed by unknown vessels have been excluded

[3] Includes the 10 regulated large mesh groundfish species.

[4] Includes all species listed in Table 8

Table 45. Summary of trips that landed less than or equal to 400 pounds of sea scallops, March 2000 through February 2001 for limited access and open access scallop permits.

		Limited Access Permit Categories												Open Access Permit Category			
		Full Time				Part Time				Occasional							
		Dredge	Trawl	Other	Total	Dredge	Trawl	Other	Total	Dredge	Trawl	Other	Total	Dredge	Trawl	Other	Total
Vessels	#	55	22	1	72	8	13	1	19	0	5	0	5	56	160	8	194
	%	19%	8%	<1%	25%	3%	4%	<1%	7%		2%		2%	19%	55%	3%	67%
Trips	#	297	48	1	342	233	45	1	279	0	17	0	17	658	909	52	1,590
	%	13%	2%	<1%	15%	10%	2%	<1%	13%		1%		1%	30%	41%	2%	71%
Scallops	Lbs.	98,548	9,900	0	108,448	83,912	10,388	17	94,317		1,892		1,892	88,006	102,359	8,626	198,991
	%	24%	2%		27%	21%	3%	<1%	23%		<1%		<1%	22%	25%	2%	49%
	$	590,083	57,613	0	647,696	495,109	51,909	76	547,094		8,622		8,622	554,100	560,369	39,988	1,154,457
	%	25%	2%		27%	21%	2%	<1%	23%		<1%		<1%	24%	24%	2%	49%
Monkfish	Lbs.	3,399	3,255	0	6,654	1,336	3,577	0	4,913		619		619	1,632	161,512	2,286	165,430
	%	2%	2%		4%	1%	2%		3%		<1%		<1%	1%	91%	1%	93%
	$	8,446	7,133	0	15,579	3,126	5,828	0	8,954		1,282		1,282	4,031	362,730	3,149	369,910
	%	2%	2%		4%	1%	1%		2%		<1%		<1%	1%	92%	1%	93%
Squid	Lbs.	0	114,325	0	114,325	0	6,156	0	6,156		631		631	0	172,563	7	172,570
	%		39%		39%		2%		2%		<1%		<1%		59%	<1%	59%
	$	0	31,911	0	31,911	0	2,722	0	2,722		418		418	0	102,128	7	102,135
	%		23%		23%		2%		2%		<1%		<1%		74%	<1%	74%
Multi-Species	Lbs.	397	101,465	0	101,862	740	488	0	1,228		104		104	10	3,352,387	4,929	3,357,326
	%	<1%	3%		3%	<1%	0%		<1%		<1%		<1%	<1%	97%	<1%	97%
	$	234	131,752	0	131,986	646	365	0	1,011		100		100	7	3,439,226	4,771	3,444,004
	%	<1%	4%		4%	<1%	0%		0%		<1%		<1%	<1%	96%	<1%	96%
Summer Flounder	Lbs.	1,216	108,572	0	109,788	1,170	114,051	0	115,221		27,206		27,206	0	139,895	55	139,950
	%	<1%	28%		28%	<1%	29%		29%		7%		7%		36%	<1%	36%
	$	1,891	120,695	0	122,586	2,099	140,014	0	142,113		42,505		42,505	0	183,590	144	183,734
	%	<1%	25%		25%	<1%	29%		29%		9%		9%		37%	<1%	37%
Other Species	Lbs.	213	76,113	1505	77,831	670	16,430	0	17,100		5,254		5,254	831,551	870,110	895	1,702,556
	%	<1%	4%	<1%	4%	<1%	1%		1%		<1%		<1%	46%	48%	<1%	94%
	$	896	22,680	1,338	24,914	181	5,075	0	5,256		3,862		3,862	360,124	435,848	477	796,449
	%	<1%	3%	<1%	3%	<1%	1%		1%		<1%		<1%	43%	52%	<1%	96%
All Species	Lbs.	103,773	413,630	1505	518,908	87,828	151,090	17	238,935	0	35,706	0	35,706	921,199	4,798,826	16,798	5,736,823
	%	2%	6%	<1%	8%	1%	2%	<1%	4%		1%		1%	14%	73%	<1%	88%
	$	601,550	371,784	1,338	974,672	501,161	205,913	76	707,150	0	56,789	0	56,789	918,262	5,083,891	48,536	6,050,689
	%	8%	5%	<1%	13%	6%	3%	<1%	9%		1%		1%	12%	65%	<1%	78%

Table 46. Summary table for all categories and gear types for trips landing 400 pounds or less of sea scallops from March 1, 2001 through February 28, 2002.

		Limited Access Permit Categories										
		Full Time				Part Time				Occasional		
		Dredge	Trawl	Other	Total	Dredge	Trawl	Other	Total	Dredge	Trawl	Other
Vessels[1]	#	43	28	0	71	9	19	0	28	1	7	0
	%	10%	7%	0%	17%	2%	5%	0%	7%	0%	2%	0%
Trips[1]	#	300	53	0	353	281	41	0	322	9	20	0
	%	6%	1%	0%	7%	6%	1%	0%	6%	0%	0%	0%
Scallops2	Lbs.	98,541	10,713	0	109,254	100,659	5,170	-	105,829	694	2,957	0
	%	8%	1%	0%	9%	8%	0%	0	9%	0%	0%	0%
	$	464,578	46,150	0	510,728	517,743	18,492	0	536,235	5,791	9,823	0
	%	9%	1%	0%	10%	10%	0%	0	10%	0%	0%	0%
American Lobster	Lbs.	-	-	0	-	-	78	0	78	0	0	0
	%	0%	0%	0%	0%	0%	0%	0	0%	0%	0	0%
	$	0	0	0	0	0	251	0	251	0	0	0
	%	0%	0%	0%	0%	0%	0%	0	0%	0%	0	0%
Black Sea Bass	Lbs.	0	23,217	0	23,217	0	14,390	0	14,390	0	5,063	0
	%	0%	26%	0%	26%	0%	16%	0	16%	0%	6%	0%
	$	0	27,100	0	27,100	0	18,013	0	18,013	0	6,631	0
	%	0%	25%	0%	25%	0%	16%	0	16%	0%	6%	0%
Bluefish	Lbs.	1,046	1,673	0	2,719	-	1,507	0	1,507	0	1,673	0
	%	5%	9%	0%	14%	0%	8%	0	8%	0%	9%	0%
	$	236	410	0	646	0	463	0	463	0	335	0
	%	4%	6%	0%	10%	0%	7%	0	7%	0%	5%	0%
Herring	Lbs.	0	30	0	30	0	-	0	-	0	-	0
	%	0%	100%	0%	100%	0%	0%	0	0%	0%	0%	0%
	$	0	3	0	3	0	0	0	0	0	0	0
	%	0%	100%	0%	100%	0%	0%	0	0%	0%	0%	0%
Monkfish	Lbs.	724	4,676	0	5,400	204	3,636	0	3,840	0	545	0
	%	0%	2%	0%	3%	0%	2%	0	2%	0%	0%	0%
	$	969	6,038	0	7,007	387	4,169	0	4,556	0	788	0
	%	0%	2%	0%	2%	0%	1%	0	2%	0%	0%	0%
Northeast Multi-Species3	Lbs.	6	114,564	0	114,570	0	84,657	0	84,657	0	7,647	0
	%	0%	3%	0%	3%	0%	2%	0	2%	0%	0%	0%
	$	9	153,695	0	153,704	0	94,937	0	94,937	0	10,019	0
	%	0%	4%	0%	4%	0%	2%	0	2%	0%	0%	0%
Ocean Quahog	Lbs.	0	-	0	-	0	-	0	-	0	-	0
	%	0%	0%	0%	0%	0%	0%	0	0%	0%	0%	0%
	$	0	0	0	0	0	0	0	0	0	0	0
	%	0%	0%	0%	0%	0%	0%	0	0%	0%	0%	0%
Scup	Lbs.	0	35	0	35	0	148	0	148	0	10	0
	%	0%	0%	0%	0%	0%	0%	0	0%	0%	0%	0%
	$	0	14	0	14	0	98	0	98	0	3	0
	%	0%	0%	0%	0%	0%	1%	0	1%	0%	0%	0%
Spiny Dogfish	Lbs.	0	-	0	-	0	-	0	-	0	-	0
	%	0%	0%	0%	0%	0%	0%	0	0%	0%	0%	0%
	$	0	0	0	0	0	0	0	0	0	0	0
	%	0%	0%	0%	0%	0%	0%	0	0%	0%	0%	0%
Squid/Mackerel/Butterfish	Lbs.	419	33,233	0	33,652	0	130,176	0	130,176	0	981	0
	%	0%	10%	0%	10%	0%	39%	0	39%	0%	0%	0%
	$	298	17,152	0	17,450	0	75,227	0	75,227	0	626	0
	%	0%	8%	0%	8%	0%	35%	0	35%	0%	0%	0%
Summer Flounder	Lbs.	20,647	147,771	0	168,418	59	143,179	0	143,238	0	37,694	0
	%	4%	26%	0%	29%	0%	25%	0	25%	0%	7%	0%
	$	15,883	124,433	0	140,316	118	119,884	0	120,002	0	47,821	0
	%	3%	21%	0%	24%	0%	20%	0	20%	0%	8%	0%
Tilefish	Lbs.	0	-	0	-	0	-	0	-	0	-	0
	%	0%	0%	0%	0%	0%	0%	0	0%	0%	0%	0%
	$	0	0	0	0	0	0	0	0	0	0	0
	%	0%	0%	0%	0%	0%	0%	0	0%	0%	0%	0%
Other Species4	Lbs.	10,218	70,417	0	80,635	0	7,243	0	7,243	0	55	0
	%	1%	7%	0%	8%	0%	1%	0	1%	0%	0%	0%
	$	4,986	25,517	0	30,503	0	1,132	0	1,132	0	20	0
	%	2%	9%	0%	11%	0%	0%	0	0%	0%	0%	0%
All Species	Lbs.	131,601	406,329	0	537,930	100,922	390,184	0	491,106	694	56,625	0
	%	2%	5%	0%	6%	1%	4%	0	6%	0%	1%	0%
	$	486,959	400,512	0	887,471	518,248	332,666	0	850,914	5,791	76,066	0
	%	4%	3%	0%	8%	4%	3%	0	7%	0%	1%	0%

Source: NMFS dealer weighout and vessel permit databases.

[1]This total represents a unique count. Vessels may have used more than one gear type.
[2]Trips landed by unknown vessels have been excluded
[3] Includes the 10 regulated large mesh groundfish species.

Table 47. Summary table for all categories and gear types for trips landing 400 pounds or less of sea scallops from March 1, 2001 through December 31, 2002.

		Limited Access Permit Categories										
		Full Time				Part Time				Occasional		
		Dredge	Trawl	Other	Total	Dredge	Trawl	Other	Total	Dredge	Trawl	Other
Vessels[1]	#	30	21	0	51	6	13	0	19	1	6	0
	%	8%	5%	0%	13%	2%	3%	0%	5%	0%	2%	0%
Trips[1]	#	88	31	0	119	138	40	0	178	7	16	0
	%	3%	1%	0%	3%	4%	1%	0%	5%	0%	0%	0%
Scallops2	Lbs.	25,197	4,197	0	29,394	52,231	10,924	-	63,155	372	3,391	0
	%	3%	1%	0%	4%	7%	1%	0	8%	0%	0%	0%
	$	107,289	16,118	0	123,407	232,389	46,994	0	279,383	3,393	13,328	0
	%	3%	0%	0%	4%	7%	1%	0	8%	0%	0%	0%
American Lobster	Lbs.	1,685	150	0	1,835	-	-	0	-	0	22	0
	%	10%	1%	0%	11%	0%	0%	0	0%	0%	0%	0%
	$	7,691	600	0	8,291	0	0	0	0	0	81	0
	%	11%	1%	0%	12%	0%	0%	0	0%	0%	0%	0%
Black Sea Bass	Lbs.	0	4,615	0	4,615	0	939	0	939	0	364	0
	%	0%	25%	0%	25%	0%	5%	0	5%	0%	2%	0%
	$	0	6,760	0	6,760	0	1,151	0	1,151	0	527	0
	%	0%	24%	0%	24%	0%	4%	0	4%	0%	2%	0%
Bluefish	Lbs.	-	1,467	0	1,467	-	264	0	264	0	833	0
	%	0%	10%	0%	10%	0%	2%	0	2%	0%	6%	0%
	$	0	1,099	0	1,099	0	105	0	105	0	245	0
	%	0%	19%	0%	19%	0%	2%	0	2%	0%	4%	0%
Monkfish	Lbs.	23,125	5,055	0	28,180	33	3,039	0	3,072	0	1,373	0
	%	12%	3%	0%	14%	0%	2%	0	2%	0%	1%	0%
	$	25,265	5,831	0	31,096	29	3,279	0	3,308	0	1,122	0
	%	10%	2%	0%	12%	0%	1%	0	1%	0%	0%	0%
Northeast Multi-Species3	Lbs.	75	95,030	0	95,105	-	107,211	0	107,211	0	14,303	0
	%	0%	4%	0%	4%	0%	5%	0	5%	0%	1%	0%
	$	133	102,840	0	102,973	0	120,837	0	120,837	0	6,930	0
	%	0%	4%	0%	4%	0%	5%	0	5%	0%	0%	0%
Scup	Lbs.	0	283	0	283	0	10	0	10	0	433	0
	%	0%	4%	0%	4%	0%	0%	0	0%	0%	7%	0%
	$	0	283	0	283	0	4	0	4	0	139	0
	%	0%	5%	0%	5%	0%	0%	0	0%	0%	2%	0%
Spiny Dogfish	Lbs.	0	-	0	-	0	-	0	-	0	-	0
	%	0%	0%	0%	0%	0%	0%	0	0%	0%	0%	0%
	$	0	0	0	0	0	0	0	0	0	0	0
	%	0%	0%	0%	0%	0%	0%	0	0%	0%	0%	0%
Squid/Mackerel/Butterfish	Lbs.	0	181	0	181	0	11,859	0	11,859	0	9,818	0
	%	0%	0%	0%	0%	0%	2%	0	2%	0%	2%	0%
	$	0	153	0	153	0	8,519	0	8,519	0	7,974	0
	%	0%	0%	0%	0%	0%	4%	0	4%	0%	3%	0%
Summer Flounder	Lbs.	64	127,830	0	127,894	0	53,473	0	53,473	0	52,807	0
	%	0%	23%	0%	23%	0%	10%	0	10%	0%	10%	0%
	$	136	124,603	0	124,739	0	63,612	0	63,612	0	59,401	0
	%	0%	19%	0%	19%	0%	10%	0	10%	0%	9%	0%
Tilefish	Lbs.	0	-	0	-	0	-	0	-	0	11	0
	%	0%	0%	0%	0%	0%	0%	0	0%	0%	5%	0%
	$	0	0	0	0	0	0	0	0	0	14	0
	%	0%	0%	0%	0%	0%	0%	0	0%	0%	6%	0%
Other Species4	Lbs.	8,330	9,553	0	17,883	0	1,558	0	1,558	0	663	0
	%	2%	2%	0%	3%	0%	0%	0	0%	0%	0%	0%
	$	2,499	3,113	0	5,612	0	962	0	962	0	488	0
	%	2%	2%	0%	3%	0%	1%	0	1%	0%	0%	0%
All Species	Lbs.	58,476	248,361	0	306,837	52,264	189,277	0	241,541	372	84,018	0
	%	1%	5%	0%	6%	1%	4%	0	5%	0%	2%	0%
	$	143,013	261,400	0	404,413	232,418	245,463	0	477,881	3,393	90,249	0
	%	2%	4%	0%	5%	3%	3%	0	6%	0%	1%	0%

Source: NMFS dealer weighout and vessel permit databases.

[1] This total represents a unique count. Vessels may have used more than one gear type.
[2] Trips landed by unknown vessels have been excluded
[3] Includes the 10 regulated large mesh groundfish species.
[4] Includes all species listed in Table 8

Table 48. List of other species included in the general category landings summary tables above.

2001	2002
BASS, STRIPED	CONCHS
BONITO	CRAB, HORSESHOE
CLAM NK	CRAB, NK
CLAM, RAZOR	CRAB, ROCK
CONCHS	CROAKER, ATLANTIC
CRAB, HORSESHOE	CUSK
CRAB, JONAH	DOGFISH SMOOTH
CRAB, NK	DRUM, BLACK
CRAB, ROCK	EEL, CONGER
CROAKER, ATLANTIC	FLOUNDER, FOURSPOT
CUSK	FLOUNDERS (NK)
DOGFISH SMOOTH	HERRING (NK)
EEL, CONGER	JOHN DORY
FLOUNDER, FOURSPOT	MACKEREL, CHUB
HERRING (NK)	MULLETS
HOGFISH	OCTOPUS
JOHN DORY	OTHER FISH
MACKEREL, SPANISH	PUFFER, NORTHERN
OCTOPUS	SEA ROBINS
OTHER FISH	SHAD, AMERICAN
OTHER GRNDFISH	SHARK, LARGE COASTAL
SEA ROBINS	SHARK, NK
SEA URCHINS	SHEEPSHEAD
SHARK, MAKO SHORTFIN	SKATES
SHARK, NK	SPADEFISH
SHARK, THRESHER	SPOT
SKATES	SQUIDS (NS)
SWORDFISH	SWORDFISH
TAUTOG	TAUTOG
TRIGGERFISH	TILEFISH, GOLDEN
WEAKFISH, SPOTTED	TRIGGERFISH
WEAKFISH, SQUETEAGUE	TUNA, LITTLE
WHELK, CHANNELED	WEAKFISH, SQUETEAGUE
WHELK, KNOBBED	WHELK, CHANNELED
WHITING, KING	WHELK, KNOBBED
WOLFFISHES	WHELK, LIGHTNING
	WHITING, KING
	WOLFFISHES

The overall number of vessels and scallop landings increased for both general category and limited access vessels (Figure 16 and Figure 17) in 2001, as has the number of vessels landing above annual thresholds (Figure 18 and Figure 19). The general category vessels, however, had a participation peak in 1997 and 2001, compared to a dip in the participation level among limited access vessels in the 1997-98 period. These relative differences also characterize the ports that are dominated by the different permit categories (see following section). Moreover, despite a much larger jump in landings by general category vessels between 1999 and 2001, the share of total landings by general category vessels has actually *decreased* during that period, though total effort (size of crew times days absent) has remained relatively constant (Table 49).

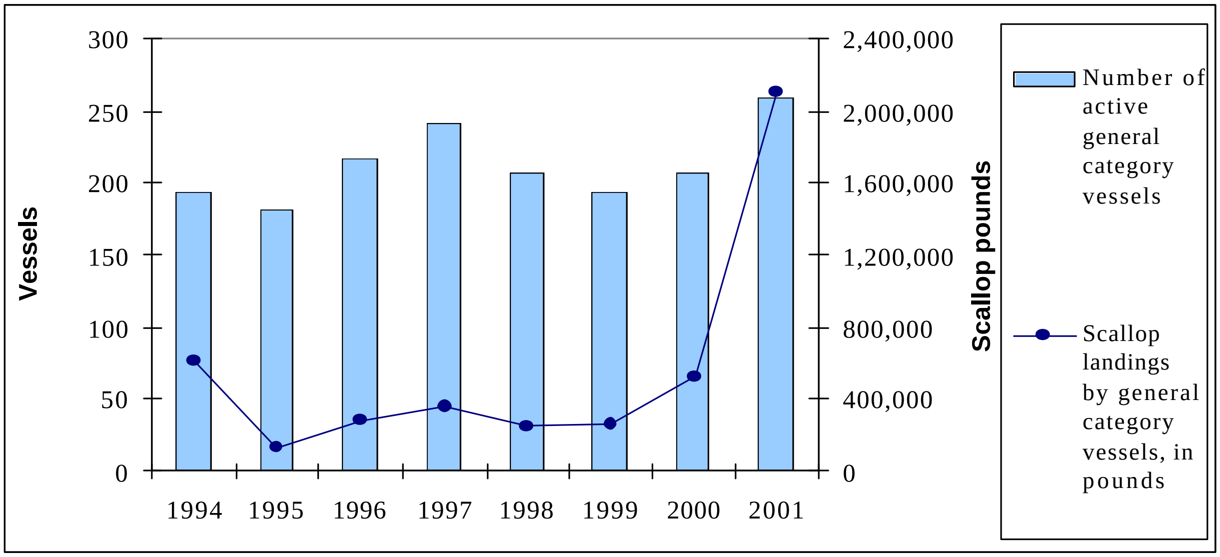

Figure 16. Number of active general category vessels with scallops landed. Source: NE permit and dealer weighout.

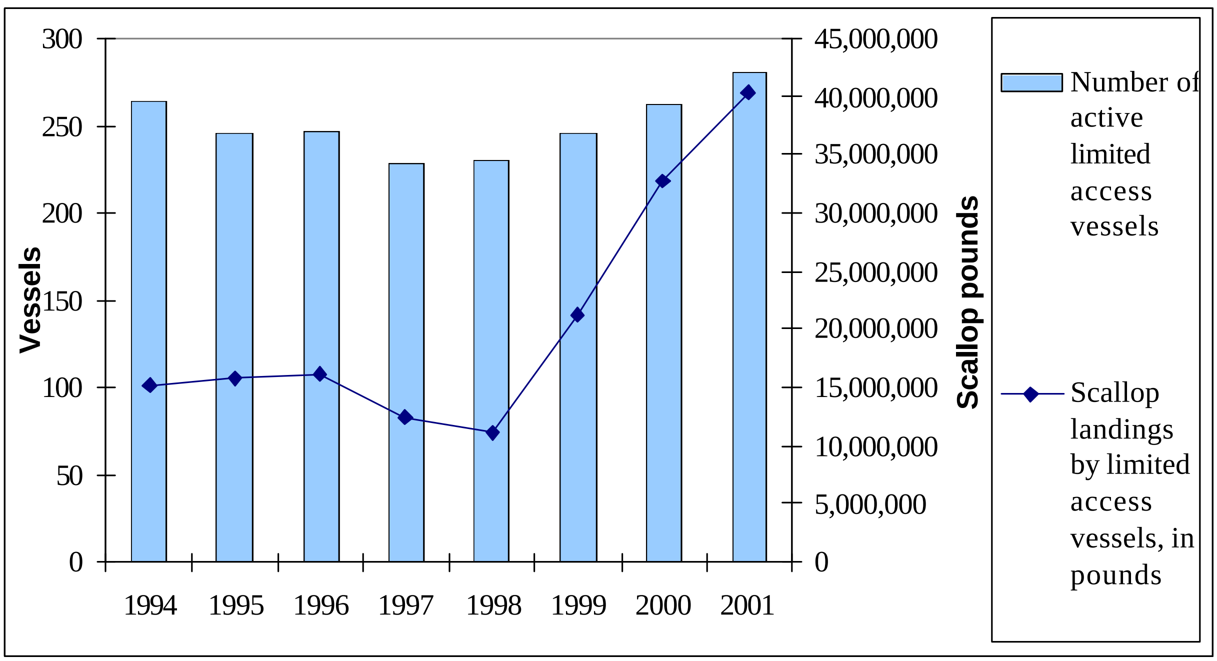

Figure 17. Number of active limited access vessels with scallops landed. Source: NE permit and dealer weighout.

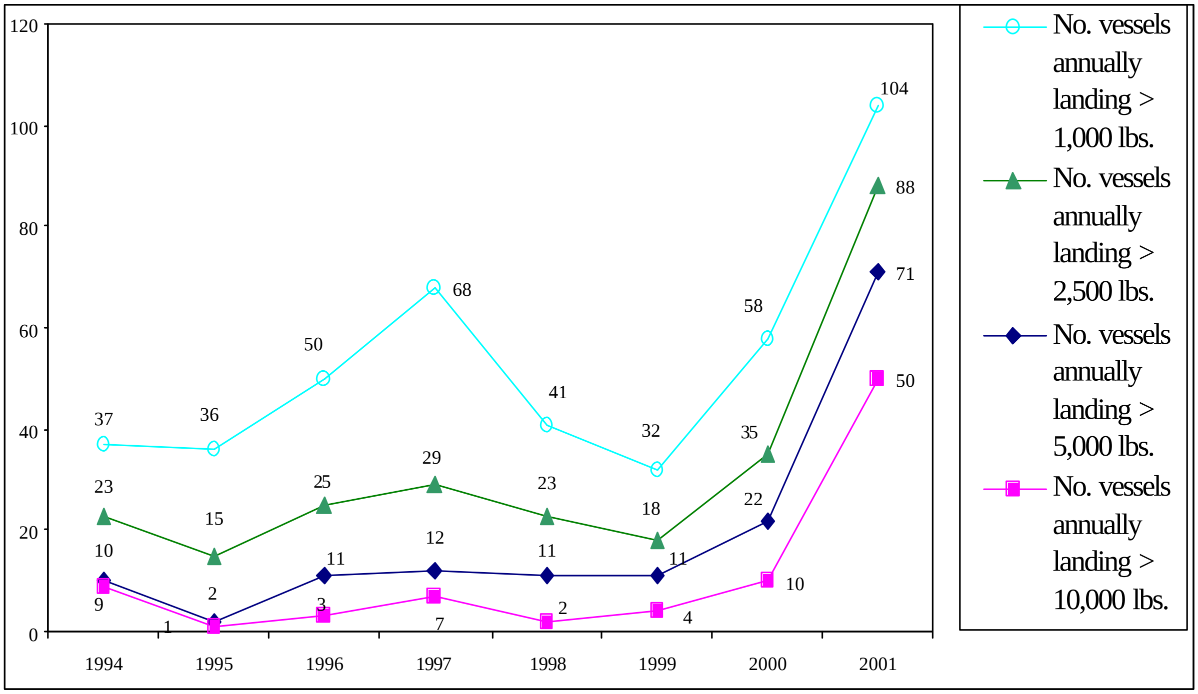

Figure 18. Number of general category vessels with landings greater than 1000, 2500, 5000 and/or 10000 pounds of scallops annually. Source: NE Region permit, logbook, and dealer weighout data.

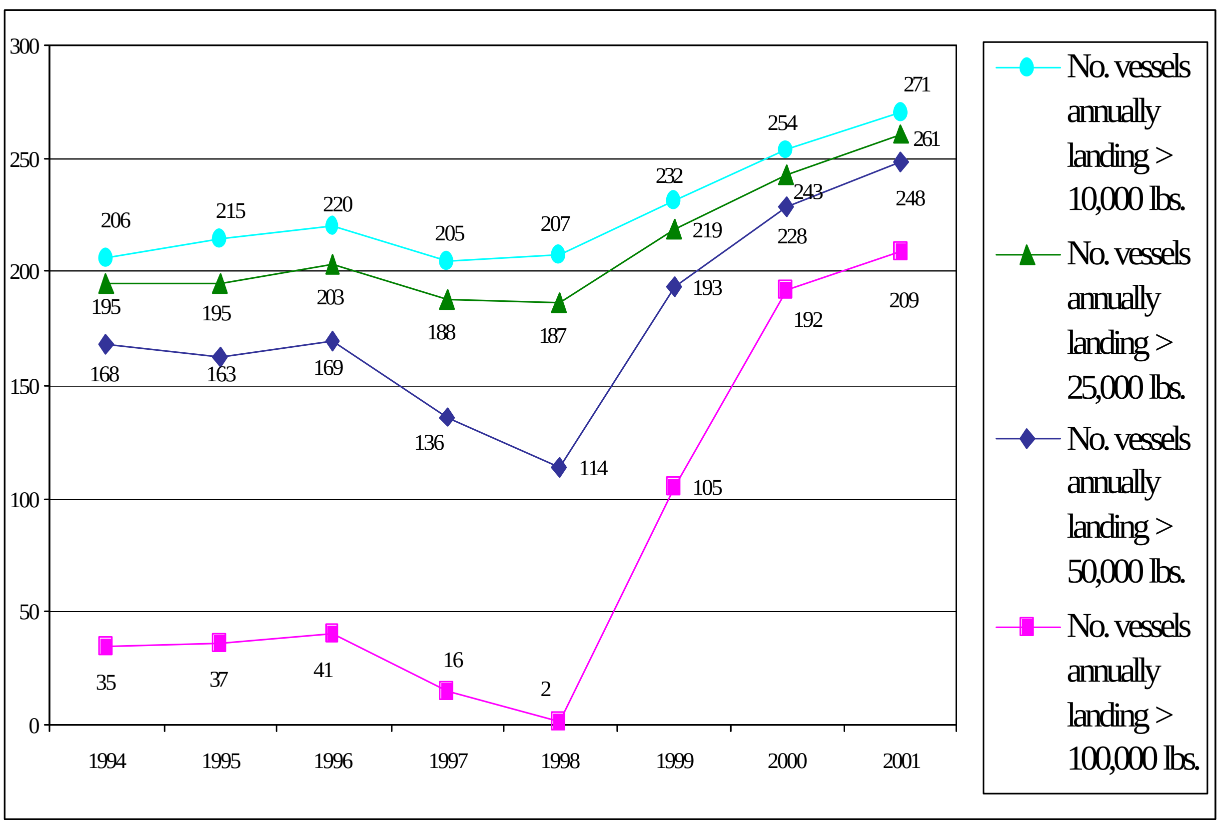

Figure 19. Number of limited access vessels with landings greater than 10000, 25000, 50000 and/or 100000 pounds of scallops annually. Source: NE Region permit and dealer weighout data.

Table 49. Landings and Effort from Scallop Vessels, 1997-2000. Source: logbooks

Fishing year	Scallops landed (lbs) by permitted vessels	% by General Category vessels	% by Limited Access vessels	Total effort by permitted vessels	% by General Category vessels	% by Limited Access vessels
1997	12,750,378	5.0	95.0	181,600	4.4	95.6
1998	11,723,006	4.3	95.7	164,027	4.7	95.3
1999	21,746,977	1.8	98.2	157,539	3.7	96.3
2000	32,676,540	1.9	98.1	176,921	4.1	95.9

7.1.1.1.2 Landings by limited access scallop vessels

A look at other species caught by scallop vessels shows a related pattern. For full-time vessels, scallops account for 92% of catch value (Figure 20). This drops to 57% for part-time vessels (though scallops are of increasing importance during 1994-2001) and 3% for occasional vessels (Figure 21 and Figure 22). The general category (Figure 23) and occasional vessels, and to a lesser extent part-time vessels, show the kind of flexible pattern of fishing often associated with "traditional" or smaller-scale fishing enterprises (Table 50); these fishing patterns are also associated with different gears, ports, and fishing grounds (see following sections).

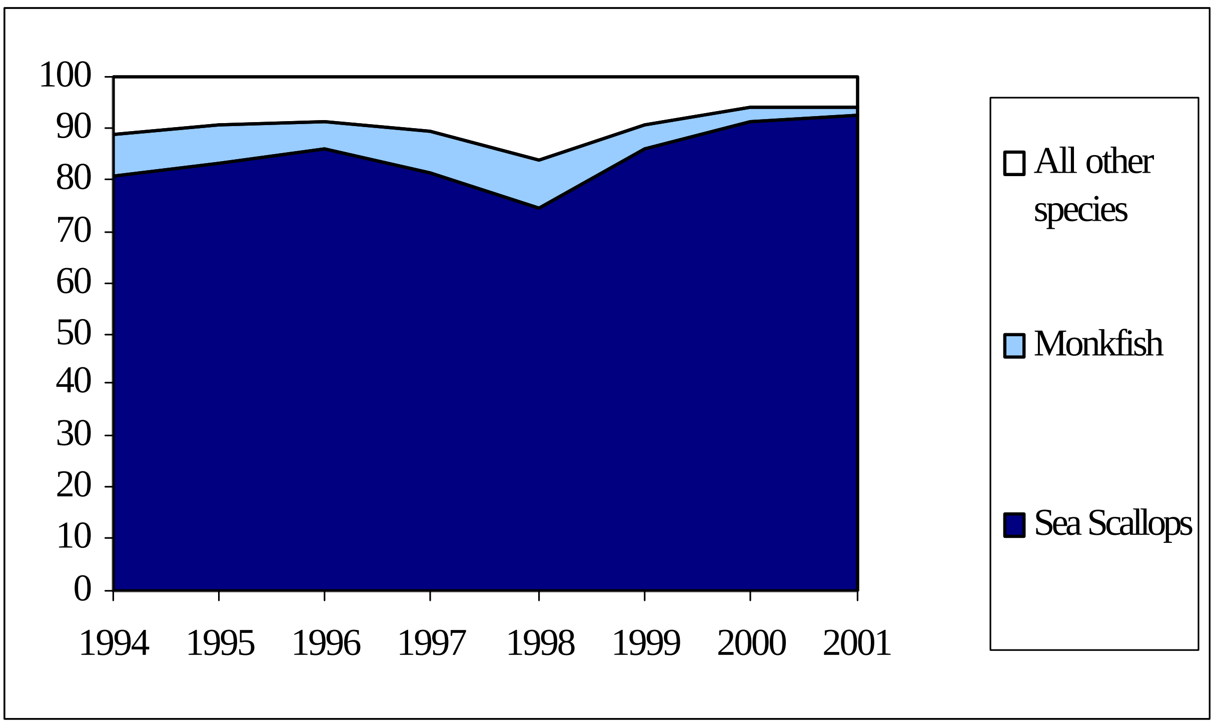

Figure 20. Value of species landed by full-time limited access vessels in 1994 -2001 fishing year[42].

42**Only species that account for 5% or more of landed value are shown. Source: NE permit and dealer data.**

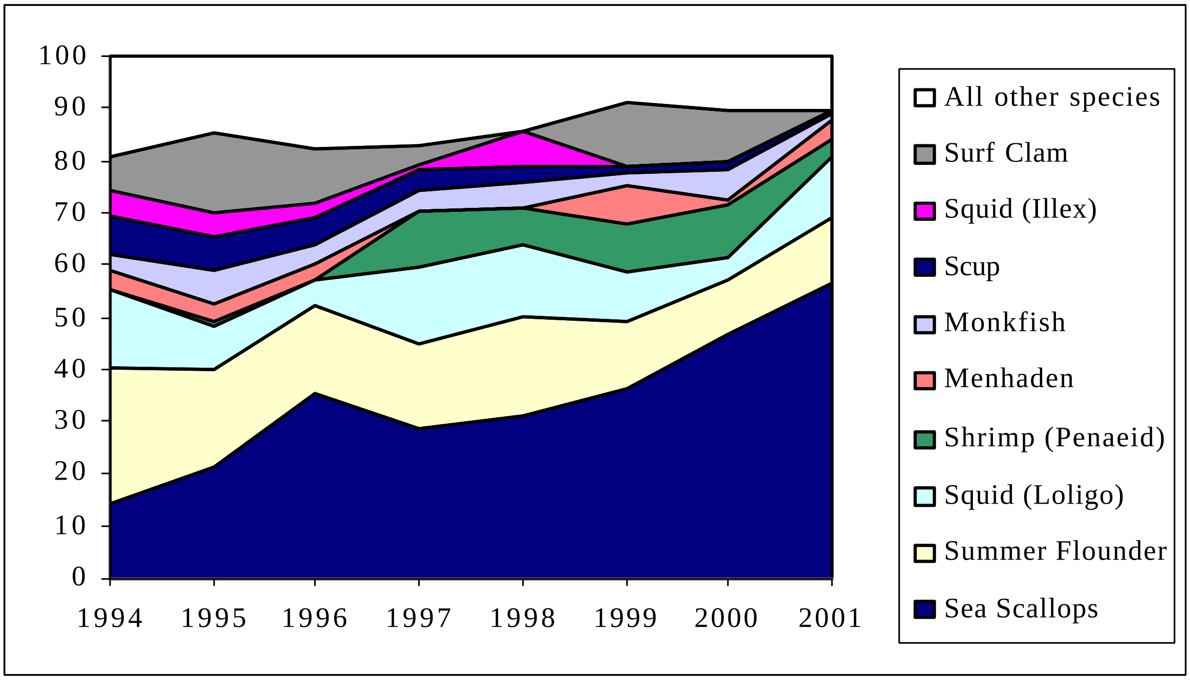

Figure 21. Value of species landed by part-time limited access vessels in 1994 -2001 fishing years.

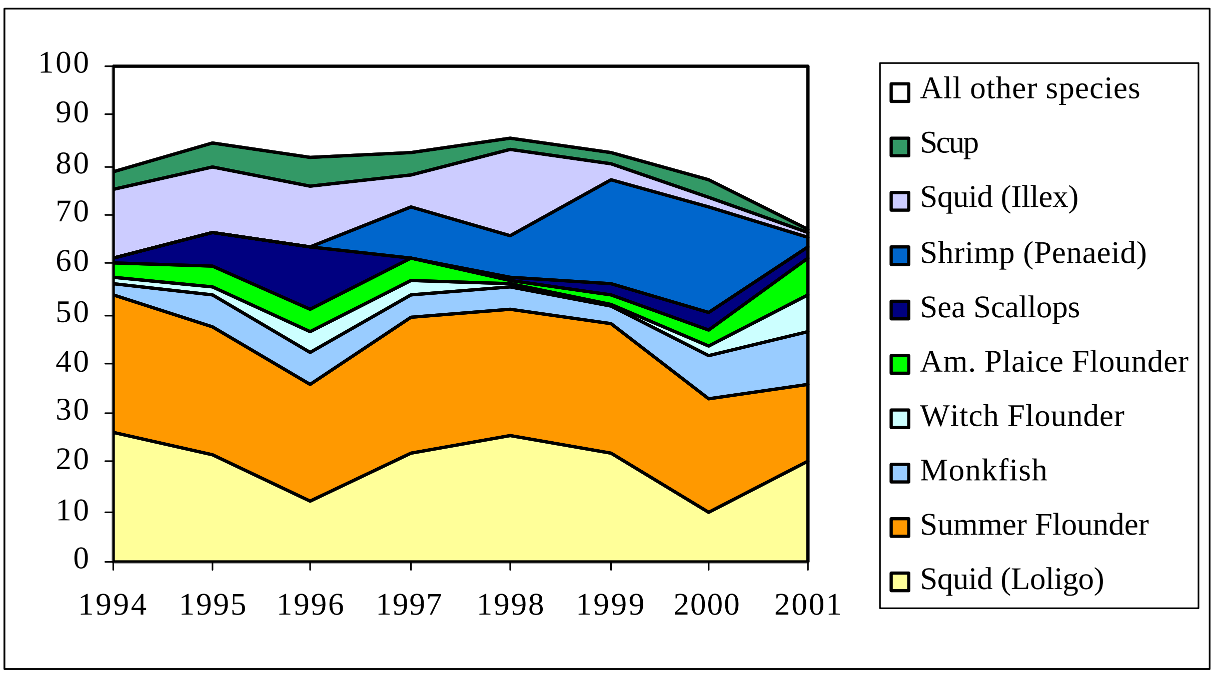

Figure 22. Value of species landed by occasional limited access vessels in 1994 -2001 fishing years.

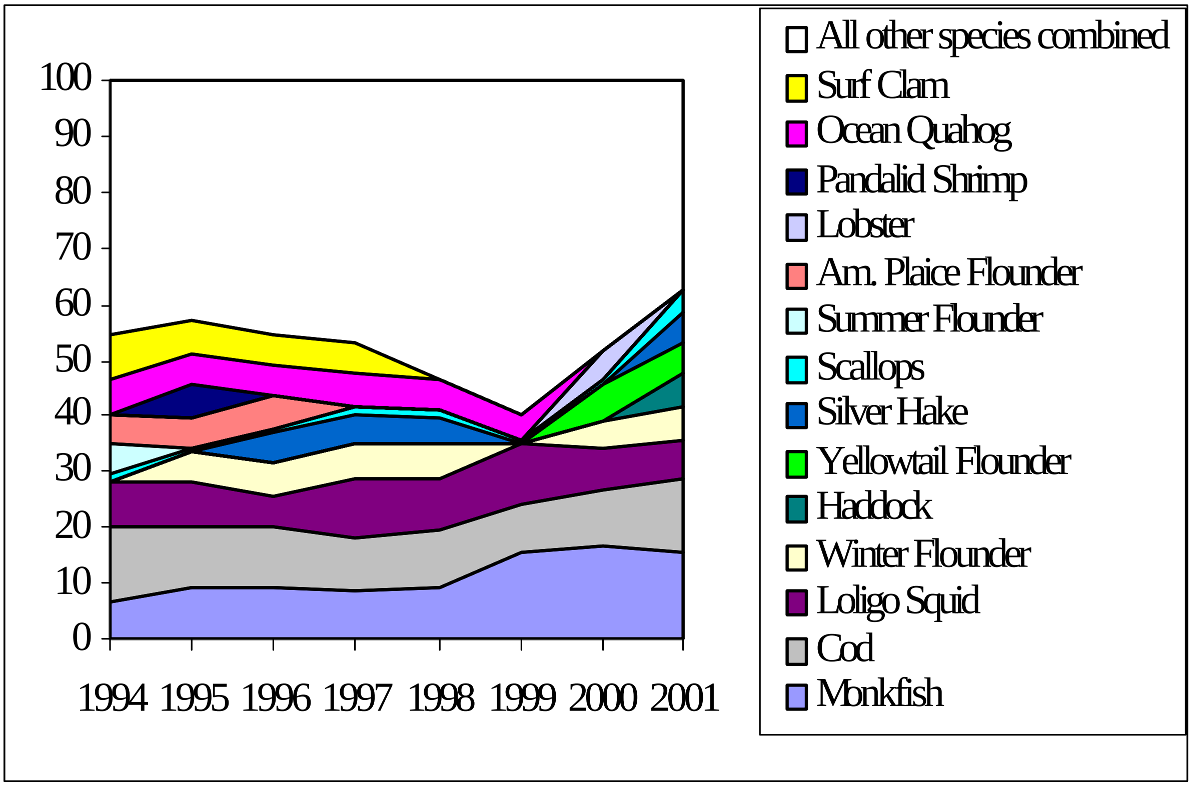

Figure 23. Value of species landed by general category vessels in 1994 -2001 fishing years (only species that account for 5% or more of landed value are shown). Source: NE permit and dealer data.

Table 50. Average trip characteristics by size of crew and permit category, fishing years 1997-2000.

FY	Plan	Crew	No. trips	No. vessels	ave. scallops	ave. fluke	ave. squid	ave. monkfish	ave. skates	ave. groundfish	ave. other	ave. days	total scallops	% total scallops	total effort
2000	General Category	1	561	38	325.8	69.6	14.1	49.5	117.1	493.7	91.0	1.1	182,746	0.6	625
		2	952	77	332.2	110.5	77.9	91.1	94.4	673.7	206.8	1.1	316,249	1.0	2,163
		3	262	57	302.2	2726.4	1026.0	381.1	6631.7	4585.2	242.0	1.6	79,184	0.2	1,240
		4	149	34	306.7	1598.3	4545.0	563.7	3806.7	24699.7	1224.2	2.7	45,696	0.1	1,610
		5	51	19	160.4	139.3	0.0	777.5	12506.2	26164.1	4593.0	6.9	8,179	0.0	1,749
		6	4	3	226.0	202.0	0.0	225.0	830.0	36825.0	20.0	2.2	904	0.0	53
	Limited Access	1	1	1	cr	cr	cr	cr	cr	cr	cr	1.0	cr	cr	1
		2	36	8	2302.6	0.0	0.0	536.6	0.0	24.0	0.0	3.2	82,893	0.3	231
		3	161	30	587.5	3170.5	90.0	111.1	4956.0	201.4	927.8	1.9	94,588	0.3	910
		4	285	34	711.2	2013.3	489.7	162.3	1.4	188.1	256.5	1.6	202,685	0.6	1,771
		5	179	51	3902.2	75.2	0.0	439.0	4206.0	933.9	1779.0	3.9	698,497	2.1	3,505
		6	392	106	8864.4	84.6	77.0	954.8	43.3	504.4	116.5	6.8	3,474,845	10.6	16,055
		7	2209	247	12506.3	345.6	2558.0	991.4	100.9	332.5	85.2	9.6	27,626,311	84.2	148,518
1999	General Category	1	358	40	295.8	63.3	9.0	57.2	47.9	433.2	157.6	1.3	105,887	0.5	466
		2	881	79	270.0	85.1	3125.3	105.4	509.3	888.2	291.1	1.3	237,856	1.1	2,256
		3	120	40	233.1	136.0	6148.6	239.1	4300.0	4079.9	1384.7	2.1	27,968	0.1	752
		4	64	31	228.2	909.2	11636.7	765.6	7280.8	14646.8	2246.3	4.8	14,606	0.1	1,241
		5	31	18	200.0	249.6	19700.0	632.0	9195.4	22180.7	2770.0	7.1	6,199	0.0	1,103
	Limited Access	1	3	3	312.3	2109.0	0.0	90.0	0.0	0.0	55.0	2.8	937	0.0	8
		2	46	11	576.4	1482.5	0.0	203.7	0.0	62.1	29.5	2.9	26,516	0.1	270
		3	129	27	555.1	2683.4	132.3	121.0	303.3	1895.6	1280.3	2.5	71,604	0.3	959
		4	351	42	736.3	1198.1	115.0	110.6	309.1	3133.3	746.5	2.1	258,435	1.2	2,896
		5	332	72	3312.8	80.9	10.0	625.5	4825.3	398.5	112.6	4.4	1,099,851	5.1	7,385
		6	755	164	8135.2	239.5	0.0	1281.6	1662.5	311.3	547.9	8.5	6,142,064	28.3	38,687
		7	1541	207	8903.6	291.1	36.0	1004.3	256.5	239.4	52.5	9.4	13,720,512	63.2	101,515
1998	General Category	1	570	41	305.7	236.0	11.0	50.5	872.5	1359.2	113.3	1.2	174,247	1.5	664
		2	1267	90	209.8	296.3	73.5	60.3	33.1	903.8	706.3	1.3	265,757	2.3	3,198
		3	251	40	211.9	3480.8	982.5	205.3	212.5	2292.6	235.4	1.5	53,178	0.5	1,134
		4	37	19	133.0	380.5	0.0	1181.7	5269.3	18071.3	778.6	5.5	4,919	0.0	814
		5	44	15	103.7	415.0	0.0	1531.9	7852.1	18432.5	1878.4	8.3	4,564	0.0	1,836
	Limited Access	1	2	2	cr	cr	cr	cr	cr	cr	cr	5.0	cr	cr	10
		2	58	9	376.2	12.0	0.0	1074.4	91.7	292.8	228.0	4.2	21,820	0.2	491
		3	102	27	620.4	2142.6	84.0	286.9	70.0	71.2	200.7	3.8	63,276	0.5	1,158
		4	603	82	1553.6	792.5	3138.5	1242.6	2148.7	282.9	465.3	5.8	936,799	8.1	13,880
		5	682	132	3593.9	265.2	8.0	1896.5	763.1	165.3	371.0	9.8	2,451,028	21.1	33,376
		6	861	157	4688.3	346.2	37.0	1650.4	665.3	168.8	91.4	11.3	4,036,594	34.8	58,226
		7	601	122	5979.4	271.8	439.0	1190.1	549.0	164.5	68.0	11.5	3,593,631	31.0	48,389
1997	General Category	1	605	52	320.1	17.0	7.0	69.3	78.6	530.9	114.0	1.3	193,663	1.5	757
		2	1593	106	224.1	102.7	5535.0	119.5	107.7	1001.4	146.1	1.2	356,959	2.8	3,778
		3	310	46	241.3	2850.0	1285.0	662.9	663.2	3709.2	2384.3	1.7	74,808	0.6	1,584
		4	25	16	200.1	255.0	700.0	1625.2	3895.0	12524.7	2239.7	6.0	5,003	0.0	601
		5	33	12	89.8	110.3	0.0	655.8	7444.4	18314.5	3130.8	7.7	2,963	0.0	1,276
		7	1	1	cr	cr	cr	cr	cr	cr	cr	1.0	cr	cr	7
	Limited Access	1	5	5	607.8	49.0	0.0	205.0	0.0	0.0	0.0	2.5	3,039	0.0	12
		2	150	10	377.5	0.0	0.0	1559.1	0.0	125.8	261.7	2.9	56,620	0.4	860
		3	102	24	639.6	1100.0	17574.0	554.6	1607.1	1843.3	53.1	3.6	65,238	0.5	1,102
		4	279	66	2060.7	845.5	1190.0	1959.5	1778.1	206.2	279.6	7.4	574,940	4.5	8,214
		5	541	126	3384.9	321.4	2180.0	2008.5	497.7	218.8	226.3	9.7	1,831,232	14.5	26,163
		6	1071	192	4599.3	208.2	103.3	2002.7	551.0	165.2	116.3	11.2	4,925,818	38.9	72,181
		7	831	147	5510.0	257.1	53.3	1202.3	491.3	165.6	185.8	11.1	4,578,778	36.1	64,803

*Only includes trips landing more than 40 lbs scallops. Landings are in lbs, where squid includes both loligo and illex squids; monkfish includes livers and tails; and groundfish includes cod, winter flounder, witch flounder, yellowtail flounder, Am. plaice flounder, sand-dab flounder, cusk, haddock, white hake, redfish, pollock, red hake, ocean pout, black whiting, silver hake, and wolfish. Trips not providing crew were excluded from analysis. Crew size includes captain. Effort refers to (crew size) * (days absent). Averages do not include null values. Source: logbooks.

The different permits that scallop vessels hold is another indication of the range of fishing activities that they either do or may participate in, given changing biological or regulatory conditions. Table 51 shows the other fishery permits held by scallop vessels, and Table 52 shows the most common combinations.

Table 51. 2001 permits* held by scallop vessels, by category. Source: NE Permit Data

	Full Time Dredge		Full Time Net		Part Time Dredge		Part Time Net		Occasional Dredge		Occasional Net		General Category	
Plan	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Bluefish	188	79.3	15	93.8	16	80.0	16	88.9	2	40.0	13	72.2	1815	77.8
Black Sea Bass	73	30.8	14	87.5	15	75.0	13	72.2	2	40.0	12	66.7	676	29.0
Dogfish	217	91.6	14	87.5	19	95.0	16	88.9	3	60.0	15	83.3	1778	76.2
Summer Flounder	203	85.7	14	87.5	16	80.0	16	88.9	2	40.0	17	94.4	774	33.2
Herring	138	58.2	11	68.8	10	50.0	11	61.1	1	20.0	9	50.0	1253	53.7
Lobster	161	67.9	8	50.0	15	75.0	9	50.0	4	80.0	10	55.6	1453	62.3
Monkfish	233	98.3	16	100.0	20	100.0	15	83.3	4	80.0	16	88.9	1965	84.2
Multispecies	216	91.1	15	93.8	18	90.0	16	88.9	4	80.0	11	61.1	1746	74.8
Ocean Quahog	175	73.8	9	56.3	12	60.0	8	44.4	3	60.0	12	66.7	1231	52.7
Scallop Limited	237	100.0	16	100.0	20	100.0	18	100.0	5	100.0	16	88.9	15	0.6
Scallop General	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2319	99.4
Scup	70	29.5	10	62.5	15	75.0	14	77.8	1	20.0	14	77.8	716	30.7
Surf Clam	185	78.1	11	68.8	12	60.0	9	50.0	3	60.0	12	66.7	1254	53.7
Squid-Mackerel- Butterfish	201	84.8	14	87.5	19	95.0	16	88.9	3	60.0	15	83.3	1763	75.5
Tilefish	160	67.5	6	37.5	10	50.0	7	38.9	1	20.0	11	61.1	769	32.9

*Note: Plans are from the last valid application in 2001, not the last valid application with a scallop permit, so not all scallop categories sum to 100%. 2 vessels that had limited access permits during 2001 did not retain those permits in their last valid permit of 2001; 24 vessels that had general category permits during 2001 did not retain those permits in their last valid permit of 2001 and 15 of these changed to limited access.

Table 52. Most common 2001 plan combinations by permit and gear category.

Permit Type	Plan Combination	No.	%
Full Time	Bluefish-Dogfish-Summer Flounder-Herring-Lobster-Monkfish-Multispecies-Ocean Quahog-Scallop Limited Access- Surf Clam-Squid, Mackerel, Butterfish-Tilefish	43	17.0
Part Time	Bluefish-Black Sea Bass-Dogfish-Summer Flounder-Lobster-Monkfish-Multispecies-Scallop Limited Access-Scup-Squid, Mackerel, Butterfish	5	13.2
	All Plans (except Scallop General Category)	4	10.5
	Bluefish-Black Sea Bass-Dogfish-Summer Flounder-Herring-Monkfish-Multispecies-Ocean Quahog-Scallop Limited Access-Scup-Surf Clam-Squid, Mackerel, Butterfish-Tilefish	4	10.5
	Bluefish-Black Sea Bass-Dogfish-Summer Flounder-Herring-Lobster-Monkfish-Multispecies-Ocean Quahog-Scallop Limited Access-Scup-Surf Clam-Squid, Mackerel, Butterfish	4	10.5
Occasional	All Plans (except Scallop General Category)	3	13.0
General Category	All Plans (except Scallop Limited Access)	92	3.9
Gear Type	Plan Combination	No.	%
Dredge	Bluefish-Dogfish-Summer Flounder-Herring-Lobster-Monkfish-Multispecies-Ocean Quahog-Scallop Limited Access-Surf Clam-Squid, Mackerel, Butterfish-Tilefish	43	16.4
Net	Bluefish-Black Sea Bass-Dogfish-Summer Flounder-Herring-Lobster-Monkfish-Multispecies-Ocean Quahog-Scallop Limited Access-Scup-Surf Clam-Squid, Mackerel, Butterfish	5	9.6

Note: Only combinations with at least 10% of vessels by type, or the most common plan combination, are shown. Source: NE 2001 Permit Data
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7.1.1.2 Dealers and Processors

Since Amendment 4, any dealer possessing scallops must hold a federal dealer permit. Around half of all active, federally licensed scallop dealers operated in Maine and Massachusetts in 2000 and 2001 (Table 53). Around half of the dealers who bought scallops in 2000 and 2001 (52.9 and 44.8%

respectively) had a relatively low (0 to 10%) dependence on scallops for their business, yet about one-fourth of scallop dealers (22.1 in 2000 and 25.5% in 2001) depended on scallops almost exclusively (90-100%) (Table 54).

Table 53. Number of dealers and processors by state*

State	Year	CT	MA	MD	ME	NC	NH	NJ	NY	PA	RI	VA
Dealers	2000	0	44	1	32	8	5	14	16	0	7	13
	2001	3	55	1	17	7	2	16	14	0	12	18
Processors	2000	1	6	2	2	0	1	1	0	0	2	4

* Includes only dealers who bought scallops. 14 of the 140 scallop dealers in 2000 bought in more than one state, as did 16 of the 145 dealers in 2001; these dealers were put in the state where most of their scallop value was generated. Source: dealer permit, weighout, and processor data.

Table 54. Dealer dependence on scallops

Relative Dependence					Absolute Dependence				
	2000		2001			2000		2001	
Percent Dependence	No. of Dealers	% of Dealers	No. of Dealers	% of Dealers	Dollars Paid to Harvesters for Scallops	No. of Dealers	% of Dealers	No. of Dealers	% of Dealers
0-10%	74	52.9	65	44.8	$1-100	4	2.9	5	3.4
10-20%	8	5.7	7	4.8	$100-1000	24	17.1	20	13.8
20-30%	3	2.1	5	3.4	$1001-10,000	36	25.7	32	22.1
30-40%	5	3.6	11	7.6	$10,001-50,000	26	18.6	16	11.0
40-50%	4	2.9	2	1.4	$50,001-100,000	6	4.3	17	11.7
50-60%	3	2.1	2	1.4	$100,001-500,000	12	8.6	19	13.1
60-70%	2	1.4	7	4.8	$500,001-1,000,000	7	5.0	9	6.2
70-80%	4	2.9	3	2.1	$1,000,001-5,000,000	13	9.3	14	9.7
80-90%	6	4.3	6	4.1	$5,000,001-10,000,000	8	5.7	9	6.2
90-100%	31	22.1	37	25.5	$10,000,001-20,000,000	4	2.9	4	2.8

* Includes only dealers who bought scallops.

Table 53 also shows the number of scallop processors by state. Since only 2 states had more than three firms, confidentiality requires that processor data be kept at a regional level. Among the 19 processors, average monthly employment for a given firm in the region was 81, varying from 4 employees to 262; average monthly employment by state in the region was 193, varying from 4 to 799 employees. States in the region processed a total of 14,381,441 pounds of scallops with a wholesale value of 73,769,869 dollars. Pounds processed ranged in the different states from 331 to 7,025,595 with an average of 756,918 per firm; value ranged from 3,310 to 33,571,045 with an average of 3,882,625 per firm. The percentage of scallop's volume and value against the total volume and value output of the plants ranged from 0.9% and 1.8% respectively, to 39.6% and 69.2%, with a state average of 12.8% and 23.9%.

7.1.1.3 The scallop ports[43]

While the fleet is spread throughout the eastern seaboard, the majority of limited access vessels are found in Massachusetts, Virginia, New Jersey, and North Carolina (Figure 24). A slightly different pattern pertains to the general category permits, where the majority operate out of Massachusetts, Maine, New Jersey, and Rhode Island, and New York (Figure 25). Most limited access vessels are large throughout, with the exception of Maine (Table 55); the general category vessels are fairly small throughout, though somewhat larger on average in North Carolina (Table 56). For the limited access

43 Homeport and logbook landings data were corrected for spelling errors, alternative spellings, and other errors to the extent possible. Permit data is by vessel and so does not provide information on the extent of multiple boat ownership or owner-operation, which may influence the impacts that regulations can have on communities.

fleet, the ports New Bedford, Cape May, and Norfolk have the highest number of permitted vessels (Table 57). For the general category fleet, the ports New Bedford, Gloucester, Point Judith, Cape May, and Chatham have the highest number of permitted vessels (Table 58).

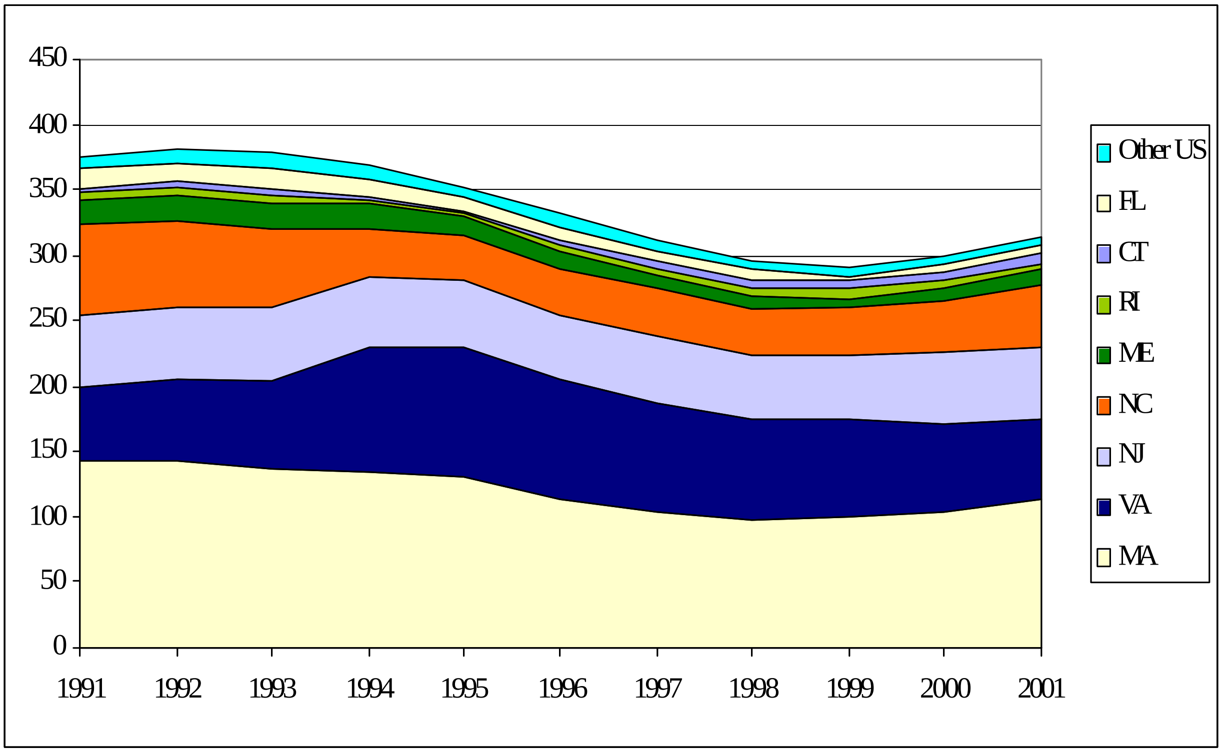

Figure 24. All permitted Limited Access vessels by homeport state (1991-1993 est.). Source: NE Permit Data.

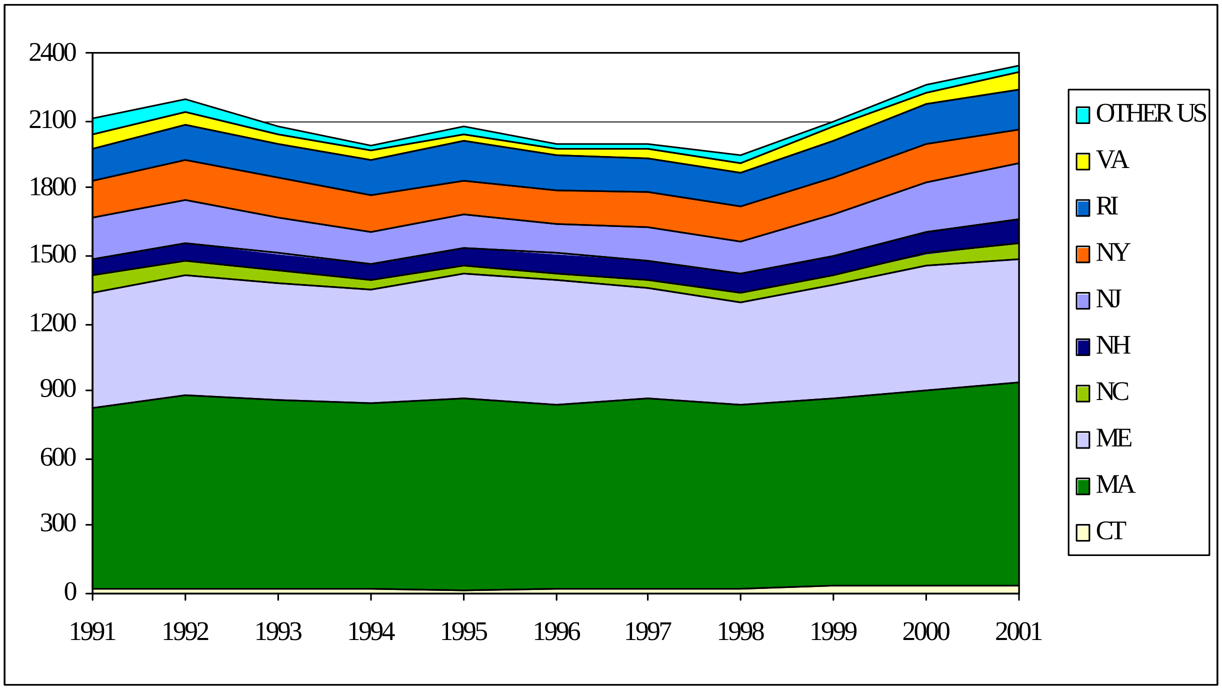

Figure 25. All permitted General Category vessels by homeport state (1991-1993 est.). Source: NE Permit Data.

Table 55. Limited Access Permits by Homeport State, with average length and tonnage, 1994-2001.

	1994			1995			1996			1997			1998			1999			2000			2001		
HPST	#	Length	GRT	#	Length	GRT	#	Length	GRT	#	Length	GRT	#	Length	GRT	#	Length	GRT	#	Length	GRT	#	Length	GRT
AK	1	115	199	1	115	199	1	115	199	1	82	181	1	82	181	1	82	181	1	94	181	1	94	181
AL	1	78	129	1	78	129	2	83	132	2	83	132	1	78	129	1	78	129	1	78	129	1	78	129
CT	3	76	154	3	79	154	5	81	154	6	82	157	6	80	157	5	80	156	6	81	162	8	82	171
DE	3	85	149	3	85	149	3	85	149	2	80	134	1	84	139	2	77	135	1	69	130	0	n/a	n/a
FL	14	75	123	10	74	122	10	73	117	9	75	127	8	76	125	4	80	136	5	76	125	6	75	122
MA	135	85	160	130	86	164	114	85	163	103	85	163	98	86	169	100	87	171	104	86	169	114	85	166
MD	1	70	103	2	69	84	2	69	84	2	69	84	2	69	84	2	69	84	2	69	84	2	69	84
ME	21	50	44	14	53	50	15	59	68	11	58	73	9	54	57	7	48	44	9	57	66	12	55	58
NC	35	76	117	34	76	111	35	75	111	37	75	108	35	74	112	36	75	115	38	74	118	46	73	117
NH	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	1	82	181	1	82	181
NJ	53	78	136	51	78	137	49	79	140	50	78	137	48	78	136	49	78	138	55	77	134	56	77	135
NY	2	80	162	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a
PA	0	n/a	n/a	0	n/a	n/a	1	72	91	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a
RI	2	75	146	2	75	146	3	76	149	3	76	149	7	92	183	8	92	184	8	92	184	5	80	136
TX	1	80	120	1	80	120	1	80	120	1	80	120	1	80	120	1	80	120	1	80	120	1	80	120
VA	96	76	136	100	77	137	91	77	138	85	77	139	78	78	138	75	78	137	68	77	138	61	79	143
Total	368			352			332			312			295			291			300			314		

Source: NE Permit Data.

Table 56. General Category Permits by Homeport State, with average length and tonnage, 1994-2001.

	1994			1995			1996			1997			1998			1999			2000			2001		
HPST	#	Length	GRT	#	Length	GRT	#	Length	GRT	#	Length	GRT	#	Length	GRT	#	Length	GRT	#	Length	GRT	#	Length	GRT
AL	0	n/a	n/a	0	n/a	n/a	2	90	156	2	90	156	1	90	180	1	90	180	0	n/a	n/a	0	n/a	n/a
CT	18	83	64	15	91	71	20	53	58	22	52	55	24	49	49	30	48	47	29	50	49	35	50	52
DE	10	52	64	9	52	71	10	54	71	8	57	74	11	52	66	11	51	61	11	51	61	11	52	59
FL	10	60	76	7	52	53	6	60	77	6	60	62	4	50	55	4	50	55	4	50	55	3	41	28
GA	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	1	58	38	4	76	99	4	76	99

	1994			1995			1996			1997			1998			1999			2000			2001		
HPST	#	Length	GRT	#	Length	GRT	#	Length	GRT	#	Length	GRT	#	Length	GRT	#	Length	GRT	#	Length	GRT	#	Length	GRT
LA	0	n/a	n/a	2	74	112	1	72	78	1	72	78	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a
MA	825	46	43	854	46	41	817	46	41	843	46	42	812	44	37	834	44	35	872	43	34	903	43	38
MD	5	55	49	4	61	58	6	51	40	7	51	40	10	49	33	8	49	28	11	50	26	12	48	27
ME	508	42	28	558	41	26	556	41	26	491	42	28	458	42	26	503	42	27	551	41	26	546	41	25
MS	0	n/a	n/a	1	80	142	1	85	143	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a
NC	39	72	103	30	72	108	34	71	103	37	70	101	41	68	99	43	66	92	56	62	82	68	62	76
NH	75	38	18	74	38	16	78	40	19	87	40	18	87	40	18	89	40	17	99	44	25	108	43	24
NJ	144	57	68	152	56	65	140	55	63	144	55	63	144	55	64	188	53	57	213	52	54	247	53	57
NY	158	51	51	156	52	54	146	52	55	152	51	52	145	51	52	162	50	50	173	49	59	155	49	49
PA	1	89	195	1	89	195	1	89	195	2	60	105	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	1	31	14
RI	152	55	66	170	55	66	155	57	70	157	56	68	160	56	66	165	55	67	175	54	63	177	54	62
SC	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	1	47	33	1	47	33	1	47	33	2	44	28
TX	2	77	143	2	77	143	1	70	101	1	70	101	1	70	101	1	70	101	0	n/a	n/a	0	n/a	n/a
VA	45	65	82	37	62	73	28	64	81	41	62	73	40	60	65	55	51	44	62	49	39	69	49	37
VT	0	n/a	n/a	2	23	2	1	23	2	1	23	2	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a
WA	0	n/a	n/a	0	n/a	n/a	0	n/a	n/a	0	N/a	n/a	0	n/a	n/a	0	n/a	n/a	2	135	252	2	135	252
Total	*1992*			*2074*			*2003*			*2002*			*1939*			*2096*			*2263*			*2343*		

Source: NE Permit Data.

Table 57. Limited Access Vessels by Homeport and County (1994–2001), in order of 2001 homeport county vessels.

Homeport County, State	1994	1995	1996	1997	1998	1999	2000	2001	Homeport	1994	1995	1996	1997	1998	1999	2000	2001
Bristol MA	109	110	94	86	87	92	98	107	New Bedford	94	91	79	75	73	78	81	94
									Fairhaven	12	13	10	10	13	12	15	12
									Westport Point	0	0	0	0	0	0	1	1
									Fall River	3	5	4	0	0	0	0	0
									North Dartmouth	0	0	0	0	0	1	1	0
									Westport	0	1	1	1	1	1	0	0
Cape May NJ	38	36	35	36	36	36	40	41	Cape May	33	31	31	33	33	34	38	39
									Wildwood	5	5	4	3	3	2	2	2
Norfolk (City) VA	65	67	63	58	51	42	35	27	Norfolk	65	67	63	58	51	42	35	27
Newport News (City) VA	8	9	10	10	12	17	19	21	Newport News	8	9	10	10	12	17	19	21
Pamlico NC	14	14	18	18	18	19	17	17	Lowland	6	6	7	6	6	8	7	7
									Oriental	2	2	3	2	4	5	4	5
									Bayboro	1	1	1	3	1	2	2	2
									Vandemere	2	2	4	3	3	3	2	2
									Hobucken	3	3	3	3	3	1	1	1
									Pamlico	0	0	0	1	1	0	1	0
Ocean NJ	15	15	14	14	12	13	15	15	Barnegat Light	9	9	9	9	8	8	10	10
									Point Pleasant	6	6	5	5	4	4	4	4
									Point Pleasant Beach	0	0	0	0	0	1	1	1
New London CT	3	3	5	6	6	5	6	8	Stonington	3	3	5	6	6	4	5	7
									New London	0	0	0	0	0	1	1	1
Craven NC	1	2	2	4	4	6	6	8	New Bern	1	2	2	4	4	6	6	8
Dare NC	4	3	2	2	2	1	4	8	Wanchese	4	3	2	2	2	1	4	8
Hampton (City) VA	15	15	11	11	8	7	6	6	Hampton	15	15	11	11	8	7	6	6
Carteret NC	10	10	7	7	6	5	5	6	Atlantic	3	3	3	3	3	3	3	3
									Beaufort	6	6	3	2	1	1	1	1
									Marshallberg	0	0	0	0	0	0	0	1
									Newport	1	1	1	1	1	1	1	1
									Davis	0	0	0	1	1	0	0	0
Hancock ME	9	6	7	6	5	4	4	5	Southwest Harbor	6	3	4	3	2	2	2	2
									Bass Harbor	1	1	1	1	1	1	1	1
									Mount Desert	1	1	1	1	1	1	1	1
									Sunshine	1	1	1	1	1	0	0	1
Washington RI	2	2	3	3	7	8	8	4	Point Judith	1	1	3	3	3	4	4	3
									Davisville	0	0	0	0	4	4	4	1
									Narragansett	1	1	0	0	0	0	0	0
Hyde NC	2	2	2	3	2	3	3	4	Swanquarter	1	1	1	1	1	2	2	2
									Engelhard	1	1	1	0	0	0	0	1
									Scranton	0	0	0	2	1	1	1	1
Barnstable MA	16	13	12	7	4	2	2	3	Hyannis	11	9	9	4	2	1	1	1
									Provincetown	2	2	1	1	0	0	0	1
									Wellfleet	1	1	1	1	1	1	1	1

Homeport County, State	1994	1995	1996	1997	1998	1999	2000	2001	Homeport	1994	1995	1996	1997	1998	1999	2000	2001
									Marstons Mills	1	0	0	0	0	0	0	0
									Truro	1	1	1	1	1	0	0	0
Knox ME	9	7	5	3	3	2	3	3	Owls Head	2	3	2	2	2	2	3	3
									Port Clyde	3	1	0	0	0	0	0	0
									Rockland	2	1	2	1	1	0	0	0
									Spruce Head	2	2	1	0	0	0	0	0
Brevard FL	4	5	4	4	4	2	2	3	Cape Canaveral	3	4	4	3	3	1	2	3
									Merritt Island	1	1	0	1	1	1	0	0
Beaufort NC	2	2	3	2	2	1	2	3	Aurora	2	2	2	2	2	1	1	2
									Belhaven	0	0	1	0	0	0	1	1
Isle of Wight VA	2	3	2	1	2	2	3	2	Carrollton	2	3	2	1	2	2	3	2
Suffolk MA	1	1	2	3	3	2	2	2	Boston	1	1	2	3	3	2	2	2
Worcester MD	1	2	2	2	2	2	2	2	Ocean City	1	2	2	2	2	2	2	2
Washington ME	3	1	1	1	1	1	1	2	Beals	1	1	1	1	1	1	1	2
									Jonesport	1	0	0	0	0	0	0	0
									Steuben	1	0	0	0	0	0	0	0
Lincoln ME	0	0	2	1	0	0	1	2	Boothbay Harbor	0	0	0	0	0	0	1	1
									South Bristol	0	0	1	1	0	0	0	1
									Medomak	0	0	1	0	0	0	0	0
York VA	1	1	1	0	0	0	0	2	Seaford	1	1	1	0	0	0	0	2
Dade FL	6	3	4	2	2	1	1	1	Miami	6	3	4	2	2	1	1	1
Essex MA	3	3	3	4	2	2	1	1	Gloucester	3	3	3	4	2	2	1	1
Virginia Beach (City) VA	2	2	2	2	2	2	1	1	Virginia Beach	2	2	2	2	2	2	1	1
Monroe FL	3	2	2	2	1	0	1	1	Marathon	3	2	1	1	1	0	1	1
									Key West	0	0	1	1	0	0	0	0
Mobile AL	1	1	2	2	1	1	1	1	Bayou La Batre	1	1	2	2	1	1	1	1
Harris TX	1	1	1	1	1	1	1	1	Houston	1	1	1	1	1	1	1	1
Middlesex MA	1	1	1	1	1	1	1	1	Bedford	1	1	1	1	1	1	1	1
Richmond (City) VA	1	1	1	1	1	1	1	1	Richmond	1	1	1	1	1	1	1	1
Duval FL	1	0	0	1	1	1	1	1	Jacksonville	1	0	0	1	1	1	1	1
Kenai Peninsula AK	0	0	0	1	1	1	1	1	Seward	0	0	0	1	1	1	1	1
Poquoson (City) VA	0	0	0	0	0	2	2	1	Poquoson	0	0	0	0	0	2	2	1
Rockingham NH	0	0	0	0	0	0	1	1	Portsmouth	0	0	0	0	0	0	1	1
Providence RI	0	0	0	0	0	0	0	1	Providence	0	0	0	0	0	0	0	1

NOTE: only shows counties with at least one vessel in 2001. Source: NE Permit Data.

Table 58. General category vessels by homeport and county (1994–2001), in order of 2001 homeport county vessels.

Home port county, State	1994	1995	1996	1997	1998	1999	2000	2001	Home port	1994	1995	1996	1997	1998	1999	2000	2001
Bristol MA	316	313	287	281	260	252	266	273	New Bedford	252	245	225	219	190	191	197	214
									Fairhaven	34	32	31	37	41	34	37	34
									Westport	14	19	15	14	19	16	22	19
Barnstable MA	220	230	223	216	219	227	235	268	Chatham	66	63	66	69	64	65	70	76
									Provincetown	29	35	31	26	25	28	25	30
									Harwich	15	16	22	21	19	22	22	26
									Orleans	13	15	15	18	14	16	17	22
									Sandwich	20	20	12	12	16	20	20	19
									Hyannis	24	24	22	13	12	11	10	15
									Barnstable	8	9	8	10	11	11	11	11
									Wellfleet	13	13	11	12	10	9	6	10
									Dennis	5	6	6	4	8	8	9	9
									Woods Hole	6	8	6	6	4	3	7	8
									Falmouth	1	1	2	2	5	5	4	6
									Yarmouth	2	1	0	1	3	3	4	6
									Bass River	0	0	1	1	1	1	3	4
									Eastham	2	2	2	1	2	1	3	3
									South Yarmouth	0	0	0	2	2	3	3	3
									Truro	2	2	2	2	4	4	4	3
Essex MA	239	244	232	245	230	244	254	263	Gloucester	151	155	144	159	151	160	158	169
									Newburyport	20	17	19	20	20	18	22	21
									Rockport	9	9	12	10	11	13	15	13
									Beverly	12	12	14	13	10	12	13	12
									Salisbury	8	10	10	7	6	7	8	10
									Marblehead	7	6	7	6	4	6	10	9
									Pigeon Cove	4	4	3	7	7	7	6	7
									Manchester	5	8	5	5	5	6	6	5
									Lynn	6	4	3	2	2	2	3	3

Home port county, State	1994	1995	1996	1997	1998	1999	2000	2001	Home port	1994	1995	1996	1997	1998	1999	2000	2001
									Salem	4	4	2	4	2	2	2	3
									Swampscott	3	3	3	3	3	3	3	3
Plymouth MA	111	119	123	132	138	153	164	149	Scituate	28	33	39	38	35	40	44	36
									Plymouth	25	28	31	30	33	29	28	31
									Marshfield	9	9	6	15	16	18	22	19
									Green Harbor	16	16	15	14	19	19	19	18
									Hull	3	4	7	8	9	13	13	13
									Brant Rock	6	6	6	8	7	10	14	10
									Mattapoisett	5	6	4	4	4	5	6	5
									Marion	0	0	0	2	1	3	3	4
									Kingston	1	0	2	2	2	2	3	3
Cumberland ME	131	136	130	130	106	134	141	133	Portland	77	76	72	67	57	70	72	66
									Cundys Harbor	18	17	15	17	10	12	12	13
									Harpswell Center	4	6	7	9	7	10	12	11
									Freeport	4	4	5	3	4	5	6	8
									Orrs Island	3	3	3	4	3	3	4	5
									South Harpswell	3	2	3	5	3	4	4	5
									South Portland	4	6	5	6	7	6	7	5
									Bailey Island	1	2	2	3	2	3	3	3
									Long Island	0	1	1	1	1	3	3	3
Washington RI	111	124	113	117	120	129	131	127	Point Judith	72	77	75	85	81	85	80	82
									Narragansett	9	13	11	8	10	12	15	14
									Wakefield	7	9	7	8	9	9	9	11
									Galilee	6	7	6	5	5	5	7	7
									Charlestown	2	4	4	3	4	4	4	4
									Block Island	3	3	3	2	1	3	4	3
Washington ME	87	102	94	87	87	92	101	121	Jonesport	14	20	22	19	17	21	27	30
									Beals	10	13	12	12	13	14	15	17
									Bucks Harbor	13	16	13	11	11	11	11	12
									Steuben	9	10	11	10	10	9	10	11
									Cutler	9	7	4	3	2	3	3	8
									Lubec	5	5	4	5	8	6	9	7
									Milbridge	6	9	8	7	5	6	4	7
									Addison	5	4	4	5	5	5	5	6
									Eastport	1	2	4	6	5	2	4	6
									Harrington	2	4	3	2	1	3	3	4
Suffolk NY	110	107	105	104	104	121	130	117	Montauk	35	34	35	36	37	44	45	42
									Shinnecock	30	29	27	26	22	28	30	29
									Hampton Bays	16	18	17	15	16	17	17	15
									Greenport	8	8	9	11	11	8	9	7
									Northport	3	1	2	3	5	6	6	6
									Islip	3	3	2	2	2	2	2	3
Ocean NJ	59	60	53	56	56	76	91	114	Barnegat Light	18	23	19	21	19	35	45	58
									Point Pleasant	30	26	25	25	29	30	31	36
									Bricktown	1	2	1	1	2	3	4	4
									Point Pleasant Beach	3	3	3	3	2	3	3	4
									Waretown	3	2	2	2	1	2	2	4
									Tuckerton	0	0	1	0	0	0	2	3
Rockingham NH	74	74	78	87	86	88	100	110	Portsmouth	19	19	25	29	30	33	40	39
									Seabrook	19	17	17	22	19	17	21	24
									Hampton	18	19	16	16	15	17	16	19
									Rye	11	12	13	13	14	12	10	12
									Newington	0	0	0	0	0	0	7	7
									Hampton Falls	0	1	3	3	4	4	3	4
Cape May NJ	81	79	76	77	78	90	102	105	Cape May	62	59	58	61	59	67	77	79
									Wildwood	15	14	12	12	12	10	12	14
									Sea Isle City	1	2	2	2	4	8	8	8
Hancock ME	84	95	109	84	83	84	96	89	Stonington	20	18	29	18	17	19	22	19
									Winter Harbor	6	10	8	6	7	7	11	11
									Southwest Harbor	14	14	17	13	10	9	9	9
									Swans Island	1	4	5	3	4	3	8	9
									Bar Harbor	15	14	11	10	9	7	8	6
									Brooksville	1	1	1	2	3	5	5	5
									Brooklin	6	5	5	4	4	3	3	3
Knox ME	67	75	81	53	56	53	61	72	Port Clyde	12	12	13	12	15	15	16	17
									Owls Head	4	6	7	4	5	5	8	11
									Rockland	17	15	17	14	8	5	8	11
									Spruce Head	11	12	8	6	7	7	7	8

Home port county, State	1994	1995	1996	1997	1998	1999	2000	2001	Home port	1994	1995	1996	1997	1998	1999	2000	2001
									Friendship	5	5	5	4	6	4	4	7
									Vinalhaven	5	8	11	4	5	8	8	6
									Tenants Harbor	4	6	7	5	8	4	4	5
									South Thomaston	1	1	1	1	1	1	2	3
Lincoln ME	72	72	70	66	58	57	64	62	South Bristol	12	11	10	13	14	12	12	12
									Boothbay Harbor	11	9	8	10	5	6	8	9
									Bremen	10	10	8	9	6	7	7	8
									Boothbay	7	5	8	8	7	5	6	6
									Monhegan	2	2	2	3	3	2	3	5
									New Harbor	10	10	9	8	9	8	8	5
									Medomak	6	7	9	3	2	3	3	3
									Southport	1	2	2	1	1	2	5	3
York ME	41	45	35	47	47	58	64	61	Kittery	7	8	5	10	11	14	14	13
									Cape Porpoise	7	6	4	6	6	9	8	8
									Kittery Point	3	3	2	3	3	4	5	7
									Saco	4	5	4	4	5	6	9	7
									Kennebunkport	4	5	2	4	3	5	5	6
									Wells	1	2	1	1	2	2	2	4
									York	3	5	4	5	3	4	5	4
									York Harbor	4	3	2	3	4	5	4	4
Monmouth NJ	44	51	48	45	43	50	52	52	Belford	26	28	25	28	24	27	26	26
									Belmar	3	3	5	3	4	5	5	6
									Brielle	2	4	5	4	4	4	5	4
									Highlands	2	4	5	3	3	6	5	4
									Manasquan	3	2	3	3	4	3	3	4
Newport RI	29	33	30	29	36	33	42	46	Newport	18	21	19	18	18	17	21	25
									Tiverton	0	1	3	2	4	3	9	10
									Little Compton	1	1	1	2	4	3	3	4
									Jamestown	5	5	3	3	4	4	4	3
Norfolk (City) VA	100	101	89	87	71	61	48	45	Norfolk	100	101	89	87	71	61	48	45
New London CT	20	17	23	26	29	30	31	37	Stonington	13	11	13	14	14	13	14	17
									New London	3	3	5	7	9	10	9	12
									Noank	2	1	2	2	3	5	6	6
Dare NC	15	15	12	15	14	16	24	30	Wanchese	14	14	11	14	12	15	18	23
Pamlico NC	19	18	22	21	23	25	23	28	Lowland	9	8	9	8	8	10	9	9
									Oriental	2	2	3	2	6	8	7	7
									Bayboro	1	1	1	3	1	2	2	5
									Vandemere	3	3	5	4	4	4	3	4
Suffolk MA	36	37	35	40	33	25	22	25	Boston	36	37	35	40	33	25	22	25
Carteret NC	20	18	18	19	19	17	20	22	Beaufort	9	7	7	6	6	7	13	13
									Atlantic	6	6	6	7	7	7	4	4
Newport News (City) VA	8	9	11	11	15	18	20	21	Newport News	8	9	11	11	15	18	20	21
Atlantic NJ	6	7	6	9	11	14	12	20	Atlantic City	5	6	5	7	9	12	11	18
Dukes MA	13	17	14	15	18	18	18	20	Menemsha	2	2	2	3	4	4	4	5
									Edgartown	4	6	5	6	6	6	5	4
									Oak Bluffs	2	2	2	3	4	4	4	4
									Chilmark	1	1	1	1	2	2	2	3
									Vineyard Haven	2	4	3	1	1	1	2	3
Nassau NY	20	22	17	23	20	22	22	20	Freeport	12	12	6	10	8	7	9	7
									Point Lookout	7	7	6	7	7	7	5	4
Accomack VA	2	2	0	4	5	10	16	19	Chincoteague	2	2	0	1	0	2	6	6
									Onancock	0	0	0	3	5	5	4	4
									Saxis	0	0	0	0	0	0	1	3
Sagadahoc ME	40	42	45	30	27	27	29	19	Sebasco Estates	16	17	14	13	9	9	8	6
									Phippsburg	5	5	5	3	4	4	4	3
									West Point	5	3	4	4	4	3	4	3
Worcester MD	5	5	7	8	10	8	11	14	Ocean City	4	5	7	8	9	7	9	12
New York NY	19	17	18	17	14	12	14	13	New York	19	17	18	17	14	12	14	13
Hyde NC	3	3	3	5	5	7	9	12	Engelhard	1	1	1	1	2	3	4	6
									Swanquarter	2	2	2	2	2	3	4	5
Virginia Beach (City) VA	2	2	2	4	7	12	14	12	Virginia Beach	2	2	2	4	7	12	13	11
Hampton (City) VA	16	15	11	12	9	8	9	10	Hampton	16	15	11	12	9	8	9	10
Beaufort NC	5	5	7	7	7	6	8	9	Belhaven	3	3	4	4	4	3	5	5
Craven NC	2	2	3	4	4	6	6	8	New Bern	2	2	3	4	4	6	6	8
Norfolk MA	4	6	3	2	1	3	5	8	Cohasset	1	2	0	0	0	1	2	3
									Quincy	0	0	0	1	0	1	1	3
Nantucket MA	4	4	3	4	4	4	6	7	Nantucket	4	4	3	4	4	4	6	7
Sussex DE	6	5	6	5	5	5	7	7	Milford	0	0	0	0	0	0	0	3
Northampton VA	0	0	0	1	2	5	7	6									

Home port county, State	1994	1995	1996	1997	1998	1999	2000	2001	Home port	1994	1995	1996	1997	1998	1999	2000	2001
Cumberland NJ	0	0	0	1	0	0	3	5									
Fairfield CT	0	0	1	1	0	3	2	5	Bridgeport	0	0	1	0	0	3	2	4
Gloucester VA	0	0	0	0	1	1	2	4	Hayes	0	0	0	0	0	1	2	3
Providence RI	9	11	9	8	5	6	5	4	Providence	6	8	6	6	4	5	4	3
Waldo ME	1	1	0	1	0	1	2	4									
Brevard FL	4	5	4	5	4	2	2	3	Cape Canaveral	3	4	4	3	3	1	2	3
Dade FL	9	6	7	5	5	4	4	3	Miami	9	6	7	5	5	4	4	3
Kent RI	2	2	3	4	3	3	4	3	Warwick	2	2	3	3	3	3	4	3
Kings NY	6	6	5	5	5	5	6	3	Brooklyn	6	6	5	4	4	4	5	3
Mathews VA	1	1	1	4	3	5	4	3									
New Castle DE	7	7	7	5	5	6	3	3	Wilmington	7	7	7	5	5	5	3	3
Beaufort SC	0	0	0	0	1	1	1	2									
Brunswick NC	1	0	0	0	0	0	2	2									
Duval FL	2	1	1	2	2	2	2	2									
Glynn GA	0	0	0	0	0	0	2	2									
Isle of Wight VA	2	3	2	1	2	2	4	2									
King WA	0	0	0	0	0	0	2	2									
McIntosh GA	0	0	0	0	0	1	2	2									
Poquoson (City) VA	1	0	0	0	0	2	2	2									
York VA	2	2	1	0	0	0	0	2									
Bristol RI	3	2	3	2	3	2	1	1									
Currituck NC	1	0	2	1	1	1	1	1									
Delaware PA	0	0	0	0	0	0	0	1									
Harris TX	2	2	2	2	2	2	1	1									
Kenai Peninsula AK	0	0	0	1	1	1	1	1									
Kent DE	0	0	0	0	2	2	2	1									
Middlesex CT	0	0	0	0	0	1	2	1									
Middlesex MA	5	5	4	4	4	3	3	1									
Middlesex NJ	3	3	3	2	2	2	2	1									
Middlesex VA	0	0	0	0	0	0	0	1									
Mobile AL	1	1	4	4	2	1	1	1									
Monroe FL	5	4	3	3	1	0	1	1									
Northumberland VA	0	0	0	0	0	2	2	1									
Onslow NC	0	0	0	0	1	0	0	1									
Penobscot ME	0	2	3	2	1	1	1	1									
Richmond NY	2	2	1	2	2	1	1	1									
Richmond (City) VA	1	1	1	1	1	1	1	1									
Union NJ	1	1	1	1	1	1	1	1									
Worcester MA	6	6	5	3	2	3	2	1									

Source: NE Permit data. NOTE: only counties with at least one registered vessel in 2001 and ports with at least 3 vessels in 2001 are shown.

Vessels land their catch at different ports at different times of the year, or at ports other than their homeports. The relation between these different geographies has significance for understanding the communities to which fishermen belong, the mutual influences between communities—as places for socialization and social organization—and the impacts of management. Table 59 to Table 62 and Figure 26 try to ground the different kinds of places to which federally-permitted scallop fishermen belong, and to gauge the spatiality of economic activity and its changes over time, by ranking ports (and counties) of landing and homeports (and counties) by dockside value and dependence. The top ten landing ports have stayed relatively consistent in recent years, with New Bedford dominating. There have been some changes, however, with Hampton VA seeing an increasingly smaller share of total landings, and other port areas—namely Cape Cod ports—seeing an increasing importance from scallops (Table 59 and Table 60). The majority of the high-volume ports have predominantly been limited access ports (i.e. at least 85% of landed value is from limited access vessels) for the period 1994-2001, including: New Bedford, Newport News, Cape May, Seaford, Hampton, Barnegat Light, and Point Pleasant. Others have been predominantly open access ports, namely Hampton Bays, Sandwich and Wellfleet. Some ports have shifted between permit category, and while these generally run as expected—with increasing landings associated with an increased presence of limited access vessels—a number of ports show an alternate pattern. Chatham, Harwichport, Provincetown, and East Haven all saw increases in landings in fishing year 2000 or 2001, which was associated with either a change to or re-emergence of open access boats as the predominant or important contributor. Gloucester, which has shifted between open access and limited access dominance, saw an increase in landings in 1996 and 2001 that was due to open access vessels. (For other ports—mainly in Connecticut and some in Maine—it is difficult to say anything conclusively about the boats landing there from the dealer data. Connecticut provides its data without accompanying permit numbers; in other areas, landings are reported at the county-level only or without the permit numbers of smaller vessels. The effect of this is to make social scientific analyses difficult for some regions.)

Table 59. Distribution of Landed Value of Scallops by County and State of Landing (1994–2001)

	Value of landed scallops, in thousands of dollars								Percent of scallops value to total county value							
County, ST	1994	1995	1996	1997	1998	1999	2000	2001	1994	1995	1996	1997	1998	1999	2000	2001
Bristol, MA	33475	39411	50343	45514	34687	70554	88493	76115	38.8	41.5	45.2	42.5	35.6	50.0	53.9	55.3
Newport News (city), VA	9289	11917	13457	11173	11275	15207	23092	25449	67.1	71.1	76.0	73.4	72.6	79.2	86.4	85.5
Cape May, NJ	9389	8888	8656	6945	5591	9765	14279	19872	26.8	25.9	27.6	20.8	18.1	33.1	46.6	61.8
York, VA	5676	7420	6746	6170	4543	6540	11168	10465	66.2	71.8	70.3	66.7	56.0	72.0	81.3	85.0
Ocean, NJ	2968	3274	4549	5400	4290	5800	10518	9580	10.6	15.2	17.8	18.5	15.4	17.9	33.7	42.1
Hampton (city), VA	12425	7863	6346	3258	4557	5084	8289	9265	71.0	66.4	63.4	47.1	55.3	61.1	73.2	75.1
New London, CT	*	**	****	****	****	****	****	**	^	^^	^^^^	^^^^	^^^^	^^^^	^^^^	^^
Hancock, ME	4119	3620	3893	3906	2278	1854	1856	287	11.3	10.6	11.9	9.5	5.2	3.5	3.2	1.2
Barnstable, MA	180	252	1124	841	710	728	1446	4831	0.9	1.1	5.0	3.7	3.8	2.2	3.8	23.9
Essex, MA	*	*	291	473	105	168	1015	1535	^	^	1.1	1.8	0.3	0.3	1.8	5.1
Newport, RI	23	229	127	784	536	447	739	2	0.1	1.4	1.0	6.4	4.2	2.7	4.6	0.0
Washington, RI	2	58	8	7	*	242	734	596	0.0	0.1	0.0	0.0	^	0.4	1.5	1.6
Knox, ME	844	1490	570	747	692	229	683	183	1.7	2.6	1.1	1.2	1.2	0.3	1.0	1.0
Washington, ME	2265	1937	1791	2330	1582	1826	658	*	9.5	7.6	6.9	9.4	5.9	6.4	2.4	^
Suffolk, NY	*	23	19	25	6	62	442	460	^	0.0	0.0	0.1	0.0	0.2	0.9	2.2
Rockingham, NH	1	1	2	8	52	607	441	577	0.0	0.0	0.0	0.1	0.5	4.7	2.6	4.5
Unspecified, CT	***	****	*	*	*	*	**	1235	^	^^	^	^	^	^	^^^^^	94.3
Accomack, VA	2	*	*	*	*	7	210	803	0.0	^	^	^	^	0.1	2.0	8.7
New Haven, CT	nr	*	*	*	*	*	**	554	nr	^	^	^	^	^	^	26.4
Worcester, MD	11	24	43	5	*	25	118	65	0.1	0.3	0.5	0.1	^	0.4	2.0	3.9
Nantucket, MA	5	*	8	*	1	*	**	*	7.8	^	3.1	^	0.9	^	^^^	^
Middlesex, CT	nr	*	*	*	*	*	**	**	nr	^	^	^	^	^	^^^^	^^^^^
Dare, NC	nr	nr	*	**	*	31	64	1350	nr	nr	^	^	^	0.2	0.4	11.0
Carteret, NC	nr	nr	*	184	371	39	56	161	nr	nr	^	2.3	5.2	0.7	1.1	5.5
Pamlico, NC	nr	nr	*	**	27	7	47	125	nr	nr	^	^	0.7	0.1	0.6	6.1

NB: Years are fishing years; ports are sorted by 2000 value. Only ports with at least 100,000 in scallop value in fishing years 2000 or 2001, or at least 50,000 if greater than 10% of landed value from scallops in fishing year 2000 or 2001, are shown. n.r. = no landings reported at all. Though 2001 data is incomplete, there appear to be some significant changes at the port level between 2000 and 2001, and additional ports showing an increased reliance on scallops in 2001 are shown in italics. Cannot report actual numbers due to fewer than 3 known entities: * = 0-50,000; ** = up to 500,000; *** = up to 1,500,000; **** = up to 4,250,000; ^ = 0.0-2.5% ^^ = up to 10% ^^^ = up to 20% ^^^^ = up to 40% ^^^^^ greater than 40%. Source: Northeast dealer weighout data.

Table 60. Distribution of Landed Value of Scallops by Port of Landing (1994–2001)

	Value of landed scallops, in thousands of dollars								Percent of scallops value to total county value							
Port (County, ST)	1994	1995	1996	1997	1998	1999	2000	2001	1994	1995	1996	1997	1998	1999	2000	2001
New Bedford (Bristol, MA)	30981	36585	48436	45615	34687	70554	88491	76115	38.7	40.9	45.2	43.6	36.5	53.2	57.1	56.3
Newport News (Newport News, VA)	9289	11962	13457	11173	11275	15207	23092	25449	67.1	71.2	76.0	73.4	72.6	79.2	86.4	85.5
Cape May (Cape May, NJ)	9381	8874	8656	6983	5588	9765	14158	18626	33.2	33.2	35.3	28.8	22.5	43.8	59.4	69.3
Seaford (York, VA)	nr	nr	nr	5553	4543	6540	11168	10465	nr	nr	nr	94.9	94.4	98.1	99.3	99.7
Hampton (Hampton, VA)	12425	7863	6346	3258	4557	5084	8289	9265	71.0	66.4	63.3	47.1	55.3	61.1	73.2	75.1
Barnegat Light (Ocean, NJ)	2653	2727	3160	3193	2693	3946	6733	6744	27.7	29.4	32.6	30.8	26.3	29.9	47.5	46.8
Point Pleasant (Ocean, NJ)	315	532	1408	2207	1590	1854	3784	2836	2.0	5.0	9.7	13.0	9.6	10.0	23.4	35.8
Stonington (New London, CT)	nr	nr	**	****	****	****	****	**	nr	nr	^^^^	^^^^	^^^^	^^^^	^^^^	^^^^
Southwest Harbor (Hancock, ME)	186	352	2109	2206	1517	1424	1803	256	43.6	56.5	50.6	40.1	39.9	34.5	12.8	4.4
Other Barnstable (Barnstable, MA)	**	191	666	516	309	435	1083	1390	^^	6.2	13.5	9.3	8.6	3.5	17.2	42.7
Gloucester (Essex, MA)	*	*	232	357	104	161	1014	1468	^	^	1.0	1.5	0.4	0.6	2.5	5.6
New London (New London, CT)	nr	nr	*	*	*	***	***	*	nr	nr	^	^	^	^^^^	^^^^	^
Point Judith (Washington, RI)	1	58	4	7	*	242	734	595	0.0	0.2	0.0	0.0	^	0.5	1.8	2.0
Newport (Newport, RI)	23	229	101	784	534	447	700	*	0.2	2.0	1.3	10.2	6.5	5.1	8.4	^
Other Washington (Washington, ME)	650	1092	816	1816	1279	****	***	*	3.6	5.3	6.9	19.3	10.2	^^^	^^	^
Hampton Bays (Suffolk, NY)	*	5	5	22	6	53	425	448	^	0.1	0.1	0.2	0.1	0.6	4.4	6.0
Other Connecticut	***	****	*	*	*	*	**	1235	^	^^	^	^	^	^	^^^^^	94.3
Rockland (Knox, ME)	**	170	93	*	*	68	327	132	^	2.9	1.5	^	^	1.7	4.0	3.9
Sprucehead (Knox, ME)	256	227	106	88	**	*	**	*	90.0	30.4	1.5	0.9	^	^	^^	^

Port (County, ST)	Value of landed scallops, in thousands of dollars 1994	1995	1996	1997	1998	1999	2000	2001	Percent of scallops value to total county value 1994	1995	1996	1997	1998	1999	2000	2001
Chincoteague (Accomack, VA)	2	0	*	0	*	7	210	803	0.2	0.0	^	0.0	^	0.3	10.1	36.3
Newington (Rockingham, NH)	nr	nr	nr	nr	nr	*	**	**	nr	nr	nr	nr	nr	^	^^	^^
Sandwich (Barnstable, MA)	23	38	284	128	243	213	157	151	0.6	1.1	8.1	3.4	9.3	6.0	3.0	7.8
Portsmouth (Rockingham, NH)	0	0	0	*	18	7	**	**	0.0	0.0	0.0	^	0.6	0.2	^^	^^
East Haven (New Haven, CT)	nr	nr	nr	*	*	*	**	554	nr	nr	nr	^	^	^	^^^	31.8
Wildwood (Cape May, NJ)	7	14	*	0	*	0	120	1246	0.2	0.3	^	0.0	^	0.0	3.0	53.0
Provincetown (Barnstable, MA)	45	24	92	97	114	57	120	2061	1.9	1.2	4.1	4.0	4.2	1.6	3.2	48.4
Ocean City (Worcester, MD)	11	24	43	5	*	25	118	65	0.1	0.3	0.5	0.1	^	0.4	2.0	3.9
Nantucket (Nantucket, MA)	5	*	8	*	1	0	**	*	7.8	^	3.1	^	0.9	0.0	^^^	^
Great Bay (Rockingham, NH)	0	0	0	0	0	***	**	nr	0.0	0.0	0.0	0.0	0.0	^^	^^	nr
Essex (Middlesex, CT)	nr	nr	nr	nr	*	*	**	**	nr	nr	nr	nr	^	^	^^^^^	^^^^^
Wanchese (Dare, NC)	nr	nr	*	**	*	31	64	1350	nr	nr	^	^	^	0.3	0.5	12.7
Chatham (Barnstable, MA)	*	*	*	*	*	*	**	581	^	^	^	^	^	^	^	7.7
Wellfleet (Barnstable, MA)	nr	*	**	70	*	23	*	66	nr	^	^^^	23.1	^^^^	30.9	^^	49.2
Atlantic (Carteret, NC)	nr	nr	nr	**	**	*	*	**	nr	nr	nr	^^	^^	^	^	^^^^^
Harwich Port (Barnstable, MA)	*	*	*	*	*	*	*	582	^	^	^	^	^	^	^	20.9
Shark River (Monmouth, NJ)	nr	nr	nr	nr	nr	nr	*	**	nr	nr	nr	nr	nr	nr	^	^^^^

NB: Years are fishing years; ports are sorted by 2000 value. Only ports with at least 100,000 in scallop value in fishing years 2000 or 2001, or at least 50,000 if greater than 10% of landed value from scallops in fishing year 2000 or 2001, are shown. Though 2001 data is incomplete, there appear to be some significant changes at the port level between 2000 and 2001, and additional ports showing an increased reliance on scallops in 2001 are shown in italics. n.r. = no landings reported at all. Cannot report actual numbers due to fewer than 3 known entities: * = 0- 50,000; ** = up to 500,000; *** = up to 1,500,000; **** = up to 3,500,000 ^ = 0.0-2.5% ^^ = up to 10% ^^^ = up to 20% ^^^^ = up to 40% ^^^^^ greater than 40%. Source: Northeast dealer weighout data.

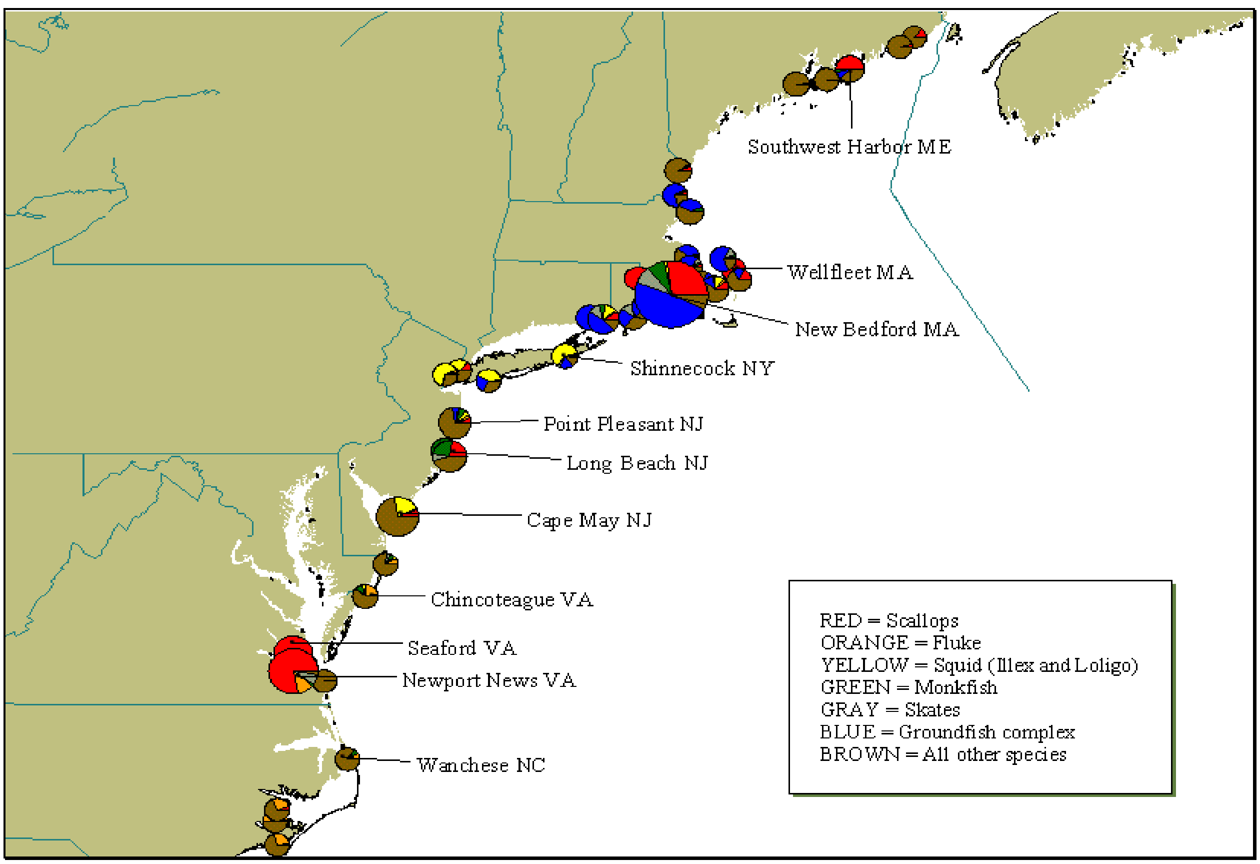

Figure 11. Distribution of pounds of scallops and other species at port of landing, fishing year 2000. Source: logbooks. Note: Size of chart corresponds to size of scallops landings, only ports with at least 5000 lbs of scallops.

A slightly different picture is told when one looks at the ports that boats call their “home ports,” for not all ports do or can buy scallops (Table 61 and Table 62). Here too, New Bedford and many of the larger landings-ports also dominate, but a number of ports in North Carolina (which until 2001 hardly appeared in the ports of landing at all) also appear significant. At the same time, there is a close overall connection between home port and port of landing (Figure 27). Despite the significance of landings from particular areas—the closed area II in 1999 or other reopened areas in 2000—*overall* the increase in landings came mainly from vessels home-ported in the same county in which they landed their catch; at the port level, there is a more variable relationship between homeport and landings port (Figure 28 and Figure 29).

Table 61. Distribution of Dealer-Reported Landed Value of Scallops by Associated Homeport County (1994–2001)

	Value of scallops to homeport county, in thousands of dollars								Percent of scallops value to total value							
Homeport county, ST	1994	1995	1996	1997	1998	1999	2000	2001	1994	1995	1996	1997	1998	1999	2000	2001
Bristol, MA	31,353.5	36,374.9	44,486.6	35,885.9	29,524.2	51,840.0	71,952.8	68,183.6	37.8	44.7	46.7	39.2	35.2	48.7	59.2	60.5
Norfolk (city), VA	14,802.8	15,818.3	16,234.3	14,093.3	10,969.8	14,764.5	18,014.7	14,188.1	75.2	76.6	76.1	69.9	64.1	72.5	83.3	86.3
Cape May, NJ	6,983.2	7,457.5	7,692.8	8,153.6	6,024.9	11,067.7	17,530.9	18,699.5	15.9	16.9	18.9	21.8	18.1	32.1	45.3	61.0
Newport News (city), VA	1,839.8	2,249.9	2,547.0	3,263.0	3,495.4	9,017.2	12,437.8	14,087.8	93.9	94.8	94.8	91.6	80.9	89.1	95.1	94.6
Ocean, NJ	3,993.8	4,347.2	4,512.9	4,412.9	3,350.6	6,105.6	9,380.4	9,679.9	24.8	30.1	32.0	34.1	22.3	25.5	37.2	45.2
Hampton (city), VA	4,113.4	4,413.4	4,001.2	3,013.7	2,601.7	3,703.6	4,997.5	4,131.0	90.6	92.7	91.5	88.3	87.4	96.3	94.9	95.0
Washington, RI	5.6	2.3	*	44.4	544.0	2,469.9	4,252.9	540.6	0.0	0.0	^	0.1	1.1	4.6	8.7	1.5
Pamlico, NC	860.2	1,078.8	1,266.5	1,132.2	1,954.0	2,925.0	3,839.5	3,716.4	47.1	60.6	63.7	44.2	54.1	51.4	54.9	69.0
Craven, NC	**	**	***	**	836.7	2,322.1	2,650.3	3,241.6	^^^^^	^^^^^	^^^^^	^^^^^	93.3	85.0	85.9	92.7
Carteret, NC	42.3	263.5	690.7	1,100.6	984.4	1,806.5	2,398.0	2,530.0	4.5	40.6	36.7	27.5	25.1	35.9	39.9	50.2
Barnstable, MA	2,608.0	2,467.6	2,517.9	1,612.5	1,103.4	719.4	1,806.6	4,482.7	12.2	10.8	12.2	8.9	6.3	3.5	9.7	21.5
Hancock, ME	253.9	602.9	1,098.7	1,290.3	776.8	1,274.5	1,730.6	1,179.8	8.6	21.0	37.2	25.2	21.6	41.1	67.1	62.4
Hyde, NC	0.0	0.0	**	**	**	***	827.1	526.5	0.0	0.0	^^^^	^^^^	^^^	^^^^	25.3	32.0
Dare, NC	46.1	13.6	3.0	0.8	485.0	0.6	816.0	2,768.4	2.7	1.1	0.2	0.0	9.5	0.0	10.8	28.5
New London, CT	0.0	*	0.0	***	**	0.0	705.6	2,895.0	0.0	^	0.0	^^^^^	^^^	0.0	33.6	46.6
Essex, MA	171.3	11.0	362.9	460.9	251.4	994.2	637.4	745.1	0.7	0.0	1.7	2.3	1.2	4.5	2.8	3.2
Rockingham, NH	0.7	1.4	1.6	12.4	45.2	7.4	568.8	730.6	0.0	0.0	0.0	0.2	0.6	0.1	6.0	7.5
Suffolk, MA	264.9	334.1	453.6	454.3	161.8	449.4	511.8	637.4	4.3	4.6	5.7	5.1	2.3	5.5	6.7	10.5
Duval, FL	**	nr	nr	**	**	**	***	***	^^^^^	nr	nr	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^
Poquoson (city), VA	0.0	nr	nr	0.0	0.0	**	***	***	0.0	nr	nr	0.0	0.0	^^^^^	^^^^^	^^^^^
Richmond (city), VA	**	**	**	**	**	***	***	***	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^
Lincoln, ME	23.2	*	58.1	24.3	*	*	***	491.5	0.4	^	1.2	0.5	^	^	^^^	11.3
Brevard, FL	***	***	**	**	**	***	***	***	^^^^^	^^^^	^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^
Isle of Wight, VA	**	**	**	**	**	***	***	***	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^
Middlesex, MA	***	***	***	***	***	***	***	***	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^
Kenai Peninsula, AK	nr	nr	nr	**	**	nr	***	***	nr	nr	nr	^^^^^	^^^^^	nr	^^^^^	^^^^^
Suffolk, NY	222.6	4.8	22.0	8.2	5.4	13.4	465.7	482.5	1.7	0.0	0.1	0.0	0.0	0.1	2.2	2.4
Knox, ME	735.2	560.1	724.2	925.3	774.5	46.8	262.1	655.5	16.9	10.9	15.0	12.4	15.0	0.9	4.5	13.9
Beaufort, NC	348.5	**	***	**	**	***	201.9	1,120.7	49.1	^^^^^	^^^^^	^^^^	^^^^	^^^^	15.9	52.5
Washington, ME	64.8	191.6	215.6	224.9	64.0	54.2	180.7	558.0	4.9	8.0	8.2	9.5	2.9	1.9	5.7	85.0
Monroe, FL	468.9	**	**	*	**	0.0	**	*	55.2	^^^^^	^^^^^	^^^^^	^^^^^	0.0	^^^^^	^^^^
Dade, FL	712.7	*	***	**	**	**	**	**	20.7	^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^
Virginia Beach (city), VA	**	**	**	**	*	**	**	**	^^^^^	^^^^	^^^^^	^^^^^	^	^^^^	^^^^	^^^^^
Providence, RI	0.0	0.0	0.0	*	0.0	*	*	**	0.0	0.0	0.0	^	0.0	^	^	^^^^
York, VA	**	**	**	nr	nr	nr	nr	**	^^^^^	^^^^^	^^^^^	nr	nr	nr	nr	^^^^^

NB: Years are fishing years, 2001 is year to date, ports are sorted by 2000 value. Only ports with at least 100,000 in scallop value in fishing years 2000 or 2001, or at least 50,000 if greater than 10% of landed value from scallops in fishing year 2000 or 2001, are shown. Figures should not be taken to represent the full universe of fishing, since not all weighout data is traceable by permit number. n.r. = no landings reported at all. * and ^: Cannot report actual numbers due to less than 3 known vessels reporting income: * = 0-50,000; ** = up to 500,000; *** = up to 1,500,000; ^ = 0.0-2.5% ^^ = up to 10% ^^^ = up to 20% ^^^^ = up to 40% ^^^^^ 40% and greater. Source: Northeast dealer weighout and permit data.

Table 62. Distribution of Landed Value of Scallops by Associated Homeport (1994–2001)

	Value of scallops to homeport, in thousands of dollars								Percent of scallops value to total value							
Hport (County, ST)	1994	1995	1996	1997	1998	1999	2000	2001	1994	1995	1996	1997	1998	1999	2000	2001
New Bedford (Bristol MA)	28,321	32,429	39,317	31,568	25,804	44,363	59,779	60,745	38.3	45.0	47.2	39.3	35.7	49.4	58.4	61.4
Norfolk (Norfolk VA)	14,803	15,818	16,234	14,093	10,970	14,765	18,015	14,188	75.2	76.6	76.1	69.9	64.1	72.5	83.3	86.3
Cape May (Cape May NJ)	6,979	7,453	7,528	7,957	5,876	10,546	16,725	17,698	19.8	21.4	23.1	27.8	21.7	36.8	52.5	65.2
Newport News (Newport News VA)	1,840	2,250	2,547	3,263	3,495	9,017	12,438	14,088	93.9	94.8	94.8	91.6	80.9	89.1	95.1	94.6
Fairhaven (Bristol MA)	2,708	3,245	4,453	4,318	3,720	6,776	11,669	7,439	53.6	55.4	63.6	57.0	46.6	66.4	78.2	70.7
Barnegat Light (Ocean NJ)	3,041	3,370	3,334	2,909	2,335	4,409	6,676	6,970	30.6	39.3	42.4	47.5	35.9	33.0	45.8	47.0
Hampton (Hampton VA)	4,113	4,413	4,001	3,014	2,602	3,704	4,998	4,131	90.6	92.7	91.5	88.3	87.4	96.3	94.9	95.0
New Bern (Craven NC)	**	**	***	**	837	2,322	2,650	3,242	^^^^^	^^^^^	^^^^^	^^^^^	93.3	85.0	85.9	92.7
Point Pleasant (Ocean NJ)	953	977	1,179	1,504	1,016	1,386	2,232	2,135	18.2	19.2	23.0	24.5	13.1	15.5	25.7	45.9
Davisville (Washington RI)	0	0	0	0	540	2,285	2,144	0	0.0	0.0	0.0	0.0	5.1	21.3	24.0	0.0
Point Judith (Washington RI)	4	2	*	9	3	182	2,099	530	0.0	0.0	^	0.0	0.0	0.7	8.3	2.7
Oriental (Pamlico NC)	**	**	174	**	890	1,627	1,776	1,260	^^^^^	^^^^^	49.6	^^^^^	69.9	57.1	62.7	68.8
Atlantic (Carteret NC)	0	**	***	930	971	1,357	1,731	2,075	0.0	^^^^^	^^^^^	41.8	41.7	47.8	77.2	83.8
Lowland (Pamlico NC)	6	120	445	0	**	963	1,466	1,786	1.8	72.4	75.8	0.0	^^^	57.9	75.0	81.8
Southwest Harbor (Hancock ME)	**	405	520	482	282	763	1,086	590	^^^^	50.5	62.8	55.1	47.4	77.0	87.2	88.7
Swanquarter (Hyde NC)	0	0	**	**	**	***	827	**	0.0	0.0	^^^^	^^^^^	^^^^	^^^^	46.0	^^^^^
Wanchese (Dare NC)	46	14	3	1	485	1	816	2,768	3.1	1.1	0.2	0.0	12.5	0.0	15.0	35.9
Wildwood (Cape May NJ)	*	5	149	**	**	***	805	1,001	^	0.1	2.1	^^	^^	^^^	13.3	42.7
Wellfleet (Barnstable MA)	0	**	318	287	68	126	679	808	0.0	^^^^	98.9	98.1	72.3	98.1	92.6	95.4
Gloucester (Essex MA)	171	11	317	372	251	986	636	594	0.9	0.1	1.9	2.3	1.4	5.0	3.3	3.1
Stonington (New London CT)	0	*	0	***	**	0	562	2,516	0.0	^	0.0	^^^^^	^^^	0.0	39.3	60.0
Boston (Suffolk MA)	265	334	454	454	162	449	512	637	4.3	4.6	5.8	5.1	2.3	5.6	6.7	10.5
Hyannis (Barnstable MA)	2,227	1,968	1,368	***	**	**	***	635	42.8	43.6	40.7	^^^^	^^^	^^^	^^^	27.8
North Dartmouth (Bristol MA)	*	0	0	0	0	***	***	nr	^^	0.0	0.0	0.0	0.0	^^^^^	^^^^^	nr
Portsmouth (Rockingham NH)	0	*	0	8	14	5	***	***	0.0	^	0.0	0.3	0.4	0.1	^^^	^^^
Boothbay Harbor (Lincoln ME)	0	0	0	0	0	0	***	**	0.0	0.0	0.0	0.0	0.0	0.0	^^^^^	^^^^
Poquoson (Poquoson VA)	0	nr	nr	0	0	**	***	***	0.0	nr	nr	0.0	0.0	^^^^^	^^^^^	^^^^^
Cape Canaveral (Brevard FL)	***	***	**	**	**	***	***	***	^^^^^	^^^^	^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^
Bass Harbor (Hancock ME)	*	**	**	**	**	**	***	**	^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^
Carrollton (Isle of Wight VA)	**	**	**	**	**	***	***	***	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^
Bedford (Middlesex MA)	***	***	***	***	***	***	***	***	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^
Richmond (Richmond VA)	**	**	**	**	**	***	***	***	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^
Jacksonville (Duval FL)	**	nr	nr	**	**	**	***	***	^^^^^	nr	nr	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^
Seward (Kenai Peninsula AK)	nr	nr	nr	**	**	nr	***	***	nr	nr	nr	^^^^^	^^^^^	nr	^^^^^	^^^^^
Shinnecock (Suffolk NY)	*	3	19	7	4	7	277	218	^	0.1	0.5	0.2	0.1	0.1	5.3	5.3
Sandwich (Barnstable MA)	20	21	137	71	83	114	128	312	1.3	1.4	7.8	3.8	4.0	4.2	6.8	16.5
Provincetown (Barnstable MA)	15	27	72	86	36	72	96	2,109	0.7	1.4	4.2	4.5	1.9	2.5	4.2	52.9
Bricktown (Ocean NJ)	0	0	0	0	0	*	**	0	0.0	0.0	0.0	0.0	0.0	^	^^^	0.0
Beaufort (Carteret NC)	42	*	*	*	0	**	**	244	14.1	^	^^	^	0.0	^^^	^^^	12.3
Bayboro (Pamlico NC)	*	**	*	*	**	**	**	670	^	^^^^^	^^^^	^^^^	^^^^^	^^^^^	^^^	62.1
Owls Head (Knox ME)	*	235	87	*	*	*	**	511	^^	62.5	59.4	^^	^^	^^	^^^	67.2
Beals (Washington ME)	*	*	84	21	6	*	**	288	^^	^	38.5	11.0	1.3	^^	^^^	96.0
Rockland (Knox ME)	**	0	535	***	***	0	**	**	^^^	0.0	49.0	^^^^	^^^^^	0.0	^^	^^^
New London (New London CT)	0	0	0	0	0	0	**	**	0.0	0.0	0.0	0.0	0.0	0.0	^^^	^^^
Marathon (Monroe FL)	469	**	**	*	**	nr	**	*	80.7	^^^^^	^^^^^	^^^^^	^^^^^	nr	^^^^^	^^^^
Virginia Beach (Virginia Beach VA)	**	**	**	**	*	**	**	**	^^^^^	^^^^	^^^^^	^^^^^	^	^^^^	^^^	^^^^^
Spruce Head (Knox ME)	228	157	61	35	0	*	**	*	74.2	86.3	62.7	52.6	0.0	^	^^^^^	^^^^^
Point Pleasant Beach (Ocean NJ)	*	0	0	0	0	**	**	**	^	0.0	0.0	0.0	0.0	^^^^^	^^^^^	^^^^^
Newport (Carteret NC)	*	**	**	**	*	**	**	**	^	^^^^^	^^^^^	^^^^^	^^	^^^^^	^^^^^	^^^^^
Miami (Dade FL)	713	*	***	**	**	**	**	**	20.7	^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^
Aurora (Beaufort NC)	**	**	**	**	**	***	**	***	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^
Mount Desert (Hancock ME)	nr	nr	*	**	*	*	**	**	nr	nr	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^	^^^^^
Pamlico (Pamlico NC)	nr	nr	nr	**	**	nr	**	nr	nr	nr	nr	^^^^^	^^^^	nr	^^^^^	nr
Harwich (Barnstable MA)	0	0	0	0	0	0	*	115	0.0	0.0	0.0	0.0	0.0	0.0	^	7.2
Newburyport (Essex MA)	*	*	*	21	*	4	*	143	^	^	^	4.1	^	1.2	^	22.2
Belhaven (Beaufort NC)	*	0	**	0	0	0	*	229	^	0.0	^^^^	0.0	0.0	0.0	^	23.0
Stonington (Hancock ME)	32	35	256	218	145	28	*	121	3.5	6.2	31.5	36.0	32.4	13.2	^^	33.7
Lubec (Washington ME)	0	0	nr	*	15	0	*	54	0.0	0.0	nr	^^^^^	100.0	0.0	^^^^^	89.5
Bucks Harbor (Washington ME)	*	*	*	*	*	*	*	159	^	^^	^^^^	^^^	^	^^	^^	100.0
Providence (Providence RI)	0	0	0	*	0	*	*	**	0.0	0.0	0.0	^	0.0	^	^	^^^^

	Value of scallops to homeport, in thousands of dollars								Percent of scallops value to total value							
Hport (County, ST)	1994	1995	1996	1997	1998	1999	2000	2001	1994	1995	1996	1997	1998	1999	2000	2001
Southampton (Suffolk NY)	nr	nr	nr	nr	*	*	*	**	nr	nr	nr	nr	^	^	^^^	^^^^^
Bremen (Lincoln ME)	0	0	*	*	*	*	*	**	0.0	0.0	^^^	^^	^^^^^	^^^	^^^^^	^^^^^
West Barnstable (Barnstable MA)	0	0	0	*	*	**	*	**	0.0	0.0	0.0	^^^	^^^^^	^^^^^	^^^^^	^^^^^
Chatham (Barnstable MA)	0	0	0	0	0	*	0	296	0.0	0.0	0.0	0.0	0.0	^	0.0	4.2
Jonesport (Washington ME)	46	50	32	28	16	4	0	54	9.3	4.9	2.9	2.1	1.9	0.3	0.0	100.0
Engelhard (Hyde NC)	0	nr	nr	0	0	0	0	**	0.0	nr	nr	0.0	0.0	0.0	0.0	^^^
Eastham (Barnstable MA)	0	0	nr	nr	nr	nr	0	**	0.0	0.0	nr	nr	nr	nr	0.0	^^^^^
Toms River (Ocean NJ)	nr	nr	nr	nr	nr	nr	0	**	nr	nr	nr	nr	nr	nr	0.0	^^^^^
Seaford (York VA)	**	**	**	nr	nr	nr	nr	**	^^^^^	^^^^^	^^^^^	nr	nr	nr	nr	^^^^^

NB: Years are fishing years, 2001 is year to date, ports are sorted by 2000 value. Only ports with at least 100,000 in scallop value in fishing years 2000 or 2001, or at least 50,000 if greater than 10% of landed value from scallops in fishing year 2000 or 2001, are shown. Figures should not be taken to represent the full universe of fishing, since not all weighout data is traceable by permit number. n.r. = no landings reported at all. * and ^: Cannot report actual numbers due to less than 3 known vessels reporting income: * = 0-50,000; ** = up to 500,000; *** = up to 1,500,000; ^ = 0.0-2.5% ^^ = up to 10% ^^^ = up to 20% ^^^^ = up to 40% ^^^^^ greater than 40%. Source: Northeast dealer weighout and permit data.

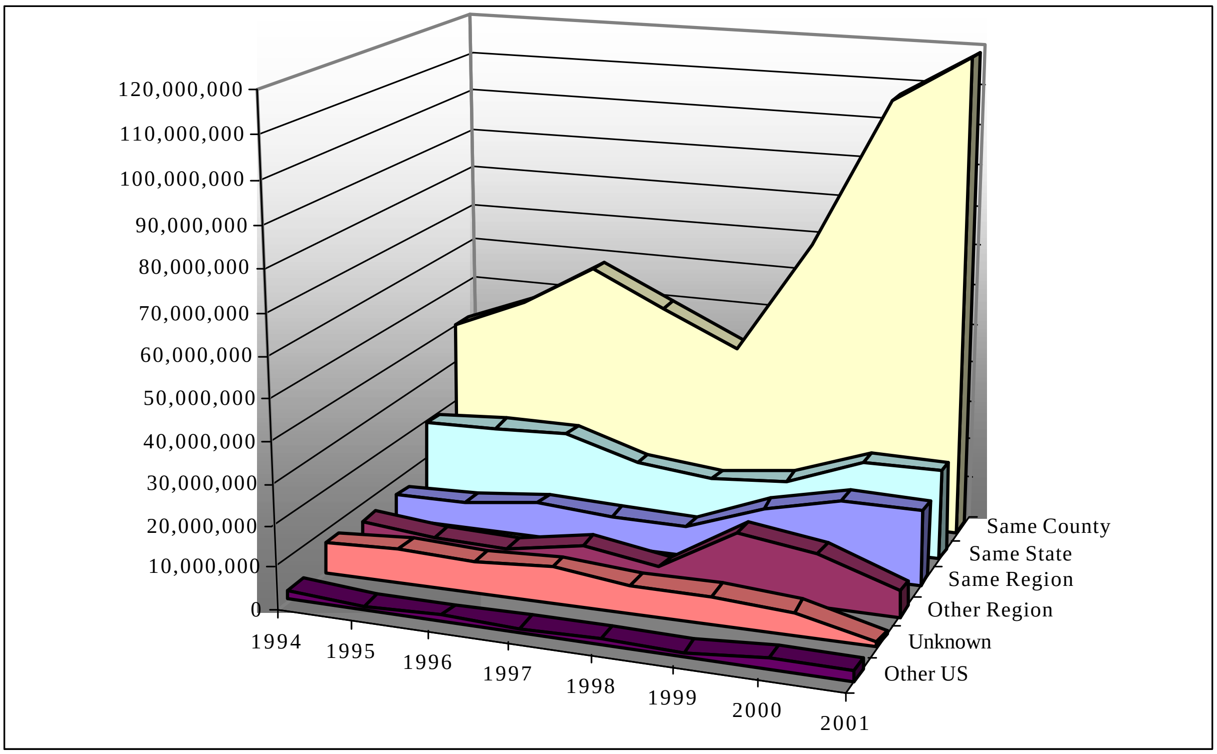

Figure 26. Relation of Landings at Port of Landing to Homeport of Vessel (1994 – 2001 fishing years).

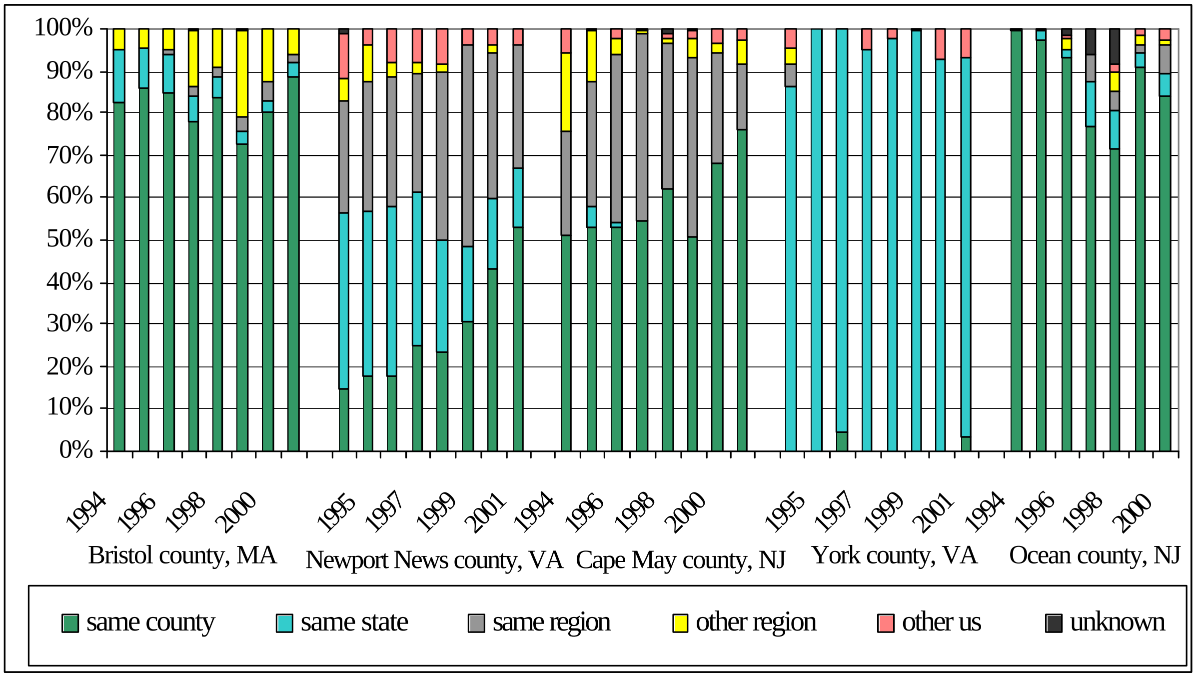

Figure 27. Scallops landing patterns (% in terms of value), landing county by homeport county

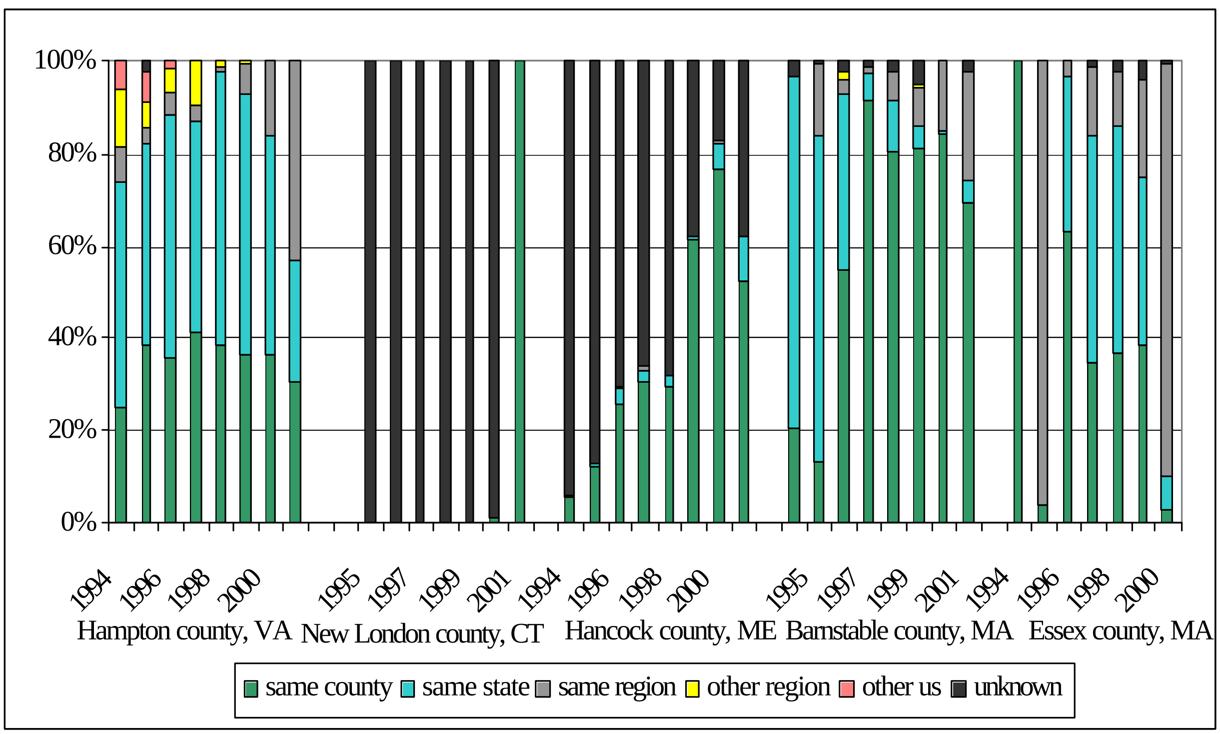

Figure 28. Scallops landing patterns (% in terms of value), landing county by homeport count

7.1.1.4 Fishing Areas and Use of Space

Despite an image of a highly mobile fleet, many fishermen tend to fish in the same areas and in areas close to their home and landing ports. The majority of vessels—limited access and general category vessels together—caught at least half of their annual scallop pounds in just one statistical area (Table 63). Virtually all general category vessels did so, as well as usually at least half of limited access vessels. This can be for any number of reasons: that they fish with small boats and/or are day-trip boats, that they have extensive knowledge of particular but not all areas, and so on. The implication for the different area management alternatives is to reinforce that any areas considered for closure must be especially sensitive of the fishermen and fishing communities that may be exclusively dependent on them.

Table 63. Number of vessels catching at least half of their annual scallop catch in one statistical area, Fishing years 1995-2000. Source: 1994-2001 logbooks

	1995		**1996**		**1997**		**1998**		**1999**		**2000**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
All vessels	272	70.1	307	74.5	295	73.2	294	76.8	272	66.5	299	69.5
Limited access only	128	53.1	119	52.7	144	58.3	143	62.2	111	45.3	132	50.4

Moreover, not all areas are the same: the spatiality of fishing grounds implies that not only are some areas biologically more productive than others, but that fishermen choose to fish in particular areas for a myriad of other social as well as economic reasons. Day-trippers, for example, may fish close to shore because of a personal and social desire to come back home every night, even if that might mean for some a lower annual income. Table 64 ranks statistical areas by the five-year average percentage of that area's contribution to a vessel's annual scallop catch. The areas that line the coast of New England, and to a lesser extent, the Mid-Atlantic, seem to be the more important in terms of annual catch dependence (also shown in Figure 30), though they are not necessarily the areas that bring home the slammer trips. These areas are related to the coastal ports that lie adjacent, and the tendency of different ports to travel further offshore is highly differential, as Figure 143 shows, as is the capacity of smaller vessels to do so (see Table 65). These tendencies are, of course, related, as many of the ports exhibiting small average distance travels are dominated by smaller vessels. Additionally, for many of these ports the distance traveled is roughly similar whether it is seen from the perspective of vessels using the port as port of landing or as homeport. Some ports, however, do show significant differences (Wanchese NC and Hampton VA, for example), which reflects on the one hand that some usually larger vessels are able to fish further from shore and land at ports other than their homeport, and that ports of landing are far more concentrated than homeports and see more differentiated activity.

Table 64. Fishing characteristics* by statistical area, fishing years 1995 – 2000. Source: 1994-2001 logbooks.

	1995			1996			1997			1998			1999			2000			5-yr Ave %
AREA	Ave %	Ave Scallops	No. Boats	Ave %	Ave Scallops	No. Boats	Ave %	Ave Scallops	No. Boats	Ave %	Ave Scallops	No. Boats	Ave %	Ave Scallops	No. Boats	Ave %	Ave Scallops	No. Boats	
512	76.2	4237	47	81.5	3874	63	79.4	2898	48	79.2	3235	39	84.5	1738	27	64.7	2816	18	77.6
511	57.4	2606	33	63.6	2949	26	68.5	2102	30	74.2	1738	39	77.6	2399	27	85.1	2133	20	71.1
514	54.7	7678	73	59.4	10495	87	68.3	9199	94	69.4	7811	54	82.2	8496	36	87.2	8765	43	70.2
513	48.8	1268	18	54.8	5558	32	64.6	3247	38	63.7	1297	21	67.0	1027	25	61.6	1001	14	60.1
611	18.3	12534	6	100.0	n/a	2	5.3	n/a	2	10.9	n/a	1	100.0	n/a	2	77.6	4048	3	52.0
539	51.6	1658	10	33.9	3204	13	29.5	4519	18	34.3	4165	23	45.5	5513	8	28.6	4101	4	37.2
626	36.1	23540	110	34.1	20800	71	24.3	9951	47	38.8	15963	83	37.8	24199	80	40.4	42280	88	35.2
521	22.1	12387	60	30.9	27035	85	38.1	24456	94	36.5	20839	70	29.7	20935	68	33.0	24611	85	31.7
525	18.3	8793	49	26.7	12936	73	33.9	13949	63	42.3	10487	86	31.6	15326	69	33.9	14154	77	31.1
613	19.9	9996	93	28.5	13486	110	32.2	13815	109	37.5	14146	90	31.4	11962	86	35.4	26068	108	30.8
622	35.5	20882	123	40.0	21057	94	30.1	13659	55	20.4	10879	43	24.6	19511	82	34.1	32082	69	30.8
537	39.1	1497	17	18.5	4695	23	19.2	5762	16	15.3	8108	18	43.9	11391	12	43.5	8236	15	29.9
522	33.4	3682	32	29.0	6742	27	27.2	6487	34	27.3	12334	35	25.9	15501	57	23.0	27579	116	27.6

AREA	1995 Ave %	1995 Ave Scallops	1995 No. Boats	1996 Ave %	1996 Ave Scallops	1996 No. Boats	1997 Ave %	1997 Ave Scallops	1997 No. Boats	1998 Ave %	1998 Ave Scallops	1998 No. Boats	1999 Ave %	1999 Ave Scallops	1999 No. Boats	2000 Ave %	2000 Ave Scallops	2000 No. Boats	5-yr Ave %
562	12.5	7976	17	23.8	6878	27	31.5	6645	24	36.1	8978	25	37.3	28969	187	21.9	19646	105	27.2
616	29.8	19579	132	31.5	22492	128	27.1	13242	89	24.5	9916	45	18.5	12031	55	25.9	28198	85	26.2
621	24.0	14107	86	19.4	9880	57	18.5	8573	40	30.1	13785	78	26.0	18703	82	33.0	33660	100	25.2
631	24.3	6175	6	43.6	9730	3	5.2	2805	10	26.2	6668	16	3.3	3387	5	46.4	n/a	2	24.8
615	22.5	14245	120	23.2	13310	110	27.5	12225	95	25.1	11493	66	22.5	22867	104	28.1	36071	144	24.8
526	14.8	9576	34	20.5	15635	29	22.8	17163	38	38.3	26836	27	28.8	28241	37	14.1	18860	137	23.2
632	30.7	15894	46	18.6	10127	28	22.5	12285	33	23.6	10161	33	8.4	8960	17	33.6	21809	12	22.9
561	15.4	8134	24	16.1	13456	31	23.7	17649	39	25.5	16783	35	24.8	22735	39	28.6	23466	27	22.3
612	35.4	4252	14	10.9	5082	19	23.6	7212	38	22.9	7868	39	15.1	11106	22	21.0	17609	22	21.5
610	13.5	11659	8	51.1	45725	9	16.9	10294	14	19.2	11649	13	14.2	15710	6	9.3	n/a	1	20.7
515	37.3	2707	6	7.1	4147	5	20.7	12486	8	5.7	2880	3	22.3	14602	5	23.9	n/a	2	19.5
620	25.1	7635	7	16.3	9897	6	14.3	8833	6	16.1	9702	7	24.9	21551	12	16.7	24139	3	18.9
614	7.7	4846	5	32.6	15507	3	20.7	5583	9	7.5	3997	4	19.0	4527	7	23.8	8116	6	18.5
600	18.6	11662	5	15.4	6447	8	31.1	17994	12	17.6	10987	8	13.9	15436	6	13.3	n/a	1	18.3
623	12.9	9687	10	54.3	n/a	2	20.0	5748	5	4.0	n/a	2	7.8	2760	3	10.4	14715	3	18.2
627	12.1	6555	6	17.4	12945	6	4.6	n/a	1	10.6	4574	4	32.8	28615	4	28.9	28489	6	17.7
543	10.4	n/a	1	6.9	n/a	1	0.0	0	0	0.0	0	0	29.2	33765	3	55.8	n/a	1	17.0
500	11.5	n/a	1	15.9	9946	6	16.4	10281	10	25.8	11580	10	25.5	6688	3	2.6	n/a	1	16.3
524	0.0	0	0	0.0	0	0	0.0	0	0	7.5	n/a	2	27.5	n/a	1	58.7	n/a	1	15.6
520	7.0	n/a	2	30.1	7341	5	20.8	16802	5	15.4	7448	8	13.8	11914	5	0.0	0	0	14.5
552	0.0	0	0	0.0	0	0	8.6	n/a	2	0.0	0	0	38.0	17638	13	21.5	31113	3	11.3

* NB: Only shows those areas that had an annual total scallop landing of at least 50,000 pounds, at least one of year during the period 1995-2000. average % refers to the average (by vessel) percentage of a vessel's annual scallop landings by area; average scal refers to the average (by vessel) annual scallop landings in that area; and boats refers to the number of vessels recording at least one trip in that area.

Table 65. Average Distance traveled from fishing grounds to port of landing, and Average Scallops Landed, stratified by plan, vessel length, and calendar year. Source: logbooks.

Limited Access Vessels, by Year and Vessel Length Category										
	Average Distance Traveled (nautical miles)					**Average Scallops Landed (pounds)**				
	1997	**1998**	**1999**	**2000**	**2001**	**1997**	**1998**	**1999**	**2000**	**2001**
Less than or equal to 45 feet	12.2	4.7	21.5	35.1	21.5	242	550	806	2086	1631
45-60 feet	60.1	63.4	85.8	20.1	35.0	2592	1395	3576	904	1225
60-80 feet	106.7	90.6	110.3	108.4	93.1	3179	3165	5505	7972	10877
Greater than 80 feet	107.1	103.3	114.0	94.9	95.1	5451	4301	7015	8605	12598
General Category Vessels, by Year and Vessel Length Category										
	Average Distance Traveled (nautical miles)					**Average Scallops Landed (pounds)**				
	1997	**1998**	**1999**	**2000**	**2001**	**1997**	**1998**	**1999**	**2000**	**2001**
Less than or equal to 45 feet	11.1	10.8	10.2	12.3	16.6	302	270	222	323	437
45-60 feet	16.6	15.3	15.4	24.5	20.9	225	228	304	376	386
60-80 feet	67.0	96.9	81.9	80.3	42.5	169	234	127	175	293
Greater than 80 feet	105.8	112.5	105.8	120.7	47.7	162	99	82	257	233

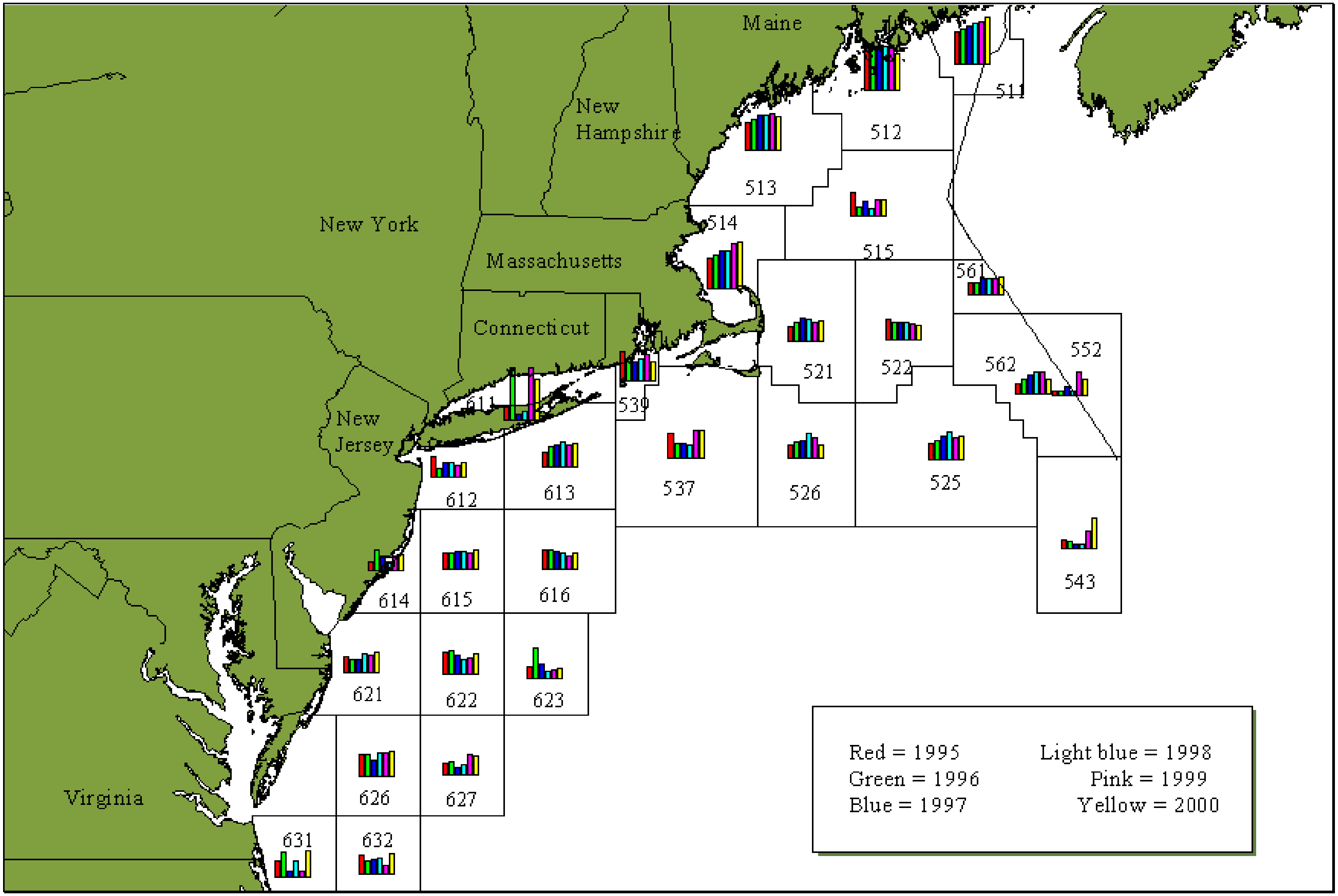

Figure 29. Average percentage that area contributes to vessel's annual scallop catch, fishing years 1995-2000 (as in Table 64)

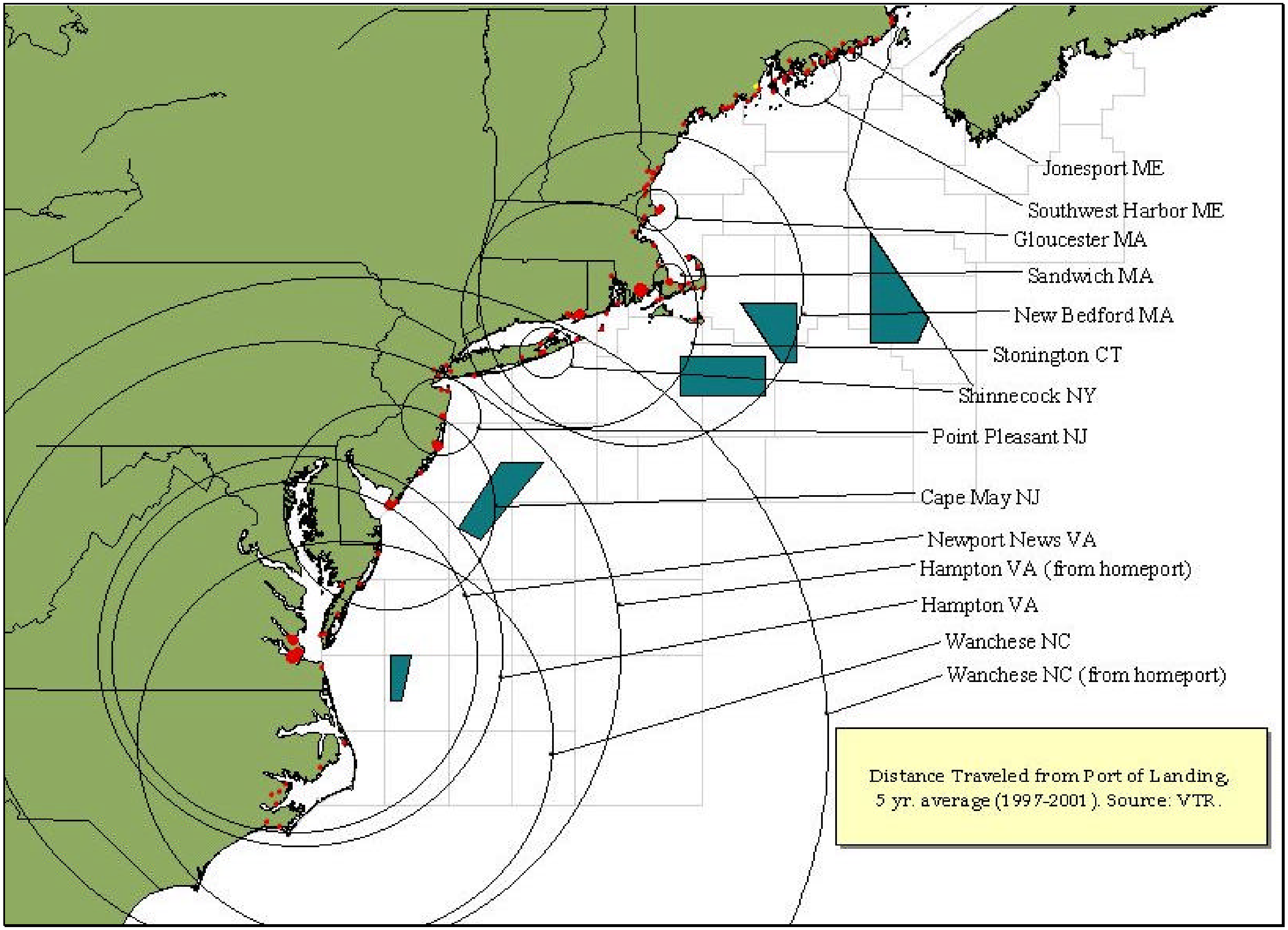

Figure 30. **Five-year average of distance traveled from port (port of landing, or homeport if specified). Includes only scallop trips (trips landing greater than 40 pounds of sea scallops) by federally permitted vessels (general category or limited access vessels). Source: logbooks.**

7.1.2 Management history

Since 1982, the Atlantic Sea Scallop FMP has regulated the fishery for scallops (Placopecten magellanicus) throughout the range on the Atlantic coast of the U.S. Initially the major regulations required scallop vessels to land scallops that averaged less than 35 to 40 count (meats per pound) or if landed in-shell, have a minimum shell height of 3 to 3½ -inches. Fishing effort increased to unsustainable levels in the late 1980s and 1990s, prompting the Council to develop Amendment 4 that became effective in 1994.

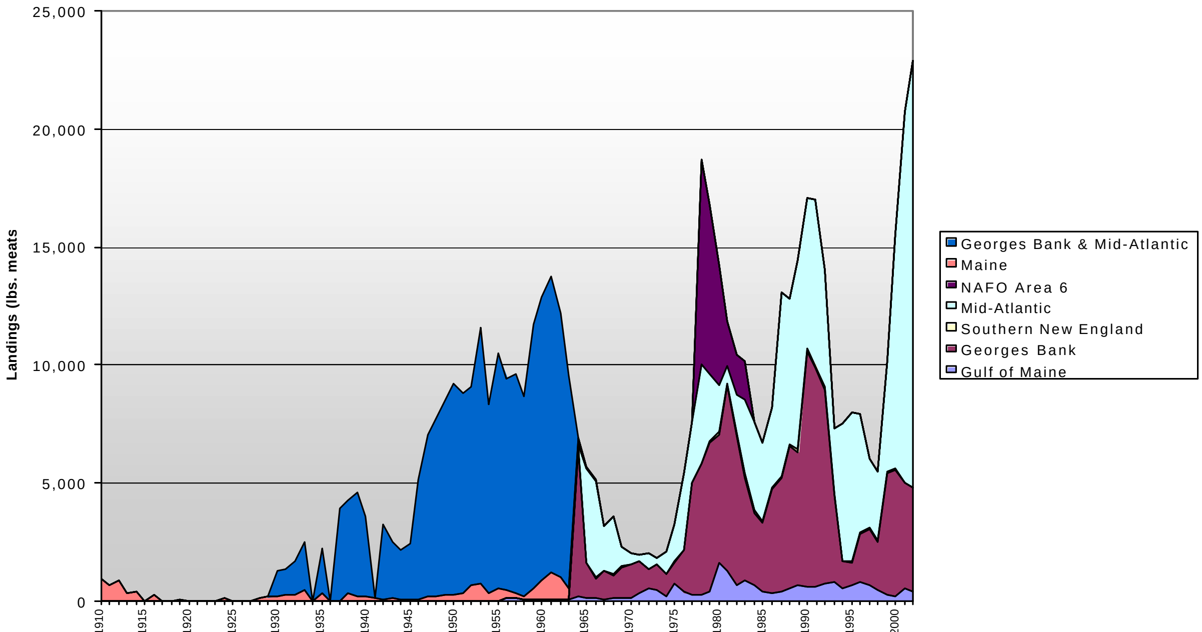

Figure 31. Total landings by region, 1910 – 2002. 2000 and 2001 landings are by fishing year (March to February) and 2002 landings are estimated based on the ratio of monthly landings in 2001.

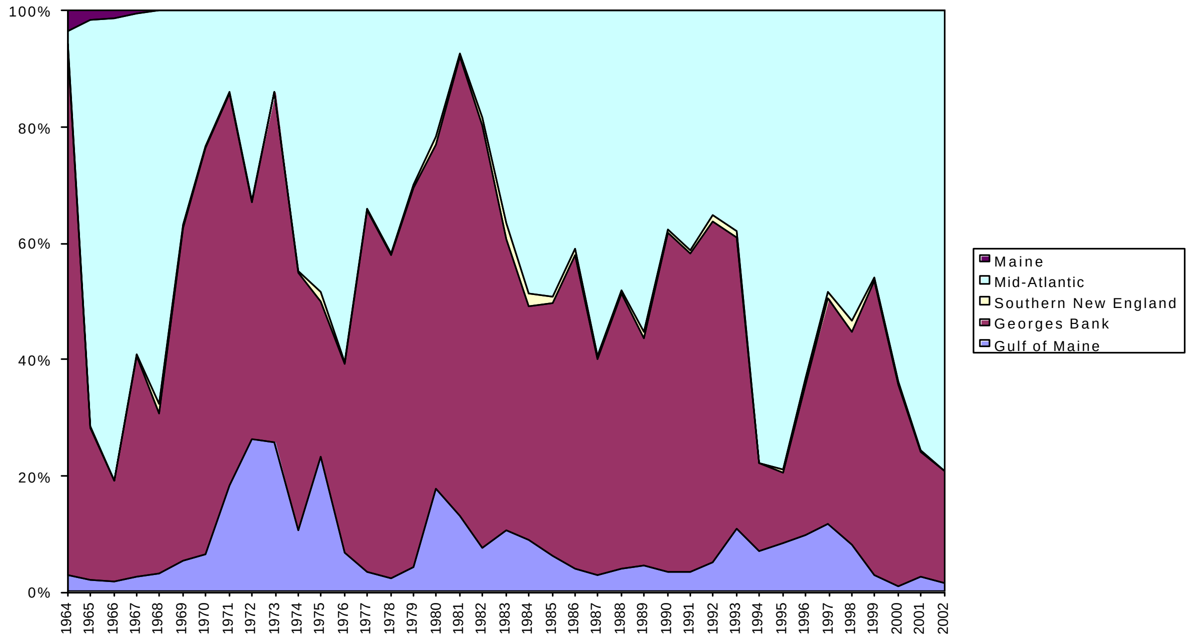

Figure 32. Proportion of landings by region, 1960 – 2002. 2000 and 2001 landings are by fishing year (March to February) and 2002 landings are estimated based on the ratio of monthly landings in 2001.

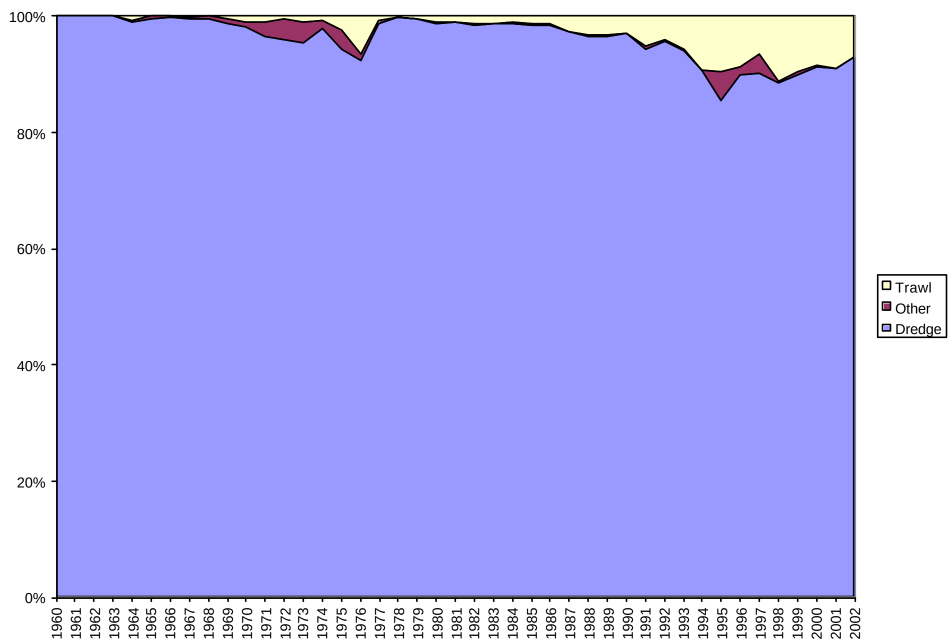

Figure 33. Proportion of landings by gear, 1964 – 2002. 2000 and 2001 landings are by fishing year (March to February) and 2002 landings are estimated based on the ratio of monthly landings in 2001.

The following is a brief description of past management actions associated with the Atlantic Sea Scallop FMP since 1982:

Amendment #1 to the plan proposed a 40-meat count (scallop meats per pound) minimum size throughout the fishery and was approved on October 9, 1985. It was never implemented.

Amendment #2 was approved in June 1988 to provide a 10% increase in the meat count standard during October through January when spawning causes a reduction in individual meat weight, and a framework mechanism to adjust the meat count standard during the spawning season. It became effective on July 22, 1988.

Amendment #3 established regional 12-hour time periods (offloading windows) for off-loading sea scallops. It became effective on February 5, 1990.

- Each full-time and part-time scallop vessel was authorized to make a maximum of two trips into Closed Area I, three trips into Closed Area II, and one trip into the Nantucket Lightship Area, with a trip limit of 10, 000 pounds and with each trip counting as 10 DAS toward the vessel's DAS allocation for fishing year 2000.

Table 66. Summary of amendments and Secretarial actions for the Atlantic Sea Scallop Fishery Management Plan.

Implementation date	Label	Primary regulatory changes
10/9/85	A1	40-meat count (scallop meats per pound) minimum average size ("meat count standard")
7/22/88	A2	10% increase in the meat count standard during October through January; framework adjustment to the meat count standard during spawning
2/5/90	A3	Regional 12-hour time periods (windows) for off-loading sea scallops
1/19/94	A4	Limited access; days-at-sea reduction schedule and allocations; overfishing definition; elimination of overfishing on a seven-year schedule
1/14/97	A5	To implement measures to permit the Sea-stead scallop grow-out project
1/10/97	A6	Gear Conflict - allowed the Council to resolve gear conflicts in the sea scallop fishery through the framework adjustment process
4/3/98	IA	Interim action to close Hudson Canyon and Virginia Beach areas to protect small scallops
3/29/98	A7	Addressed SFA stock rebuilding requirements by establishing new management reference points and fishing mortality targets to achieve B_{MSY} on a continuing basis and the elimination of overfishing through DAS reductions. (120 DAS for full time vessels with further reductions planned to meet fishing mortality targets). Extension of Hudson Canyon and Virginia Beach areas to protect small scallops through March 1, 2001.
2/19/99	A8	Made upgrading and vessel replacement provision consistent with those in other New England and Mid-Atlantic FMPs.
4/21/99	A9	EFH – Addressed SFA requirements for designating Essential Fish Habitat
3/2/01	IA	Interim Action – requested by the Council to delay the opening of the Mid-Atlantic closed areas until controlled access to these areas could be implemented by Framework Adjustment 14.

Table 67. Summary of annual and in-season framework adjustments for the Atlantic Sea Scallop Fishery Management Plan

Implementation date	Label	Primary regulatory changes
7/19/94	FW1	Implementation of first-year effort controls on a full-year basis
11/21/94	FW2	State waters exemptions from gear restrictions
12/5/95	FW3	Elimination of vessel ownership requirement to retain limited access permit
4/5/95	FW4	Temporary adjustment (reduction to seven) in crew-size limit
6/29/95	FW5	Restrictions on the use of nets by dredge vessels and twine-top mesh size restrictions
7/10/95	FW6	Change to DAS demarcation line (DAS are counted when a vessel crossed this line)
3/5/96	FW7	Indefinite extension of (reduction to seven) crew-size limit
7/24/96	FW8	Further restrictions on the use of nets to catch sea scallops
8/14/97	FW9	Exemption from the 400-pound possession limit for state waters fisheries
8/28/98	FW10	Extension of measures needed for continuation of the Sea-stead scallop grow-out project
6/15/99	FW11	Scallop vessel access to Georges Bank Closed Area 2 (this action also included GF Framework 29)
3/1/00	FW12	Annual adjustment –DAS allocations adjusted to 120 for full-time; 48 for part-time & 10 for occasional vessels.
6/15/00	FW13	Scallop vessel access to Georges Bank Closed Areas with 10,000 pound trip limit and 10 DAS trade-off. Access for general category scallop vessels to the Nantucket Lightship Closed Area and Closed Area I was disapproved because of enforcement and administrative issues.
5/1/01	FW14	Annual adjustment – DAS allocations adjusted to 120 for full-time; 48 for part-time & 10 for occasional vessels; controlled access to Virginia Beach and Hudson Canyon areas; additional area closures
3/1/03	FW15	Annual adjustment - DAS allocations adjusted to 120 for full-time; 48 for part-time & 10 for occasional vessels; controlled access to Virginia Beach and Hudson Canyon areas

Amendment 4 radically changed the management of the sea scallop fishery and resource to achieve a maximum fishing mortality threshold equal to $F_{5\%}$. This reference point was calculated to protect recruitment by attempting to keep spawning stock biomass above five-percent of virgin conditions, a level thought to be sufficient to prevent a recruitment-caused stock collapse for a fecund species like sea scallops. Implemented with this management change were limited access permits, annual day-at-sea allocations, dredge ring-size minimums, restrictions on gear configuration to improve escapement of small scallops, a minimum twine top mesh to improve finfish escapement, and a nine-man maximum crew limit. All were intended to reduce fishing mortality and/or reduce the capture and landing of small sea scallops. Both effects would allow biomass to increase and over the long term improve total yield to the fishery.

Initially the day-at-sea allocations began at 204 for full-time limited access vessels, 91 for part-time limited access vessels, and 18 for occasional limited access vessels. These annual allocations were reduced by Amendments 4 and 7, according to the schedule in the table below. Framework Adjustments 14 kept the day-at-sea allocations constant in 2001 and 2002 because the anticipated day-at-sea reductions in Amendment 7 were not needed to achieve the FMP's annual fishing mortality targets.

In 1994, Amendment 4 also prohibited the use of chafing gear, cookies, and triple links between rings. Vessels were required to use twine top mesh no less than 5½ inches to improve the escapement of finfish. Framework Adjustment 11 increased this regulation to an 8-inch minimum mesh to reduce finfish bycatch more and help to mitigate the potential increases of finfish bycatch in Closed Area II, re-opened to scallop fishing in 1999. This measure was successful and did not significantly affect the catches of larger scallops then becoming more abundant, so the Council has kept the 8-inch twine top mesh regulation in place. In the re-opened closed areas, where scallops were even larger and the finfish were thought to be more abundant, Framework Adjustment 11 and 13 required scallop vessels to use a 10-inch twine top mesh. It was thought that the vessels would not see a significant loss of these large scallops with the larger twine top mesh.

The crew limit was initially nine men to prevent vessels from targeting small scallops when and where they were abundant, by using more men to shuck the smaller scallops. It takes more time to shuck and equal weight of small scallops compared to larger scallops, so the crew limit helped replace the effectiveness of the meat count regulation that Amendment 7 discontinued. Framework Adjustment 1 reduced the crew limit to seven men in response to higher abundances of small scallops in the Mid-Atlantic in 1994.

Amendment 5 to the Northeast Multispecies FMP in 1994 closed Closed Area I, Closed Area II, and the Nantucket Lightship Area to scallop fishing, because of concerns over finfish bycatch and disruption of spawning aggregations. Except for the limited access program in Framework Adjustment 11 and 13 during 1999 and 2000, these areas remain closed to scallop fishing. Amendment 7 to the Sea Scallop FMP continued the closure of the Hudson Canyon and VA/NC Areas, initially closed by Emergency Action in 1998. The Council closed these areas in response to above average recruitment and high abundance of small scallops. A sunset date for the closures was March 1, 2001 and would have allowed these areas to re-open without additional restrictions, if not for a Council-requested Interim Action to postpone the sunset date, until this framework adjustment becomes effective.

Table 68. Annual day-at-sea allocations and reported day-at-sea use by limited access scallop vessels.

Fishing year	1992	1993	1994[44]	1995	1996	1997	1998	1999	2000	2001	2002	2003
Full-time			204	182	182	164	142	120	120	120	120	120
Part-time			91	82	82	66	57	48	48	48	48	48
Occasional			18	16	16	14	12	10	10	10	10	10
Day-at-sea use	44,934	40,490	36,747	33,490	34,404	30,830	27,089	23,074[45]	24,958[46]	28,198[47]	30,065[48]	30,082[49]

44 Initial day-at-sea allocation under Amendment 4

45 Accumulated days in 1999, including charges from the day-at-sea tradeoff for trips taken in the groundfish closed areas totaled 25,155 days.

46 Accumulated days in 2000, including charges from the day-at-sea tradeoff for trips taken in the groundfish closed areas totaled 27,492 days.

47 Accumulated days in 2001, including charges from the day-at-sea tradeoff for trips taken in the Hudson Canyon and VA/NC Areas totaled 29,174 days.

48 Accumulated days in 2002, including charges from the day-at-sea tradeoff for trips taken in the Hudson Canyon and VA/NC Areas totaled 30,314 days.

49 Accumulated days in 2003 estimated based on the ratio to used days during 2002 from March to July of each year. Total accumulated days is estimated to be 30,276 assuming the same number of Hudson Canyon and VA/NC Areas trips are made in 2003. The scallop possession limit in the Hudson Canyon and VA/NC Areas increased to 21,000 lbs. of scallop meats.

Framework Adjustment 14 implemented a new area access program to the Hudson Canyon and VA/NC Areas since scallop biomass had rapidly increased due to the enhanced survival of the strong 1997 and 1998 year classes, especially in the Hudson Canyon Area. Following the structure of the highly successful area access program for the Georges Bank closed areas in 2000, the framework adjustment allocated trips to limited access vessels and applied a scallop possession limit and a day-at-sea tradeoff. Unlike the Georges Bank closed area access program, however, Framework Adjustment 14 allowed vessels with general category scallop permits to retain and land 100 pounds of scallop meats if they had fished in the Hudson Canyon and VA/NC Areas. Because the rapidly rebuilding scallop resource in the open areas was causing catches to rise, it was necessary to increase the scallop possession limit to attract effort in the area access program for the automatic 10 day-at-sea charge. Economic analysis indicated that raising the scallop possession limit to 17,000 and 18,000 pounds per trip could have insufficient economic incentives to fish in the Hudson Canyon and VA/NC Areas. During 2001, this appears to have been the case, since only 55 percent of the TAC was taken by limited access scallop vessels, even though up to six trips had been authorized for authorized vessels[50]. Early indications are that fishing effort is likewise below expectations in the Hudson Canyon and VA/NC Areas during the 2002 fishing year, even though Framework Adjustment 14 increased the scallop possession limit to 18,000 pounds per trip.

Although the Amendment 7 management objectives remained unchanged in the subsequent framework adjustments, concern was expressed about the cumulative effects of the proposed management actions in Frameworks 11 to 14 and consideration of new area closures would have significant effects. The actions proposed in Framework Adjustment 14 were also intended for a two-year period and included a permanent measure that would prohibit vessels from landing large amounts of shell stock and/or shucking sea scallops while off the day-at-sea clock. The Council therefore developed and took comment on a Supplemental Environmental Impact Statement (SEIS), which analyzed the cumulative effects of scallop management since Amendment 7 and the projected effects of the measures proposed in Framework Adjustment 14.

Framework Adjustment 15 continued the measures implemented in Framework Adjustment 14, but increased the Hudson Canyon and VA/NC Area scallop possession limit from 18,000 to 21,000 lbs. per trip. This action was needed to achieve the objectives and fishing mortality target specified in Amendment 7, while the Council developed Amendment 10.

In summary, the sea scallop fishery is governed primarily by day-at-sea allocations, crew limits, gear restrictions, and ad hoc area closures to achieve annual fishing mortality targets and achieve maximum sustainable yield (MSY). These efforts have been very successful, reducing fishing mortality and allowing biomass to recover nearly to the long-term targets well ahead of schedule. During the last seven years, the amount of fishing effort has declined from 45,000 days in 1992-1993 to 23,000 days in 2000-2001. At the same time, the number of limited access permits has declined from around 450 in 1994 to 340 in 2000. Only 276 of the 340 limited access permits used allocated days-at-sea in the 2000 fishing year. At the same time, age 2 and 3 scallops have become less vulnerable to the fishery because of gear restrictions, crew limits, and the Hudson Canyon and VA/NC Area closures. Overall fishing mortality on the Georges Bank stock has declined from 1.51 in 1991 to 0.15 in 1999 (NMFS 2001a), while biomass has increased from 1.30 kg/tow in the 1991 survey to 9.08 kg/tow in the 2000 survey (Table 69). For the Mid-Atlantic stock, fishing mortality has declined from 1.31 in 1991 to 0.43 in 1999 (NMFS 2001a), while biomass also increased from 0.99 kg/tow in the 1991 survey to 3.78 kg/tow in the 2000 survey (Table 70).

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50 All vessels with a limited access scallop permit, even if the permit were converted from a Confirmation of Permit History during the year, were initially authorized to take three trips in the Hudson Canyon and VA/NC Areas. On October 1, 2001, the Regional Administrator authorized an additional three trips for vessels that fished in the area access program before September 1, 2001.

Table 69. Trends in landings, biomass, and fishing mortality for the Georges Bank scallop stock (NMFS 2001a and NMFS 2001b).

Calendar year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001[51]	2002
Landings (mt)	9,311	8,238	3,655	1,137	982	2,045	2,326	2,016	5,155	8,572[52]	4,514	
Biomass (kg/tow)	1.30	1.65	0.53	0.46	0.80	1.51	1.50	3.72	3.53	3.67	8.92	~8.653
Fishing mortality	1.51	1.11	1.28	0.34	0.23	0.19	0.16	0.05	0.14	0.18	0.07	

Table 70. Trends in landings, biomass, and fishing mortality for the Mid-Atlantic scallop stock (NMFS 2001a and NMFS 2001b).

Calendar year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001[54]	2002
Landings (mt)	7,011	4,955	2,778	5,872	6,318	4,999	2,910	2,948	4,653	6,579[55]	15,533	
Biomass (kg/tow)	0.99	0.56	0.76	1.03	1.51	0.78	0.53	1.04	2.42	3.57	4.28	~4.356
Fishing mortality	1.31	1.54	1.12	1.20	0.95	1.12	0.92	0.69	0.43	0.33	0.37	

51 Fishing year 2001, ending February 28, based on preliminary statistics compiled by the NMFS NE Regional Office Fisheries Statistics Division and published at http://www.nero.nmfs.gov/ro/fso/mul.htm.
52 Preliminary estimate.
53 Preliminary estimate based on unaudited preliminary results from the 2002 scallop survey.
54 See footnote 8.
55 Preliminary estimate.
56 Preliminary estimate based on unaudited preliminary results from the 2002 scallop survey.

7.2 Biological Environment

7.2.1 Description of biological characteristics: Sea scallop life history, habitat, and the physical environment

The Atlantic, or giant, sea scallop (Placopecten magellanicus (Gmellin)), is a large, fast-growing, highly fecund and valuable bivalve mollusc in the Family Pectinidae. Landings, primarily from the US and Canada, accounted for nearly 30% of worldwide scallop production of all species (Naidu 1991). Although the Atlantic sea scallop reaches maturity in 3 to 4 years and grows rapidly through age six to seven, sea scallops have been observed to age 29, and have a shell height of 208 mm (Norton 1931) and maximum meat weight of 231 g (0.51 lb.; slightly less than 2 per pound).

Sea scallops range from the north coast of the Gulf of St. Lawrence (Squires 1962) to the SSE of Cape Hatteras, NC (Posgay 1957), with large concentrations on Georges Bank and the Mid-Atlantic shelf. Smaller concentrations occur along coastal Maine, in the Bay of Fundy (Digby grounds), the Gulf of St. Lawrence, on St. Pierre Bank, and in Port au Port Bay, Newfoundland. Scallops are found in shallow water along Cape Cod and the Gulf of Maine, but are commonly found in 40 to 100 m elsewhere. Most abundant on the continental shelf between 20 and 50 m (65-165 ft), it is found less abundantly from 18 to 110 m (60-360 ft). Occasionally, the sea scallop is found as shallow as 2 m (6 ft) along the ME coast (Serchuk et al. 1982; Naidu and Anderson 1984) and as deep as 384 m (1260 ft) (Merrill 1959).

Sea scallops seem to be vulnerable to high temperatures above 20 degrees C (Posgay 1953, Johannes 1957 and Dickie 1958) and larvae also appear to sensitive to temperatures above 19 degrees C. (Culliney 1974). This sensitivity to high temperature appears to limit the southern range and the inshore distribution on the Mid-Atlantic shelf. The northern range appears to be limited by delayed maturation and/or insignificant scallop sets (Dickie 1955, Medcof and Bourne 1964) Scallops appear to be robust to changes in salinity (Cuulliney 1974), but vulnerable to anoxia (MacKenzie (1977).

Scallops are also constrained by the presence of fine suspended sediments which not only reduce the availability of phytoplankton, but also inhibit filter feeding and require frequent expulsion of sediments by clapping. Suitable adult scallop habitat is therefore dictated by presence of suitable temperatures, adequate food, bottom substrate, and physical oceanographic features (which influence pelagic larval distributions) (Packer et al. 1999).

Scallop shells rest on their right valve with adults ranging from 12.5 to 20.0 cm, the largest measured being 23 cm (Norton 1931). Juveniles, around 5 mm shell height, are similar to adults but exhibit a prismatic structure in the thin right valve and the adductor muscle is offcenter.

Stokesbury and Himmelman (1993) found that sea scallops in unharvested beds exhibited contagious spatial distributions, with clump size ranging from 1 to 4.5 m. Based on laboratory experiments where high sperm concentrations were required for fertilization success and this clumping, they speculated that this natural aggregation at this scale is an adaptation to maximize spawning success. Thouzeau et al. (1991) determined that scallop distribution on Georges Bank was random within sediment types in heavily fished areas. Thus, Stokesbury and Himmelman (1993) suggested that fishing with scallop dredges and other types of bottom gear may have an adverse effect on reproductive success.

Scallop movement is very restricted as adults and there is little evidence of seasonal or directed movement patterns (Posgay 1964), although tagged scallops have been recaptured as much as 50 km (31 mi.) from their origin (Melvin et al. 1965). Some movement may be oriented along the path of prevailing currents, such as around the gyre of Georges Bank. Scallops on the Mid-Atlantic shelf appear to move upslope with age, possibly allowing some scallops in the closed Hudson Canyon area to become available to the fishery (DuPaul, pers. comm.)

Georges Bank scallop spat densities in February 1977 were 1.7 to 122.8 per m^2 (16 stations) and 2.5 to 62.5 per m2 (12 stations) in May 1977 (Larsen and Lee 1978). In 1969, along the northern edge of Georges Bank, Caddy (1971a) measured scallop (<10 cm) densities averaging 0.98 per m^2. In August 1967, Caddy (1968) measured Northumberland Straight scallop densities of mixed sizes averaging 4.2 per m^2 on sand bottom and 1.4 per m^2 on mud bottom. In 1968, Caddy (1970) measured scallop desities averaging 4.8 per m^2 on sand bottom and less than 0.1 per m^2 on mud bottom. This compares to recent video surveys where Stokesbury (2002) measured scallop densities ranging from 0.25 to 0.59 per m^2 in closed areas of Georges Bank.

Individual egg production probably totals millions of eggs each season. Sexes are normally separate, but hermaphrodism is a rare occurrence (two out of 3,000 from Georges Bank (Merrill and Burch 1960) and 42 of 3,000 scallops from Port au Port, Newfoundland (Naidu 1970)). The female to male sex ratio is about 0.9:1 (Welch 1950). Male (white) and female (red) gonads are distinct and occupy most of the body ventral to the foot. The gonads expand and form a larger part of the body mass before and during spawning, shrinking thereafter.

In Newfoundland, scallops spawn after the first growth ring formation at about 20 to 30 mm, with the youngest spawning on Georges Bank occurring at 50 mm (Posgay and Norman 1958). Large scallops with correspondingly large gonads contribute most to egg production.

Like other bivalve mollusks, sea scallops are filter feeders and appear to consume diatomaceous phytoplankton, with possible contributions of organic debris (Posgay 1964). Scallops in deep water are often small for their age, possibly owing to lower phytoplankton availability. Feeding is sensitive to current speed and sediment load, potentially shutting down when either is too high. Thus high levels of suspended sediment or other particulates may cause lethal or non-lethal damage to sea scallops if the duration is long or continuous. This response may also play a factor in the distribution of sea scallops, favoring areas with moderate currents and clear water, often associated with harder bottom substrates, gravel, and coarse sand. Areas with clay, mud, or other fine particulates are not very good habitats for sea scallops.

Stokesbury (2002) characterized the substrates where scallops beds occurred within the surveyed areas of the Georges Bank groundfish closed areas. Within this area, he found that the areas were primarily composed of sand, shell debris, and granule/pebbles (90% of the Nantucket Lightship Area, 93% of Closed Area I, and 74% of Closed Area II). The video survey showed that the scallop distribution was highly aggregated in patches on the scale of square kilometers and they were strongly associated with coarse sand-pebble and pebble substrates. Beds were often oriented in a N-S direction, parallel to the prevailing direction of strong tidal currents (Brown and Moody 1987). Stokesbury (2002) observed that these substrates were frequently moved by tidal currents and storm events, therefore tending to not support epifauna and giving a low habitat complexity score (Auster and Langton 1999). In contrast, areas with cobble and boulder are less disturbed by natural events and support more epifaunal diversity, giving higher habitat complexity scores.

Parasites are rare, but there are many predators of sea scallops. Parasites probably include the flagellate, Hexamita sp., common in many mollusks and found in some dying sea scallops held in the laboratory (Medcof 1961), as well as the ciliate, Trichodina sp. (Dickie and Medcof 1963). Many other species live in association with sea scallops and have little or sublethal effects. These species include the attached hydroid, *Hydractinia enchinata*, which grows around the shell margin and interferes with shell generation by the mantle (Merrill 1967a). The scallop reacts by starting a new shell edge within the existing margin, bypassing the hydroid colony. The bivalve mollusk, *Musculus dicors* lives in and nests on the upper scallop valve as eggs and adults (Merrill 1962b, Merrill and Turner 1963). The widespread and abundant burrowing anemone and suspected predator of scallops, *Ceriantheopsis americanus*, also occurs within the sea scallop distribution on Georges Bank and the Mid-Atlantic shelf. Predators appear to consume many juvenile sea scallops, which can be easily bored, cracked open, and swallowed whole (MacKenzie 1979). They include cod (*Gadus morhua*), American plaice (*Hippoglossoides platesooides*), wolfish (Anarhichas lupus) (Medcof and Bourne 1964), and starfish (*Asterias vulgaris*) (Welch 1950, Dow 1962, Dow 1969, and Metcof and Bourne 1964).

Recruitment of Atlantic sea scallops has been very episodic, even going back well before the current survey. It appears that a significant set of Georges Bank scallops occurred in 1959-60, which supported a fishery for several years. Subsequently, high numbers of recruits were not observed until 1966-67, when Caddy (1971a) measured 270 million scallops in a 274 km^2 area of the northern edge of Georges Bank, apparently as three year olds. Similarly, MacKenzie et al. (1978) observed high abundance of three year olds in 1975, from a 1972 year class that was widely distributed over Georges Bank, the Great South Channel, and from Long Island to Chesapeake Bay. During the contemporary survey time series, a strong year class was observed in 1989 in the Great South Channel, in 1993 in the DelMarVa region, in 1997 near Hudson Canyon and VA Beach, and in 1998 near Hudson Canyon. Since then, recruitment has generally been above average in the Mid-Atlantic until the 2002 survey when recruitment was only high in the DelMarVa region and below average elsewhere.

The average instantaneous mortality rate is 0.10 (Merrill and Posgay 1964). Sources of natural mortality and reduced productivity include:

1. Low summer temperatures (in the northern range) that diminish spawning and delay larval development.

2. High summer temperatures (primarily in the southern range) that have lethal effects on adults and larvae.

3. Currents that advect larvae away from suitable settlement areas.

4. Parasites that may kill or weaken sea scallops and predators.

Mass mortalities have been associated with influxes of predatory starfish and exposure to lethal high temperatures (Dickie and Medcof 1963). Other types of mortality or stress from fishing and other marine activities include

1. Damage on the bottom from fishing, either by direct contact with the dredge or from silt clogging from suspended sediments. Caddy (1971) estimated that 13 to 17 percent of scallops were damaged by the dredge, but this estimate did not include the amount of scallops in the dredge path before capture. Including this factor and accounting for dredge efficiency, NEFSC (2001) estimated that the total non-catch mortality was less than 10 percent on Georges Bank and less than 5 percent on the Mid-Atlantic shelf.

2. On-board handling of small scallops to be discarded, including cracking shells while boarding and dumping the dredges and culling or shovelling the scallops, impacts with rocks in the dredge, and long (2 to 3 hours) air exposure in hot weather (MacKenzie 1979).

3. Attraction of predatory fish and crabs that can be 3 to 30 times greater inside dredge tracks than outside, soon after dredging (Caddy 1973).

7.2.2 Status of the resource

Stocks assessments are conducted frequently by the Northeast Fisheries Science Center and reviewed by a Stock Assessment Review Committee. The last assessment was reported in 2001 using 2000 fishery and resource survey data (NEFSC 2001a). That assessment concluded:

> *"The U.S. Georges Bank portion of the sea scallop stock is not overfished overfishing is not occurring. The Mid-Atlantic portion of the stock is not overfished (i.e below ¼ B_{MSY} biomass threshold), but overfishing is occurring (i.e. mortality is above F_{max}.)"*

The Northeast Fisheries Science Center performed a new stock assessment that updated the status of the resource using the 1999 and 2000 scallop surveys and estimate area-specific fishing mortality through 1999. The assessment also included new information on dredge efficiency and tow length, two factors that affect our estimates of total stock biomass and fishing mortality.

The assessment results (SAW 32; NMFS 2001) were reported to the Council in January 2001 and were considered during the approval of the proposed action. Catches and biomass estimates have since been updated and analyzed during the development of annual framework adjustments. The biomass and landings estimates are therefore consistent with the updated information and no revisions are needed until new survey information is available or different dredge efficiency estimates are accepted (see below).

For the Georges Bank stock area, the updated estimates are near the same values as in SAW 29, but the declining fishing mortality trend is steeper for the updated estimates (Table 71). Fishing mortality is now estimated to be higher in 1992-1993 and lower in 1996-1998. Fishing mortality in 1999 was estimated to increase from 1998, partly due to the increased landings from fishing in Closed Area II. For comparison, the projections in Section 8.2.1 estimate fishing mortality in 2002 to be around 0.06 to 0.08, taking into account the higher biomass estimates from the 2002 R/V Albatross survey and the TACs expected to be harvested from the Hudson Canyon and VA/NC Areas.

One notable difference between the updated assessment and the projections in Section 8.2.1 are the higher fishing mortality estimates in the Mid-Atlantic stock area. Table 71 compares the old and new fishing mortality estimates from successive scallop assessments. For the Mid-Atlantic stock area, the SAW 32 fishing mortality estimates are consistently higher than those from SAW 29. SAW 32 estimated the 1999 fishing mortality to be 0.43, below the Amendment 7 threshold mortality (0.83) but above the threshold mortality for 2000 (0.34). For comparison, the projections in Section 8.2.1 estimate fishing mortality in 2002 to be around 0.09 to 0.14, taking into account the updated survey information for 2002 and the expected catches from the Hudson Canyon and VA/NC Areas and other open fishing areas.

Even though the 1999 fishing mortality estimate for the Mid-Atlantic is above the Amendment 7 target for 2000, the FMP treats the scallop fishery as one with a single resource made up of two biological components (with individual overfishing definitions). Even if fishing mortality remained at 1999 levels (the day-at-sea allocations remained constant in 2000, but biomass increased substantially suggesting a possible decrease in fishing mortality with existing measures), the average fishing mortality, weighted by exploitable biomass, would be 0.24, below the Amendment 7 targets for 2000 (0.34) and 2001 (0.28).

Table 71. Comparison of updated fishing mortality estimates to the last assessment for 1998 (NMFS 1999 and NMFS 2001), with updates for 2002 and projections for 2003 (Section 8.2.1).

Stock	SAW	1992	1993	1994	1995	1996	1997	1998	1999	2002	2003	2004[57]
Georges Bank	29	0.85	1.22	0.43	0.22	0.24	0.24	0.09		0.11	0.08	0.06
	32	1.11	1.28	0.34	0.23	0.19	0.16	0.05	0.14			
Mid-Atlantic	29	1.14	0.47	0.74	0.50	0.81	0.67	0.30		0.35	0.43	0.54
	32	1.54	1.12	1.20	0.95	1.12	0.92	0.69	0.43			
Combined										0.23	0.23	0.23

A second piece of new information in the SAW 32 report is the preliminary research in the Hudson Canyon and VA/NC Areas indicated that dredge efficiency may be higher than assumed in the biomass estimates and projections (Section 8.2.1). SAW 32 reported that:

> *"The Patch model with ?=0.75 and the LD model gave mean efficiencies of 0.59 and 0.58 in the southern Mid-Atlantic Bight stock area compared to 0.27 and 0.30 in the northern Georges Bank stock area."*

These results were not fully adopted by the SARC however, which reported in the SAW 32 Consensus Summary of Assessments (NMFS 2001) that there was unsatisfactory uncertainty arising from the covariance in the estimates of dredge efficiency and scallop density:

> *"Depletion studies have been pursued for the scallop surveys because the ability to convert biomass estimates from the survey to the population level using estimates of dredge efficiency is important for the assessment of these stocks. While significant progress has been made on estimating the efficiency of the dredge, the analyses of the experiments where both efficiency and density have to be estimated from the same data has been problematic. The SARC considered preliminary results of depletion studies where independent density estimates were provided from photographic surveys in the same general area. This approach was seen to be an improvement in experimental design and the SARC recommended that further studies of this kind be done. In particular, the design should be such that the depletion studies must be in exactly the same area that the photographic survey was done.*
>
> *At present, photographic/depletion experiments are only available for Georges Bank. The results of theses experiments are preliminary and deficiencies in the design noted above need to be addressed. Therefore, the SARC could not recommend new efficiency factors for Georges Bank. We have no new information on efficiency estimates using this experimental design for the Mid-Atlantic area."*

The projections and biomass (Section 8.2.1) estimates assume a 50% dredge efficiency for the Georges Bank resource and a 70% dredge efficiency for the Mid-Atlantic resource

Stokesbury (2002) used a video camera apparatus to survey unfished (since 1994) portions of the Georges Bank groundfish closed areas, including the NE corner of the Nantucket Lightship Area, a central wedge-shaped portion of Closed Area I, and the northern edge of Georges Bank in Closed Area II. Scallop densities were among the highest reported in any Georges Bank survey, with mean densities of 0.38, 0.25, and 0.59 for the three areas respectively. Area specific meat-weight/shell height equations

[57] Status quo day-at-sea allocation without rotation or controlled access.

were applied to the scallop size frequency distributions derived from the video images, giving a total estimate of 16,900 mt of scallop meats within the 1,938 km2 survey area. These data were subsequently used in combination with the NMFS stratified-random annual scallop survey data to refine the total exploitable biomass estimate and establish TACs for the area access program in the 2000 scallop fishing year.

7.2.3 Status and management of the scallop resource in Canada

A description of Canadian scallop management was reported in NEFMC 1998. The effects of Canadian management on the scallop resource are considered in assessments, but because scallops are not very mobile the primary effect is on recruits that were spawned in Canada and settle in the U.S. This mainly affects the scallop resource on the Northern Edge and possibly the South Channel, near Closed Area I (Naidu 1991).

7.2.4 Other Affected Fishery Resources of the Northeast Region

Through calendar year 2001, the primary source for stock status of northeast regulated groundfish is the report of the Groundfish Assessment Review Meeting (GARM) (NEFSC 2002b). The GARM updated assessments for all groundfish stocks. Groundfish assessments are usually prepared by the Stock Assessment Workshop (SAW) and reviewed by the Stock Assessment Review Committee (SARC). Assessments focus on individual stocks with a gap of several years common between updates. Georges Bank cod, haddock, and yellowtail flounder are assessed annually by the Trans-boundary Resource Assessment Committee (TRAC), which is prepared by NEFSC scientists to provide information to managers. On an annual basis, the Council's Multi-Species Monitoring Committee compiles available assessment information, conducts projections if necessary to estimate stock status between assessment cycles, and reports to the Council on the status of all groundfish stocks. The GARM report published in October 2002 supercedes the information from previous assessments and the MSM.

In the spring of 2002, the Final Report of the Working Group on re-Evaluation of Biological Reference Points for New England Groundfish (NEFSC 2002) was prepared. While the focus of this working group was to re-estimate B_{MSY} and F_{MSY}, the group also estimated biomass and fishing mortality for groundfish stocks through calendar year 2001. This was done through projecting forward stock status based on the 2001 landings for age-based stocks, rather than through updating assessment models. Survey indices were examined and exploitation rates calculated for index –based stocks. There are differences between stock conditions reported by the working group and the GARM. The most significant are for SNE yellowtail flounder, plaice, SNE winter flounder, and witch flounder. The GARM determined that significant mortality reductions are necessary for these stocks, while the Working Group report concluded that only minor reductions were necessary. While the GARM included information on GOM winter flounder and SNE/MA winter flounder, the assessments will be reviewed by the SARC in December, 2002 and changes may result.

7.2.4.1 Current estimates of bycatch and bycatch mortality

7.2.4.1.1 Georges Bank closed area access program (analysis by D. Hart)

Scallop fishery finfish catches in the 2000 fishing year area access program for the three Georges Bank closed areas were estimated from the observed trips in the access areas, whose costs were partly compensated by possession limit allowances under the TAC set aside for Framework Adjustment 13. Finfish catches on observed tows were expanded to the entire access program by multiplying the observed catch by the ratio between total scallop landings and scallop hail weights from observed tows. In the 2000 fishing year, sea sampling occurred on 36 percent of total controlled access area trips. The highest sampling rate (51% of total trips) occurred in Closed Area II, while the lowest rate (29%) occurred in Closed Area I.

Over all species, finfish catches totaled 3.4 million pounds, or 54% of the total weight of scallop meats caught by the area access program fishery (Table 72), nearly half being unclassified “other” skates that are predominately winter and little skate. For the amount of scallops landed, the bycatch rates were highest (118%) in Closed Area II and lowest (15%) in the Nantucket Lightship Area. In Closed Area II, the finfish catches were predominately other skates, yellowtail flounder, and monkfish. The analysis suggested that finfish bycatch rates were highest in Closed Area II because it took longer for vessels to catch the scallop possession limit (i.e. they fished more per trip) and because abundance of rebuilt yellowtail flounder was high. Also notable is that the barndoor skate catch (51,000 lbs.) and witch flounder (25,000 lbs.) was higher than in other areas. Finfish catch rates in the Nantucket Lightship Area wee lower than other areas for most species, including other skates and monkfish. Much of the reason for the low finfish catches in the Nantucket Lightship Area is that it took vessels little fishing time to catch the scallop possession limit, with much of the time the vessel was in the Nantucket Lightship Area dedicated to shucking scallops rather than fishing. More complete analysis and discussion of bycatch for individual species is included in Appendix 9.

Overall, unclassified skates were the largest component of the finfish catches in the 2000 area access program, totaling about 1.7 million pounds (Table 72). Monkfish was the second largest finfish catch by weight in the Georges Bank areas, totaling a little over 800,000 lbs. Yellowtail flounder catches ranked third at a little over 500,000 lbs., but nearly 90% of the catches came from Closed Area II where the Georges Bank stock was rebuild and yellowtail flounder were abundant. Catches of other species were quite low in comparison. Two species of concern, cod and barndoor skate, together contributed to about 1.1% of the weight of scallops landed. Although the weight of barndoor skate was over 68,000 lbs., this catch represents a relatively small number of individuals, compared with other finfish species, because barndoor skate are often quite large.

The bycatch assessment for the 2000 fishing year area access program provides more details about the estimated finfish catches and evaluates them with respect to catches made in all fisheries. In nearly all cases, the estimated finfish catches were a very small fraction of the overall catch and do not appear to be a significant cause of mortality that would inhibit recovery to target biomass levels. Even for Southern New England yellowtail flounder whose stock biomass is very low, scallop catches were only about 10 mt and the associated fishing mortality was well below 0.01. For barndoor skate, the catches including those in Closed Area II where barndoor skate skate catches were highest were about 30 mt, compared to a catchability adjusted swept area biomass estimate of 23,680 mt. Thus the analysis estimates that less than 0.2% of the total swept area biomass had been remove by the scallop fishery during the area access program.

Table 72. Estimated total finfish catches made by the scallop fleet during the 2000 fishing year area access program for the Georges Bank closed areas.

	Closed Area I		*Closed Area II*		*Nantucket Lightship Area*		*Total area access program*	
SPECIES	*Catch (lbs.)*	*Catch per lb. of scallops*	*Catch (lbs.)*	*Catch per lb. of scallops*	*Catch (lbs.)*	*Catch per lb. of scallops*	*Catch (lbs.)*	*Catch per lb. of scallops*
Monkfish	380,263	11.4%	385,277	22.9%	35,545	2.8%	801,085	12.7%
Yellowtail Flounder	52,478	1.6%	469,523	27.9%	12,705	1.0%	534,706	8.5%
Winter Flounder	142,608	4.3%	6,807	0.4%	4,855	0.4%	154,271	2.5%
Summer Flounder	3,363	0.1%	3,223	0.2%	347	0.0%	6,933	0.1%
Atlantic Halibut	125	0.0%	143	0.0%	9	0.0%	277	0.0%
American Plaice	11,249	0.3%	15,936	0.9%	426	0.0%	27,611	0.4%
Witch Flounder	9,453	0.3%	24,943	1.5%	91	0.0%	34,487	0.5%
Windowpane Flounder	20,574	0.6%	6,004	0.4%	1,384	0.1%	27,962	0.4%
Red Hake	2,170	0.1%	7,268	0.4%	2,087	0.2%	11,525	0.2%
Silver Hake	1,382	0.0%	9,743	0.6%	628	0.0%	11,753	0.2%
Haddock	142	0.0%	14	0.0%	0	0.0%	156	0.0%
Atlantic Cod	2,244	0.1%	350	0.0%	85	0.0%	2,679	0.0%
Barndoor Skate	1,353	0.0%	51,215	3.0%	15,648	1.2%	68,216	1.1%
Thorny Skate	3,727	0.1%	7,815	0.5%	957	0.1%	12,299	0.2%
Other Skates	598,204	18.0%	1,005,689	59.8%	123,912	9.6%	1,727,805	27.5%
Total finfish	1,229,336	37.0%	1,993,750	118.6%	198,679	15.4%	3,421,765	54.4%
Sea Scallops caught (meats)	3,322,000		1,681,605		1,286,864		6,290,469	
% Scallops discarded	14%		24%		10%		18%	
# Trips			164		136			
% Observed	28%		51%		35%		38%	

The impact of the scallop fishery on bycatch species in 2000 was generally low. The bycatch species that is most seriously impacted is monkfish, and that only represents less than 10% of the total mortality on the stock, and less than 15% of the target mortality. Other species which may be marginally affected include Cape Cod yellowtail flounder, and little and winter skates. Much of the reason for the low impact on bycatch species is the considerable reduction in bottom contact time that has occurred over the last six years.

7.2.4.1.2 Open area finfish catches

Annual estimates of finfish catches for the total scallop fishery are not available due to the paucity of sea sampling and the poor reliability of vessel trip reports. When pooled across years, however, the sea sampling data provide a reliable relative indicator of which species had elevated levels of bycatch in the scallop fishery over the time period. Over time, these rankings likely changed due to differences in fishing patterns, from changes in species selectivity over time related to gear modifications (i.e. larger rings and twine tops), and from trends in abundance for scallops and each finfish species.

Over the decade ending in 2000, finfish catches on observed scallop dredge tows accounted for 65% of the weight of the scallop catches. A large part of this incidental catch was other shellfish (14.4%) and starfish (6.6%), which may be partly due to a few surf clam trips using mid-coded clam dredges. Other than that exception, the finfish species that rank highest are the same ones observed for the 2000 area access program finfish catches, namely little skate (11.7%), unclassified skates (11.0%), and monkfish (9.7%). Yellowtail flounder finfish catches rank much lower than the controlled access areas estimates above, because a large part of the scallop resource does not co-occur with the distribution of yellowtail flounder.

Table 73. Frequency of occurrence and total hail weight on observed tows on scallop dredge trips, 1991-2000, Sea Sampling Observer Program. Source: NMFS, April 2002. Rows with groundfish and other species of concern are shaded.

Species	Number of tows with catch	Catch (pounds).	Catch per lb. of scallops
Scallop, Sea	28,188	6,823,619	
Total finfish	28,188	4,454,109	65.3%
Monkfish	27,307	659,541	9.7%
Skate, Little	10,401	800,531	11.7%
Flounder, Yellowtail	10,170	61,666	0.9%
Skates	8,241	753,608	11.0%
Crab, Rock	7,390	97,483	1.4%
Flounder, Fourspot	6,955	32,876	0.5%
Starfish	6,745	451,531	6.6%
Flounder, Summer	6,727	54,116	0.8%
Flounder, Winter	6,286	34,900	0.5%
Flounder, Sand-Dab	6,233	31,071	0.5%
Crab, Nk	4,478	91,276	1.3%
Crab, Jonah	3,005	30,315	0.4%
Sea Raven	2,942	18,770	0.3%
Hake, Silver	2,731	7,700	0.1%
Other Shellfish	2,358	981,160	14.4%
Flounder, Witch	2,287	8,915	0.1%
Dogfish Spiny	2,153	28,357	0.4%
Sculpins	1,942	9,142	0.1%
Skate, Winter(Big)	1,876	90,823	1.3%
Lobster	1,746	5,613	0.1%
Hake, Red	1,660	4,665	0.1%
Crab, Horseshoe	1,608	19,132	0.3%
Sea Urchins	1,064	4,898	0.1%
Sea Robins	1,050	3,885	0.1%
Pout, Ocean	1,041	6,214	0.1%
Flounder, Am. Plaice	1,034	6,484	0.1%
Cod	967	6,549	0.1%
Skate, Clearnose	929	33,944	0.5%
Squid (Loligo)	918	1,544	0.0%
Hake, White	843	6,859	0.1%
Sea Robin, Northern	787	2,358	0.0%
Clam Nk	612	10,263	0.2%
Skate, Smooth	600	29,342	0.4%
Skate, Thorny	582	23,195	0.3%
Sea Bass, Black	547	1,288	0.0%
Quahog	502	7,475	0.1%
Conchs	431	1,425	0.0%
Skate, Barndoor	405	3,837	0.1%
Sea Robin, Striped	372	1,244	0.0%
Squid (Illex)	318	470	0.0%
Clam, Surf	236	5,093	0.1%
Mollusks Nk	236	2,029	0.0%
Mussels	226	4,321	0.1%
Quahog, Ocean	206	2,587	0.0%

Species	Number of tows with catch	Catch (pounds).	Catch per lb. of scallops
Worms	*189*	*251*	*0.0%*
Eel, Conger	*161*	*669*	*0.0%*
Wolffishes	*160*	*1,655*	*0.0%*
Whelk, Knobbed	*158*	*704*	*0.0%*
Crab, Cancer	*153*	*1,029*	*0.0%*
Flounders (Nk)	*140*	*1,934*	*0.0%*
Toadfish, Oyster	*131*	*335*	*0.0%*
Butterfish	*130*	*122*	*0.0%*
Scup	*119*	*184*	*0.0%*
Crab, Spider Nk	*109*	*672*	*0.0%*
Haddock	*83*	*335*	*0.0%*
Other Fish	*69*	*564*	*0.0%*
Unknown	*68*	*659*	*0.0%*
Sea Cucumbers	*68*	*121*	*0.0%*
Whelk, Channeled	*65*	*281*	*0.0%*
Cunner	*65*	*117*	*0.0%*
Clam, Razor	*64*	*339*	*0.0%*
Squids (Ns)	*62*	*153*	*0.0%*
Dogfish Smooth	*62*	*438*	*0.0%*
Dogfish (Nk)	*61*	*844*	*0.0%*
Mackerel, Atlantic	*59*	*66*	*0.0%*
Skate, Rosette	*53*	*467*	*0.0%*
Hake, Offshore	*49*	*75*	*0.0%*
Herring, Atlantic	*45*	*46*	*0.0%*
Flounder, Gulfstream	*40*	*41*	*0.0%*
Crab, Blue	*31*	*112*	*0.0%*
Eel, Nk	*31*	*19*	*0.0%*
Octopus	*25*	*29*	*0.0%*
Sea Bass, Nk	*22*	*40*	*0.0%*
Cusk	*19*	*57*	*0.0%*
Sea Weeds, Nk	*18*	*66*	*0.0%*
Lumpfish	*18*	*72*	*0.0%*
Eel, Sand (Launce)	*15*	*7*	*0.0%*
Crab, Red	*14*	*12*	*0.0%*
Tautog	*12*	*38*	*0.0%*
Halibut, Atlantic	*11*	*50*	*0.0%*
Pollock	*9*	*34*	*0.0%*
Croaker, Atlantic	*9*	*31*	*0.0%*
Porgy, Nk	*9*	*13*	*0.0%*
Dogfish Chain	*9*	*8*	*0.0%*
Eel, American	*8*	*7*	*0.0%*
Scallop, Bay	*8*	*1,671*	*0.0%*
Sea Robin, Armored	*8*	*28*	*0.0%*
Snapper	*8*	*425*	*0.0%*
Scallop, Icelandic	*7*	*50*	*0.0%*
Herring, Blue Back	*6*	*8*	*0.0%*
Bluefish	*6*	*72*	*0.0%*
Triggerfish	*5*	*6*	*0.0%*
Menhaden	*4*	*3*	*0.0%*

Species	Number of tows with catch	Catch (pounds).	Catch per lb. of scallops
Herring (Nk)	*4*	*129*	*0.0%*
Oysters	*4*	*26*	*0.0%*
Saury, Atlantic	*4*	*1*	*0.0%*
Bass, Striped	*4*	*38*	*0.0%*
Puffer, Northern	*3*	*3*	*0.0%*
Shad, Hickory	*3*	*77*	*0.0%*
Shrimp (Nk)	*2*	*0*	*0.0%*
Puffer	*2*	*5*	*0.0%*
Weakfish, Squeteague	*2*	*6*	*0.0%*
Redfish	*2*	*2*	*0.0%*
Shark, Nk	*2*	*12*	*0.0%*
John Dory	*2*	*2*	*0.0%*
Silverside, Atlantic	*2*	*3*	*0.0%*
Shark, Angel	*1*	*85*	*0.0%*
Grouper	*1*	*1*	*0.0%*
Silverside, Nk	*1*	*151*	*0.0%*
Seatrout, Nk	*1*	*2*	*0.0%*
Clam, Soft	*1*	*5*	*0.0%*
Spadefish	*1*	*1*	*0.0%*
Shad, American	*1*	*2*	*0.0%*
Capelin	*1*	*35*	*0.0%*
Pompano, Common	*1*	*40*	*0.0%*
Crab, Queen Snow	*1*	*1*	*0.0%*
Shark, Mako	*1*	*25*	*0.0%*
Hogchocker	*1*	*2*	*0.0%*
Shrimp (Pandalid)	*1*	*1*	*0.0%*

7.2.5 Biological Characteristics of Regional Systems

7.2.5.1 Gulf of Maine

The Gulf of Maine's geologic features, when coupled with the vertical variation in water properties, result in a great diversity of habitat types. The greatest number of invertebrates in this region are classified as mollusks, followed by annelids, crustaceans, echinoderms and other (Theroux and Wigley 1998). By weight, the order of taxa changes to echinoderms, mollusks, other, annelids and crustaceans. Watling (1998) used numerical classification techniques to separate benthic invertebrate samples into seven types of bottom assemblages. These assemblages are identified in Table 75 and their distribution is depicted in Map 29. This classification system considers benthic assemblage, substrate type and water properties.

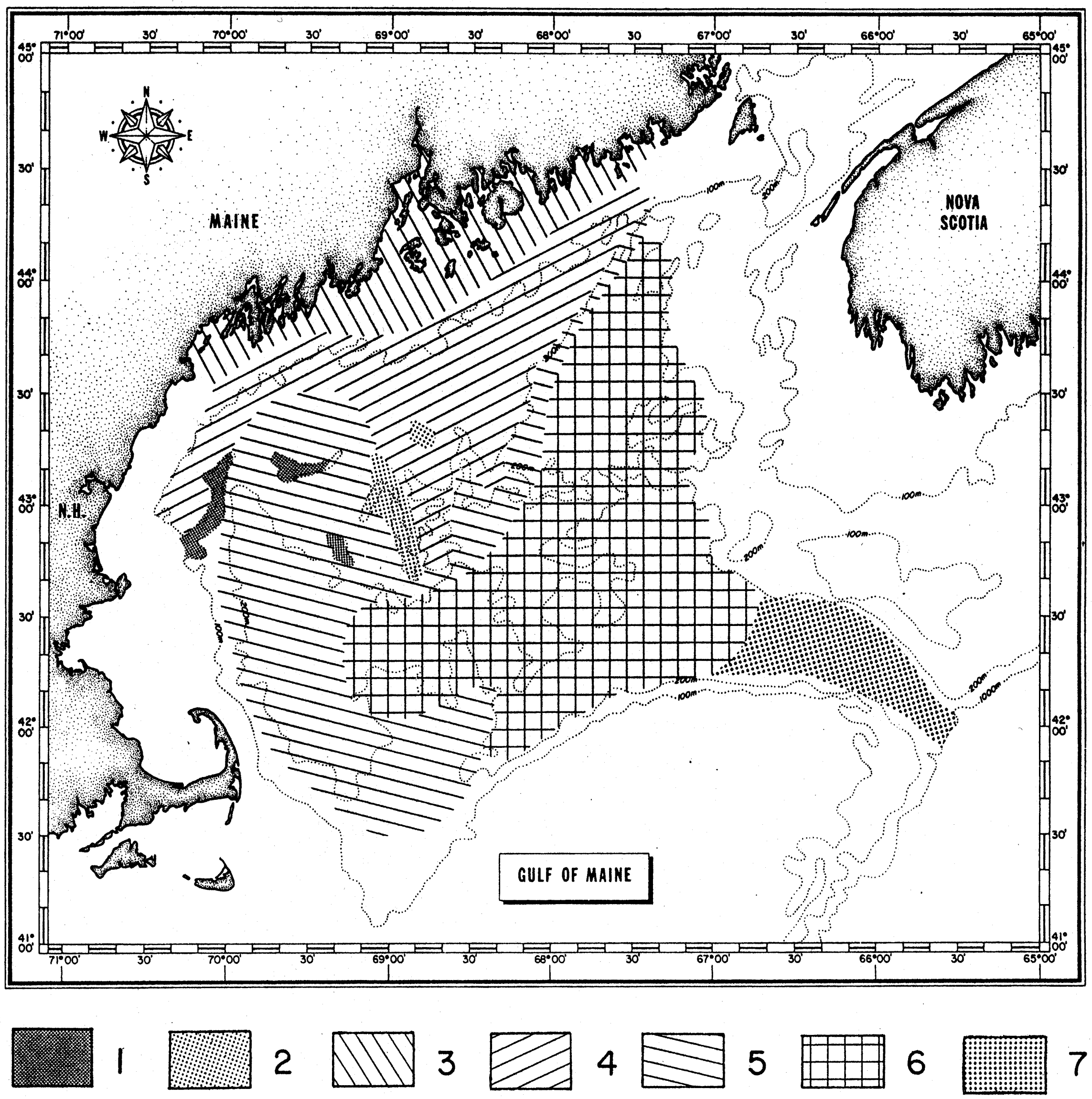
An in-depth review of GOM habitat types has been prepared by Brown (1993). Although still preliminary, this classification system is a promising approach. It builds on a number of other schemes, including Cowardin et al. (1979), and tailors them to Maine's marine and estuarine environments. A significant factor that is included in this system but has been neglected in others is the amount of "energy" in a habitat. Energy could be a reflection of wind, waves, or currents present. This is a particularly important consideration in a review of fishing gear impacts since it indicates the natural disturbance regime of a habitat. The amount and type of natural disturbance is in turn an indication of the habitat's resistance to and recoverability from disturbance by fishing gear. Although this work appears to be complete in its description of habitat types, unfortunately, the distribution of many of the habitats are unknown.

Demersal fish assemblages for the Gulf of Maine and Georges Bank were part of broad scale geographic investigations conducted by Mahon et al. (1998) and Gabriel (1992). Both these studies and a more limited study by Overholtz and Tyler (1985) found assemblages that were consistent over space and time in this region. In her analysis, Gabriel found that the most persistent feature over time in assemblage structure from Nova Scotia to Cape Hatteras was the boundary separating assemblages between the Gulf of Maine and Georges Bank, which occurred at approximately the 100 m isobath on northern Georges Bank.

Overholtz & Tyler (1985) identified five assemblages for this region (Table 76). The Gulf of Maine-deep assemblage included a number of species found in other assemblages, with the exception of American plaice and witch flounder, which was unique to this assemblage. Gabriel's approach did not allow species to co-occur in assemblages, and also classified these two species as unique to the deepwater Gulf of Maine-Georges Bank assemblage. Results of these two studies are compared in Table 76. Auster et al. (2001) went a step further, and related species clusters on Stellwagen Bank to reflectance values of different substrate types in an attempt to use fish distribution as a proxy for seafloor habitat distribution. They found significant reflectance associations for twelve of 20 species, including American plaice (fine substrate), and haddock (coarse substrate). Species clusters and associated substrate types are given in Table 77.

Table 75. Gulf of Maine benthic assemblages as identified by Watling (1998). Geographical distribution of assemblages is shown in Map 29.

Benthic Assemblage	Benthic Community Description
1	Comprises all sandy offshore banks, most prominently Jeffreys Ledge, Fippennies Ledge, and Platts Bank; depth on top of banks about 70 m; substrate usually coarse sand with some gravel; fauna characteristically sand dwellers with an abundant interstitial component.
2	Comprises the rocky offshore ledges, such as Cashes Ledge, Sigsbee Ridge and Three Dory Ridge; substrate either rock ridge outcrop or very large boulders, often with a covering of very fine sediment; fauna predominantly sponges, tunicates, bryozoans, hydroids, and other hard bottom dwellers; overlying water usually cold Gulf of Maine Intermediate Water.
3	Probably extends all along the coast of the Gulf of Maine in water depths less than 60 m; bottom waters warm in summer and cold in winter; fauna rich and diverse, primarily polychaetes and crustaceans; probably consists of several (sub-) assemblages due to heterogeneity of substrate and water conditions near shore and at mouths of bays.
4	Extends over the soft bottom at depths of 60 to 140 m, well within the cold Gulf of Maine Intermediate Water; bottom sediments primarily fine muds; fauna dominated by polychaetes, shrimp, and cerianthid anemones.
5	A mixed assemblage comprising elements from the cold water fauna as well as a few deeper water species with broader temperature tolerances; overlying water often a mixture of Intermediate Water and Bottom Water, but generally colder than 7° C most of the year; fauna sparse, diversity low, dominated by a few polychaetes, with brittle stars, sea pens, shrimp, and cerianthid also present.
6	Comprises the fauna of the deep basins; bottom sediments generally very fine muds, but may have a gravel component in the offshore morainal regions; overlying water usually 7 to 8° C, with little variation; fauna shows some bathyal affinities but densities are not high, dominated by brittle stars and sea pens, and sporadically by a tube-making amphipod.
7	The true upper slope fauna that extends into the Northeast Channel; water temperatures are always above 8° and salinities are at least 35 ppt; sediments may be either fine muds or a mixture of mud and gravel.



Map 29. Distribution of the seven major benthic assemblages in the Gulf of Maine as determined from both soft bottom quantitative sampling and qualitative hard bottom sampling.

The assemblages are characterized as follows: 1. Sandy offshore banks; 2. Rocky offshore ledges; 3. Shallow (<50 m) temperate bottoms with mixed substrate; 4. Boreal muddy bottom, overlain by Maine Intermediate Water, 50 – 160 m (approx.); 5. Cold deep water, species with broad tolerances, muddy bottom; 6. Deep basin warm water, muddy bottom; 7. Upper slope water, mixed sediment. Source: Watling 1998.

Table 76. Comparison of demersal fish assemblages of Georges Bank and Gulf of Maine identified by Overholtz and Tyler (1985) and Gabriel (1992)58.

Overholtz & Tyler (1984)		**Gabriel (1992)**	
Assemblage	**Species**	**Species**	**Assemblage**
Slope & Canyon	offshore hake blackbelly rosefish Gulf stream flounder fourspot flounder monkfish, whiting white hake, red hake	offshore hake blackbelly rosefish Gulf stream flounder fawn cusk-eel, longfin hake, armored sea robin	**Deepwater**
Intermediate	whiting red hake monkfish Atlantic cod, haddock, ocean pout, yellowtail flounder, winter skate, little skate, sea raven, longhorn sculpin	whiting red hake monkfish short-finned squid, spiny dogfish, cusk	**Combination of Deepwater Gulf of Maine/Georges Bank & Gulf of Maine-Georges Bank Transition**
Shallow	Atlantic cod haddock pollock whiting white hake red hake monkfish ocean pout yellowtail flounder windowpane winter flounder winter skate little skate longhorn sculpin summer flounder sea raven, sand lance	Atlantic cod haddock pollock yellowtail flounder windowpane winter flounder winter skate little skate longhorn sculpin	**Gulf of Maine-Georges Bank Transition Zone** **Shallow Water Georges Bank-Southern New England**
Gulf of Maine-Deep	white hake American plaice witch flounder thorny skate whiting, Atlantic cod, haddock, cusk Atlantic wolffish	white hake American plaice witch flounder thorny skate, redfish	**Deepwater Gulf of Maine-Georges Bank**
Northeast Peak	Atlantic cod haddock pollock ocean pout, winter flounder, white hake, thorny skate, longhorn sculpin	Atlantic cod haddock pollock	**Gulf of Maine-Georges Bank Transition Zone**

58 *Gabriel analyzed a greater number of species and did not overlap assemblages.*

SUBSTRATE TYPE									
Coarse		**Coarse**		**Wide Range**		**Fine**		**Fine**	
Species	**Mean**	**Species**	**Mean**	**Species**	**Mean**	**Species**	**Mean**	**Species**	**Mean**
Northern Sand Lance Atlantic herring Spiny dogfish Atlantic cod Longhorn sculpin American plaice Haddock Yellowtail flounder Whiting Ocean pout **No. tows = 83**	1172. 0 72.2 38.4 37.4 29.7 28.0 25.7 20.2 7.5 9.0	Haddock Atlantic cod American plaice Whiting Longhorn sculpin Yellowtail flounder Spiny dogfish Acadian redfish Ocean pout Alewife **No. tows = 60**	13.1 7.3 5.3 3.3 2.0 1.9 1.6 1.6 1.3 1.1	American plaice Northern sand lance Atlantic herring Whiting Acadian redfish Atlantic cod Longhorn sculpin Haddock Pollock Red hake **No. tows = 159**	63.3 53.0 28.5 22.4 16.0 14.0 9.5 9.1 7.9 6.2	American plaice Acadian redfish Whiting Atlantic herring Red hake Witch flounder Atlantic cod Haddock Longhorn sculpin Daubed shanney **No. tows = 66**	152.0 31.3 29.5 28.0 26.1 23.8 13.1 12.7 12.5 11.4	Whiting American plaice Atlantic mackerel Pollock Alewife Atlantic herring Atlantic cod Longhorn sculpin Red hake Haddock **No. tows = 20**	275.0 97.1 42.0 41.1 37.2 32.0 18.1 16.8 15.2 13.2

Table 77. Ten dominant species and mean abundance/tow^{-1} from each cluster species group and its associated substrate type as determined by reflectance value, from Stellwagen Bank, Gulf of Maine (Auster et al. 2001).

7.2.5.2 Georges Bank

The interaction of several environmental factors including availability and type of sediment, current speed and direction, and bottom topography have been found to combine to form seven sedimentary provinces on eastern Georges Bank (Valentine *et al.* 1993), which are outlined in Table 78 and depicted in Map 30.

Theroux and Grosslein (1987) identified four macrobenthic invertebrate assemblages that corresponded with previous work in the geographic area. They noted that it is impossible to define distinct boundaries between assemblages because of the considerable intergrading that occurs between adjacent assemblages; however, the assemblages are distinguishable. Their assemblages are associated with those identified by Valentine et al. (1993) in Table 78.

The Western Basin assemblage (Theroux and Grosslein 1987) is found in the upper Great South Channel region at the northwestern corner of the bank, in comparatively deep water (150-200 m) with relatively slow currents and fine bottom sediments of silt, clay and muddy sand. Fauna are comprised mainly of small burrowing detritivores and deposit feeders, and carnivorous scavengers. Representative organisms include bivalves (*Thyasira flexuosa, Nucula tenuis, Musculus discors*), annelids (*Nephtys incisa, Paramphinome pulchella, Onuphis opalina, Sternaspis scutata),* the brittle star *Ophiura sarsi*, the amphipod *Haploops tubicola*, and red crab (*Geryon quedens*). Valentine et al. 1993 did not identify a comparable assemblage; however, this assemblage is geographically located adjacent to Assemblage 5 as described by Watling (1998) (Table 75).

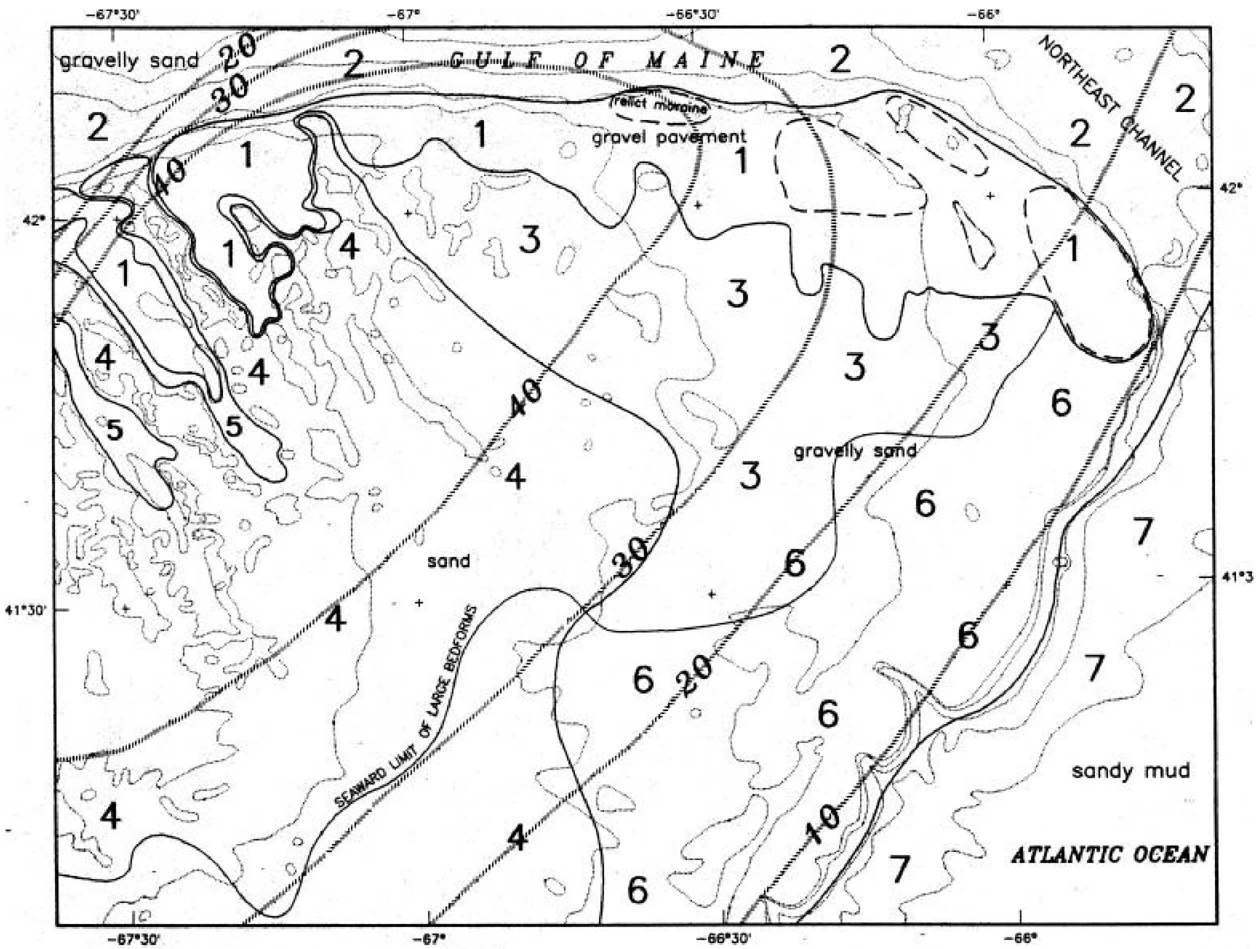
The Northeast Peak assemblage is found along the Northern Edge and Northeast Peak, which varies in depth and current strength and includes coarse sediments, mainly gravel and coarse sand with interspersed boulders, cobbles and pebbles. Fauna tend to be sessile (coelenterates, brachiopods, barnacles, and tubiferous annelids) or free-living (brittlestars, crustaceans and polychaetes), with a characteristic absence of burrowing forms. Representative organisms include amphipods (*Acanthonotozoma serratum*, *Tiron spiniferum*), the isopod *Rocinela americana*, the barnacle *Balanus hameri*, annelids *Harmothoe imbricata, Eunice pennata, Nothria conchylega,* and *Glycera capitata*, sea scallops (*Placopecten magellanicus*), brittlestars (*Ophiacantha bidentata*, *Ophiopholis aculeata*), and soft corals (*Primnoa resedaeformis*, *Paragorgia arborea*).

The Central Georges assemblage occupies the greatest area, including the central and northern portions of the bank in depths less than 100 m. Medium grained shifting sands predominate this dynamic area of strong currents. Organisms tend to be small to moderately large in size with burrowing or motile habits. Sand dollars (*Echinarachnius parma*) are most characteristic of this assemblage. Other representative species include mysids (*Neomysis americana*, *Mysidopsis bigelowi*), the isopod *Chiridotea tuftsi*, the cumacean *Leptocuma minor*, the amphipod *Protohaustorius wigleyi*, annelids (*Sthenelais limicola, Goniadella gracilis, Scalibregma inflatum*), gastropods (*Lunatia heros*, *Nassarius trivittatus*), starfish (*Asterias vulgaris*), *Crangon septemspinosa* shrimp and the crab *Cancer irroratus*.

The Southern Georges assemblage is found on the southern and southwestern flanks at depths from 80 m to 200 m, where fine grained sands and moderate currents predominate. Many southern species exist here at the northern limits of their range. Dominant fauna include amphipods, copepods, euphausiids and starfish genus *Astropecten.* Representative organisms include amphipods (*Ampelisca compressa, Erichthonius rubricornis, Synchelidium americanum*), the cumacean *Diastylis quadrispinosa*, annelids (*Aglaophamus circinata*, *Nephtys squamosa*, *Apistobranchus tullbergi*), crabs (*Euprognatha rastellifera, Catapagurus sharreri*) and the shrimp *Munida iris.*

Sedimentary Province	**Depth (m)**	**Description**	**Benthic Assemblage**
Northern Edge / Northeast Peak (1)	40-200	Dominated by gravel with portions of sand, common boulder areas, and tightly packed pebbles. Representative epifauna (bryozoa, hydrozoa, *anemones,*and *calcareous* worm tubes) are abundant in areas of boulders. *Strong tidal and storm currents.*	Northeast Peak
Northern Slope & Northeast Channel (2)	200-240	Variable sediment type (gravel, gravel-sand, and sand) scattered bedforms. This is a transition zone between the northern edge and southern slope. *Strong tidal and storm currents.*	Northeast Peak
North / Central Shelf (3)	60-120	Highly variable sediment type (ranging from gravel to sand) with rippled sand, large bedforms, and patchy gravel lag deposits. *Minimal epifauna on gravel due to sand movement. Representative epifauna in sand areas include amphipods, sand dollars, and burrowing anemones.*	Central Georges
Central & Southwestern Shelf - *shoal ridges* (4)	10-80	Dominated by sand (fine and medium grain) with large sand ridges, dunes, waves, and ripples. Small bedforms in southern part. *Minimal epifauna on gravel due to sand movement. Representative epifauna in sand areas include amphipods, sand dollars, and burrowing anemones.*	Central Georges
Central & Southwestern Shelf - *shoal troughs* (5)	40-60	Gravel (including gravel lag) and gravel-sand between large sand ridges. Patch large bedforms. Strong currents. (Few samples – submersible observation noted presence of gravel lag, rippled gravel-sand, and large bedforms.) *Minimal epifauna on gravel due to sand movement. Representative epifauna in sand areas include amphipods, sand dollars, and burrowing anemones.*	Central Georges
Southeastern Shelf (6)	80-200	Rippled gravel-sand (medium and fine-grained sand) with patchy large bedforms and gravel lag. Weaker currents; *ripples are formed by intermittent storm currents. Representative epifauna include sponges attached to shell fragments and amphipods.*	Southern Georges
Southeastern Slope (7)	400-2000	Dominated by silt and clay with portions of sand (medium and fine) with rippled sand on shallow slope and smooth silt-sand deeper.	none

Table 78. Sedimentary provinces of Georges Bank, as defined by Valentine *et al.* (1993) and Valentine and Lough (1991) with additional comments by Valentine (personal communication) and Benthic Assemblages assigned from Theroux and Grosslein (1987). See text for further discussion on benthic assemblages.



Map 30. Sedimentary provinces of eastern Georges Bank based on criteria of sea floor morphology, texture, sediment movement and bedforms, and mean tidal bottom current speed (cm/sec). *Relict moraines (bouldery sea floor) are enclosed by dashed lines. See Table 2.4 for descriptions of provinces. Source: Valentine and Lough (1991).*

Along with high levels of primary productivity, Georges Bank has been historically characterized by high levels of fish production. Several studies have attempted to identify demersal fish assemblages over large spatial scales. Overholtz and Tyler (1985) found five depth-related groundfish assemblages for Georges Bank and the Gulf of Maine that were persistent temporally and spatially. Depth and salinity were identified as major physical influences explaining assemblage structure. Gabriel identified six assemblages, which are compared with the results of Overholtz & Tyler (1984) in Table 76. Mahon et al. (1998) found similar results.

A few recent studies (Garrison 2000, Garrison and Link 2000, Garrison 2001) demonstrate the persistence of spatio-temporal overlap among numerically dominant, commercially valuable and /or ecologically important species. The studies by Garrison and associates utilized an index of spatial overlap based on the NOAA spring and fall surveys. He found that among the community of fish species on Georges Bank, only a very few species have high spatial overlaps with other species. The most notable example is silver hake (whiting), which had a very high overlap with most other species, suggestive of a ubiquitous distribution. Trends in spatial overlap over time generally reflect changes in species abundance. During the 1960's, haddock and yellowtail flounder were both widely distributed and had high spatial overlaps with other species. As abundance of these species declined through the 1970's into the 1990's, their spatial range contracted and their overlaps with other species subsequently declined. In contrast to this, species whose abundance has increased through time show an expansion of ranges and increased spatial overlap with other species. Interestingly and to confirm other studies of fish assemblages, the major species assemblages have been generally consistent across time given the changes in relative abundance.

Seasonal trends in spatial overlap are also apparent. Spiny dogfish, for example, has a far stronger association and a far broader range of species' associations in the winter than it does in the summer. Similarly, winter skate is a more prevalent co-correspondent in winter than other times of the year. This metric, like the spatial overlap trend over time (above), is sensitive to abundance as evidenced by the lack of spatial overlap between Atlantic halibut and any other species.

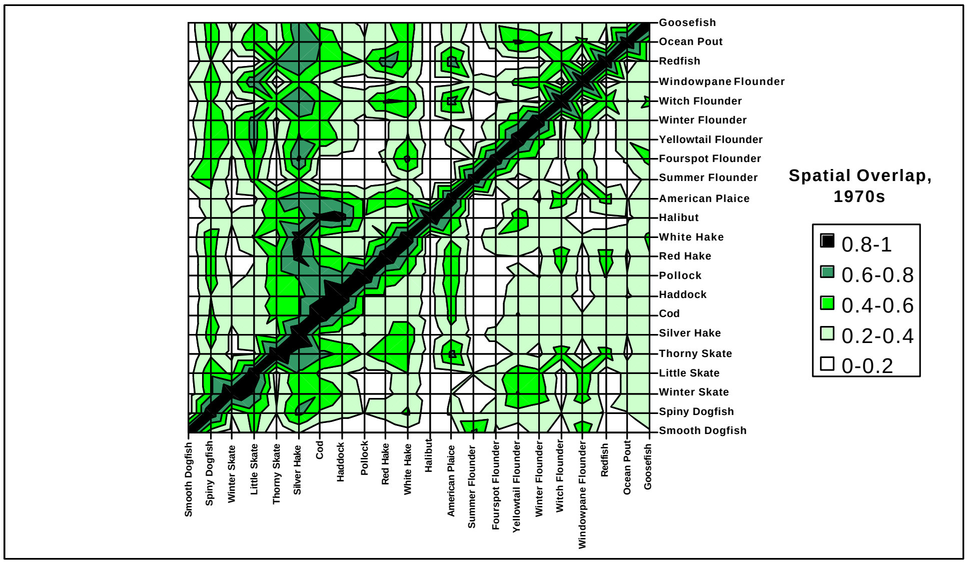


Figure 34. Spatial overlap of primary finfish species on Georges Bank, 1970's (as modified from Garrison and Link 2000)

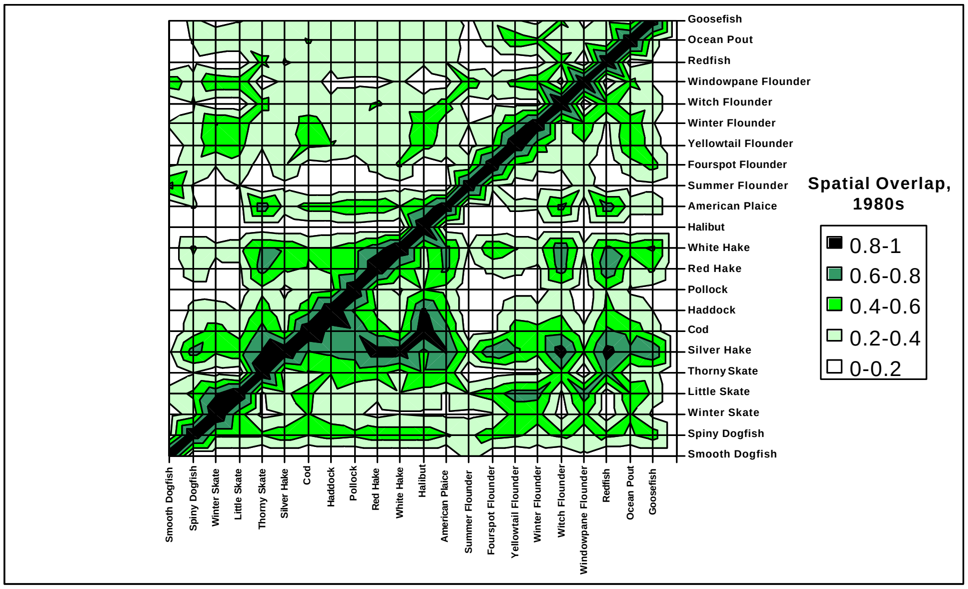


Figure 35. Spatial overlap of primary finfish species on Georges Bank, 1980's (as modified from Garrison and Link 2000)

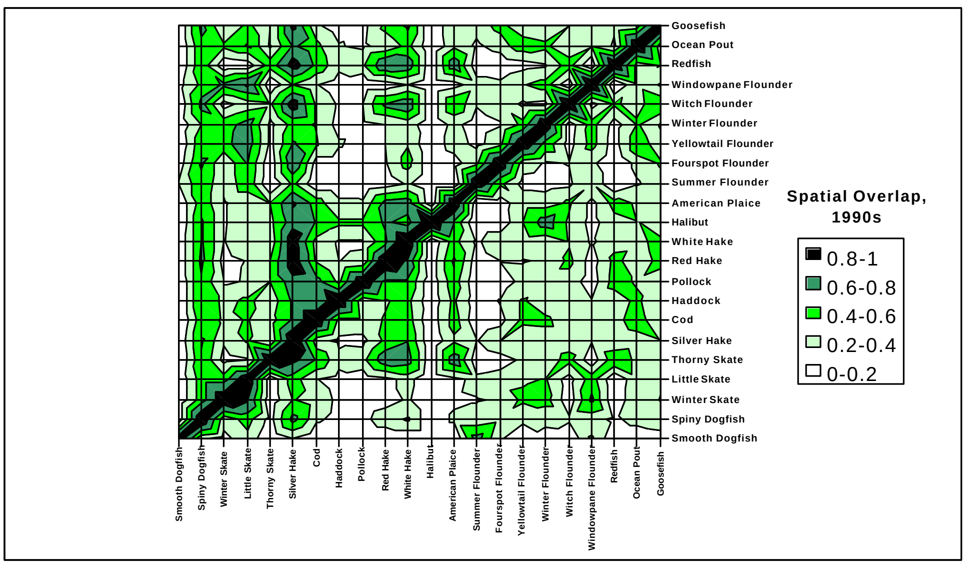


Figure 36. Spatial overlap of primary finfish species on Georges Bank, 1990's (as modified from Garrison and Link 2000)

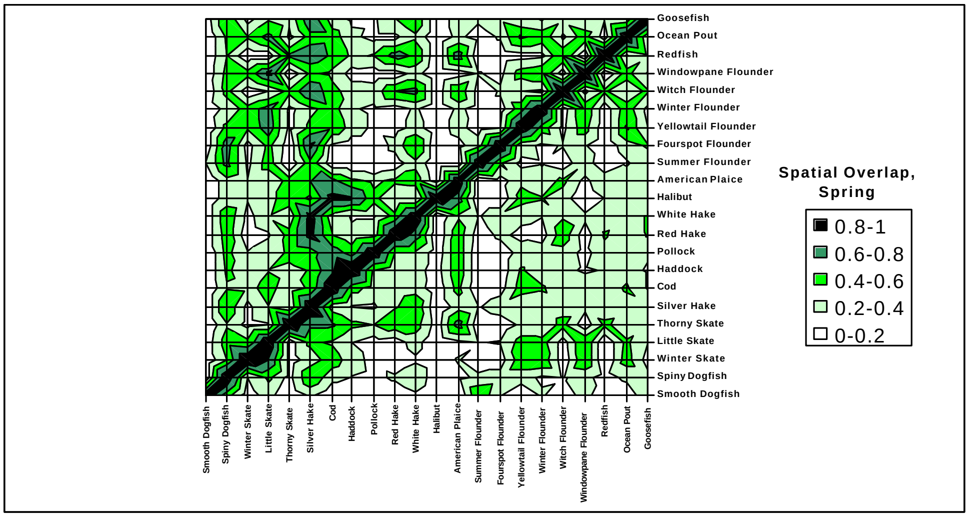


Figure 37. Spatial overlap of primary finfish species on Georges Bank, spring 1970-1998 (as modified from Garrison and Link 2000)

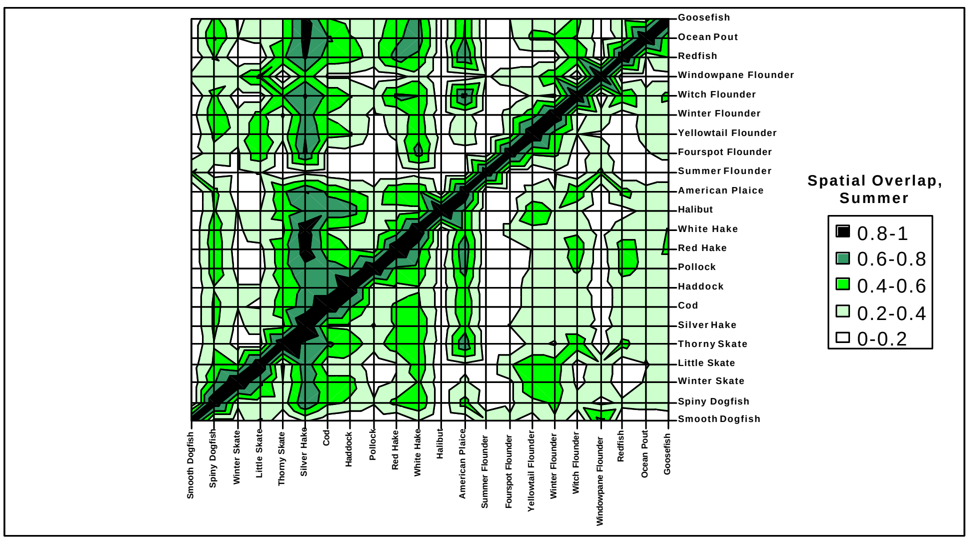


Figure 38. Spatial overlap of primary finfish species on Georges Bank, Summer 1970-1998 (as modified from Garrison and Link 2000)

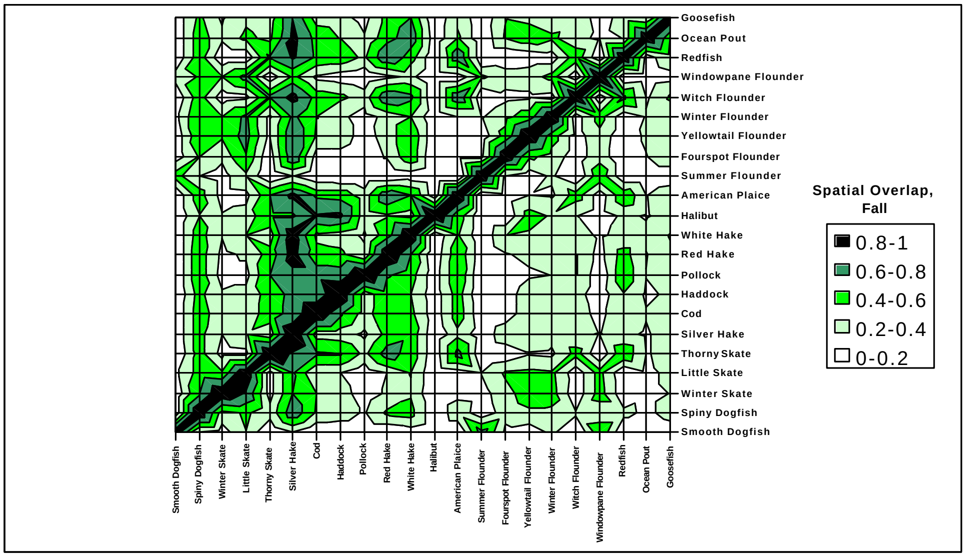


Figure 39. Spatial overlap of primary finfish species on Georges Bank, fall 1970-1998 (as modified from Garrison and Link 2000)

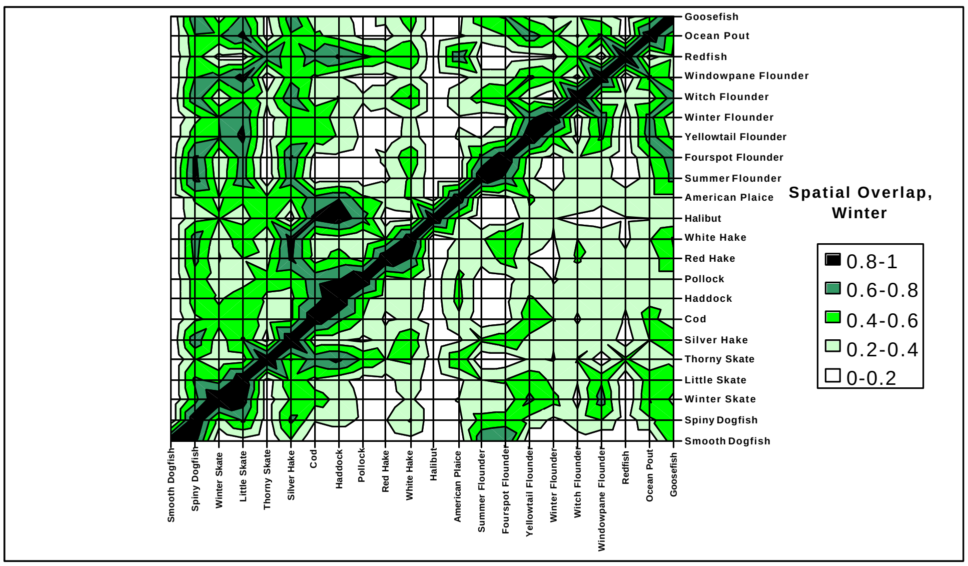


Figure 40. Spatial overlap of primary finfish species on Georges Bank, winter 1970-1998 (as modified from Garrison and Link 2000)

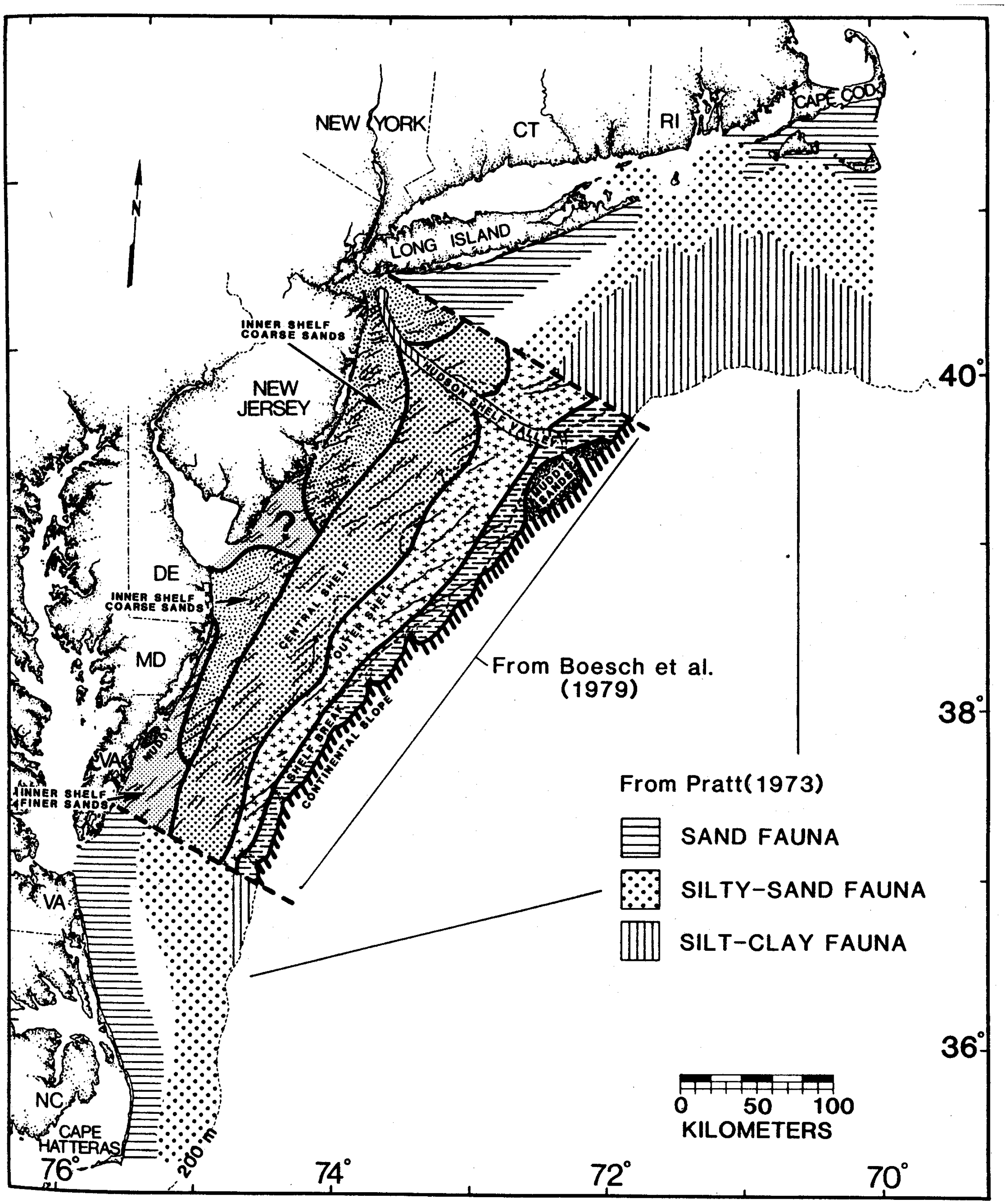
7.2.5.3 Mid-Atlantic Bight

Three broad faunal zones related to water depth and sediment type were identified for the Mid-Atlantic by Pratt (1973). The "sand fauna" zone was defined for sandy sediments (1% or less silt) which are at least occasionally disturbed by waves, from shore out to 50 m. The "silty sand fauna" zone occurred immediately offshore from the sand fauna zone, in stable sands containing at least a few percent silt and slightly more (2%) organic material. Silts and clays become predominant at the shelf break and line the Hudson Shelf Valley, and support the "silt-clay fauna."

Building on Pratt's work, the Mid-Atlantic shelf was further divided by Boesch (1979) into seven bathymetric/morphologic subdivisions based on faunal assemblages (Table 79, Map 31). Sediments in the region studied (Hudson Shelf Valley south to Chesapeake Bay) were dominated by sand with little finer materials. Ridges and swales are important morphological features in this area. Sediments are coarser on the ridges, and the swales have greater benthic macrofaunal density, species richness and biomass. Faunal species composition differed between these features, and Boesch incorporated this variation in his subdivisions (Table 79). Much overlap of species distributions was found between depth zones, so the faunal assemblages represented more of a continuum than distinct zones.

Habitat Type (after Boesch 1979)	**Description**		
	Depth (m)	**Characterization (Pratt faunal zone)**	**Characteristic Benthic Macrofauna**
Inner shelf	0-30	characterized by coarse sands with finer sands off MD and VA (sand zone)	Polychaetes: *Polygordius, Goniadella, Spiophanes*
Central shelf	30-50	(sand zone)	Polychaetes: *Spiophanes, Goniadella* Amphipod: *Pseudunciola*
Central and inner shelf swales	0-50	occurs in swales between sand ridges (sand zone)	*Polychaetes:* Spiophanes, Lumbrineris, Polygordius
Outer shelf	50-100	(silty sand zone)	Amphipods: *Ampelisca vadorum, Erichthonius* Polychaetes: *Spiophanes*
Outer shelf swales	50-100	occurs in swales between sand ridges (silty sand zone)	Amphipods: *Ampelisca agassizi, Unciola, Erichthonius*
Shelf break	100-200	(silt-clay zone)	not given
Continental slope	>200	(none)	not given

Table 79. Mid-Atlantic habitat types as described by Pratt (1973) and Boesch (1979) with characteristic macrofauna as identified in Boesch 1979.



Map 31. Schematic representation of major macrofaunal zones on the Mid-Atlantic shelf. *Approximate location of ridge fields indicated. Source: Reid and Steimle (1988).*

Wigley and Theroux (1981) found a general trend in declining macrobenthic invertebrate density from coastal areas offshore to the slope, and on the shelf from southern New England south to Virginia/North Carolina. There were no detectable trends in density from north to south on the slope. Number of individuals was greatest in gravel sediments, and declined in sand-gravel, sand-shell, sand, shell, silty sand, silt and finally clay. However, biomass of benthic macrofauna was greatest in shell habitat, followed by silty sand, gravel, sand-gravel, sand, sand-shell, silt and clay.

Demersal fish assemblages were described at a broad geographic scale for the continental shelf and slope from Cape Chidley, Labrador to Cape Hatteras, North Carolina (Mahon *et al.* 1998) and from Nova Scotia to Cape Hatteras (Gabriel 1992). Factors influencing species distribution included latitude and depth.

Results of these studies were similar to an earlier study confined to the Mid-Atlantic Bight continental shelf (Colvocoresses and Musick 1983). In this study, there were clear variations in species abundances, yet they demonstrated consistent patterns of community composition and distribution among demersal fishes of the Mid-Atlantic shelf. This is especially true for five strongly recurring species associations that varied slightly by season (Table 80). The boundaries between fish assemblages generally followed isotherms and isobaths. The assemblages were largely similar between the spring and fall collections, with the most notable change being a northward and shoreward shift in the temperate group in the spring.

Steimle and Zetlin (2000) described representative finfish species and epibenthic/epibiotic and motile epibenthic invertebrates associated with mid-Atlantic reef habitats (Table 81). Most of these reefs are manmade structures.

Season	Species Assemblage				
	Boreal	**Warm temperate**	**Inner shelf**	**Outer shelf**	**Slope**
Spring	Atlantic cod little skate sea raven monkfish winter flounder longhorn sculpin ocean pout whiting red hake white hake spiny dogfish	black sea bass summer flounder butterfish scup spotted hake northern searobin	windowpane	fourspot flounder	shortnose greeneye offshore hake blackbelly rosefish white hake
Fall	white hake whiting red hake monkfish longhorn sculpin winter flounder yellowtail flounder witch flounder little skate spiny dogfish	black sea bass summer flounder butterfish scup spotted hake northern searobin smooth dogfish	windowpane	fourspot flounder fawn cusk eel gulf stream flounder	shortnose greeneye offshore hake blackbelly rosefish white hake witch flounder

Table 80. Major Recurrent Demersal Finfish Assemblages of the Mid-Atlantic Bight During Spring and Fall as Determined by Colvocoresses and Musik (1983).

Location (Type)	**Representative Flora & Fauna**		
	Epibenthic/Epibiotic	**Motile Epibenthic Invertebrates**	**Fish**
Estuarine (Oyster reefs, blue mussel beds,other hard surfaces, semi-hard clay and Spartina peat reefs)	Oyster, barnacles, ribbed mussel, blue mussel, algae, sponges, tube worms, anemones, hydroids, bryozoans, slipper shell, jingle shell, northern stone coral, sea whips, tunicates, caprellid amphipods, wood borers	Xanthid crabs, blue crab, rock crabs, spider crab, juvenile American lobsters, sea stars	Gobies, spot, striped bass, black sea bass, white perch, toadfish, scup, drum, croaker, spot, sheepshead porgy, pinfish, juvenile and adult tautog, pinfish, northern puffer, cunner, sculpins, juvenile and adult Atlantic cod, rock gunnel, conger eel, American eel, red hake, ocean pout, white hake, juvenile pollock
Coastal (exposed rock/soft marl, harder rock, wrecks & artificial reefs, kelp, other materials)	Boring mollusks (piddocks), red algae, sponges, anemones, hydroids, northern stone coral, soft coral, sea whips, barnacles, blue mussel, horse mussel, bryozoans, skeleton and tubiculous amphipods, polychaetes, jingle shell, sea stars	American lobster, Jonah crab, rock crabs, spider crab, sea stars, urchins, squid egg clusters	Black sea bass, pinfish, scup, cunner, red hake, gray triggerfish, black brouper, smooth dogfish, sumemr flounder, scad, bluefish amberjack, Atlantic cod, tautog, ocean pout, conger eel, sea raven, rock gunnel, radiated shanny
Shelf (rocks & boulders, wrecks & artificial reefs, other solid substrates)	Boring mollusks (piddocks) red algae, sponges, anemones, hydroids, stone coral, soft coral, sea whips, barnacles, blue mussels, horse mussels, bryozoans, amphipods, polychaetes	American lobster, Jonah crabs, rock crabs, spider crabs, sea stars, urchins, squid egg clusters (with addition of some deepwater taxa at shelf edge)	Black sea bass, scup, tautog, cunner, gag, sheepshead porgy, round herring, sardines, amberjack, spadefish, gray triggerfish, mackerels, small tunas, spottail pinfish, tautog, Atlantic cod, ocean pout, red hake, conger eel, cunner, sea raven, rock gunnel, pollock, white hake
Outer shelf (reefs and clay burrows including "pueblo village community")			Tilefish, white hake, conger eel

Table 81. Mid-Atlantic Reef Types, Location, and Representative Flora and Fauna, as Described in Steimle and Zetlin (2000)

7.2.5.4 Continental Slope

Polychaetes represent the most important slope faunal group in terms of numbers of individuals and species (Wiebe et al. 1987). Ophiuroids are considered to be among the most abundant slope organisms, but this group is comprised of relatively few species. The taxonomic group with the highest species diversity includes the peracarid crustaceans represented by Amphipoda, Cumacea, Isopoda, and the Tanaidacea. Some species of the slope are widely distributed, while others appear to be restricted to particular ocean basins. The ophiuroids and bivalves appear to have the broadest distributions, while the peracarid crustaceans appear to be highly restricted because they brood their young, and lack a planktonic stage of development. In general, Gastropods do not appear to be very abundant; however past studies are inconclusive since they have not collected enough individuals for large-scale community and population studies.

In general, slope-inhabiting benthic organisms are strongly zoned by depth and/or water temperature, although these patterns are modified by the presence of topography, including canyons, channels, and current zonations (Hecker 1990). Moreover, at depths of less than 800 meters, the fauna is extremely variable and the relationships between faunal distribution and substrate, depth, and geography are less obvious (Wiebe et al. 1987). Fauna occupying hard-surface sediments are not as dense as in comparable shallow-water habitats (Wiebe et al. 1987), but there is an increase in species diversity from the shelf to the intermediate depths of the slope. Diversity then declines again in the deeper waters of the continental rise and plain. Hecker (1990) identified four megafaunal zones on the slope of Georges Bank and southern New England (Table 82).

Zone	**Approximate Depth (m)**	**Gradient**	**Current**	**Fauna**
Upper Slope	300-700	Low	strong	Dense filter feeders; Scleratinians (*Dasmosmilia lymani, Flabellum alabastrum*), quill worm (*Hyalinoecia*)
Upper Middle Slope	500-1300	High	moderate	Sparse scavengers; red crab (*Geryon quinqueidens*), long-nosed eel (*Synaphobranchus*), common grenadier (*Nezumia*). Alcyonarians (*Acanella arbuscula*, *Eunephthya florida*) in areas of hard substrate
Lower Middle Slope/Transition	1200-1700	High	moderate	Sparse suspension feeders; cerianthids, sea pen (*Distichoptilum gracile*)
Lower Slope	>1600	Low	strong	Dense suspension & deposit feeders; ophiurid (*Ophiomusium lymani*), cerianthid, sea pen

Table 82. Faunal zones of the continental slope of Georges Bank and southern New England (from Hecker 1990)

One group of organisms of interest because of the additional structure they can provide for habitat and their potential long life span are the Alcyonarian soft corals. Soft corals can be bush or treelike in shape; species found in this form attach to hard substrates such as rock outcrops or gravel. These species can range in size from a few millimeters to several meters, and the trunk diameter of large specimens can exceed 10 cm. Other Alcyonarians found in this region include sea pens and sea pansies (Order Pennatulacea), which are found in a wider range of substrate types. In their survey of northeastern U.S. shelf macrobenthic invertebrates, Theroux and Wigley (1998) found Alcyonarians (including soft corals *Alcyonium sp., Acanella sp., Paragorgia arborea, Primnoa reseda* and sea pens) in limited numbers in waters deeper than 50 m, and mostly at depths from 200-500 m. Alcyonarians were present in each of the geographic areas identified in the study (Nova Scotia, Gulf of Maine, Southern New England Shelf, Georges Slope, Southern New England Slope) except Georges Bank. However, *Paragorgia* and *Primnoa* have been reported in the Northeast Peak region of Georges Bank (Theroux and Grosslein 1987). Alcyonarians were most abundant by weight in the Gulf of Maine, and by number on the Southern New England Slope (Theroux and Wigley 1998). In this study, Alcyonarians other than sea pens were collected only from gravel and rocky outcrops. Theroux and Wigley (1998) also found stony corals (*Astrangia danae* and *Flabellum sp*.) in the northeast region, but they were uncommon. In similar work on the mid-Atlantic shelf, the only Alcyonarians encountered were sea pens (Wigley and Theroux 1981). The stony coral *Astrangia danae*, was also found, but its distribution and abundance was not discussed, and is assumed to be minimal.

As opposed to most slope environments, canyons may develop a lush epifauna. Hecker et al. (1983) found faunal differences between the canyons and slope environments. Hecker and Blechschmidt (1979) suggested that faunal differences were due at least in part to increased environmental heterogeneity in the canyons, including greater substrate variability and nutrient enrichment. Hecker et al. (1983) found highly patchy faunal assemblages in the canyons, and also found additional faunal groups located in the canyons, particularly on hard substrates, that do not appear to occur in other slope environments. Canyons are also thought to serve as nursery areas for a number of species (Hecker 2001; Cooper et al. 1987). The canyon habitats in Table 83 were classified by Cooper et al. (1987).

Most finfish identified as slope inhabitants on a broad spatial scale (Gabriel 1992; Overholtz and Tyler 1985; and Colvocoresses and Musik 1983) (Table 76) are associated with canyon features as well (Cooper et al. 1987). Finfish identified by broad studies that were not included in Cooper et al. (1987) include offshore hake, fawn cusk-eel, longfin hake, witch flounder and armored searobin. Canyon species (Cooper et al. 1987) that were not discussed in the broad scale studies include squirrel hake, conger eel and tilefish. Cusk and ocean pout were identified by Cooper et al. (1987) as canyon species, but classified in other habitats by the broad scale studies.

7.2.5.5 Assemblages of Northeast Shelf Finfish Species Based on Feeding Habits

A guild is defined by Root (1967) as ‘a group of species that exploit the same class of environmental resources in a similar way’ and explicitly focuses on classifying species based upon their functional role in a community without regard to taxonomy. The guild is used to simplify the structure and dynamics of complex ecosystems regardless of the mechanism generating resource partitioning. Guild members play similar functional roles within ecosystems (Garrison and Link 2000).

Cluster analysis modified from Garrison and Link (2000) found 14 groups of finfish in the Northeast region with significant dietary similarities. These 14 guilds were broadly categorized into six trophic groups, emphasizing similarities in diet at very broad taxonomic levels. Within these groups, the trophic guilds reflect utilization of specific prey types. For example, Guild 6b (Figure 41) consumed primarily engraulids in contrast to other guilds in the piscivore group.

Habitat Type	Geologic Description	Canyon Locations	Most Commonly Observed Fauna
I	Sand or semi-consolidated silt substrate (claylike consistency) with less than 5% overlay of gravel. Relatively featureless except for conical sediment mounds.	Walls & axis	Cerianthid, pandalid shrimp, white colonial anemone, Jonah crab, starfishes, portunid crab, greeneye, brittle stars, mosaic worm, red hake, four spot flounder, shell-less hermit crab, silver hake, gulf stream flounder
II	Sand or semi-consolidated silt substrate (claylike consistency) with more than 5% overlay of gravel. Relatively featureless.	Walls	Cerianthid, galatheid crab, squirrel hake, white colonial anemone, Jonah crab, silver hake, starfishes, ocean pout, brittle stars, shell-less hermit crab, greeneye
III	Sand or semi-consolidated silt (claylike consistency) overlain by siltstone outcrops and talus up to boulder size. Featured bottom with erosion by animals and scouring.	Walls	White colonial anemone, pandalid shrimp, cleaner shrimp, rock anemone, white hake, starfishes, ocean pout, conger eel, brittle star, Jonah crab, lobster, black-bellied rose fish, galatheid crab, mosaic worm, tilefish
IV	Consolidated silt substrate, heavily burrowed/excavated. Slope generally more than 5º and less than 50º Termed "pueblo village" habitat.	Walls	Starfishes, black-bellied rosefish, Jonah crab, lobster, white hake, cusk, ocean pout, cleaner shrimp, conger eel, tilefish, galatheid crab, shell-less hermit crab
V	Sand dune substrate.	Axis	Starfishes, white hake, Jonah crab, and monkfish

(Faunal characterization is for depths < 230 m only).

Table 83. Habitat Types for the Canyons of Georges Bank Described by Geologic Attributes and Characteristic Fauna (from Cooper *et al.* 1987).

The dietary guilds in the Northeast US shelf fish community reflect similarity in the utilization of specific prey categories. Within guilds, 10 to 15 prey taxa generally accounted for greater than 70% of predator diets and usually less than five prey accounted for greater than 50% of the diet. A relatively small set of prey taxa distinguishes the observed dietary guild structure (2000).

The general guild structure and levels of dietary overlap in this system are consistent across both temporal and spatial scales. Complimentary analyses to the current study within the Georges Bank region identified similar trophic guilds, similar patterns of size-based shifts in diets, and general stability in the trophic guild structure over the last three decades (Garrison 2000). Despite the notable changes in species composition in the Northeast shelf fish community, the patterns of trophic resource use and guild structure are remarkably consistent (2000).

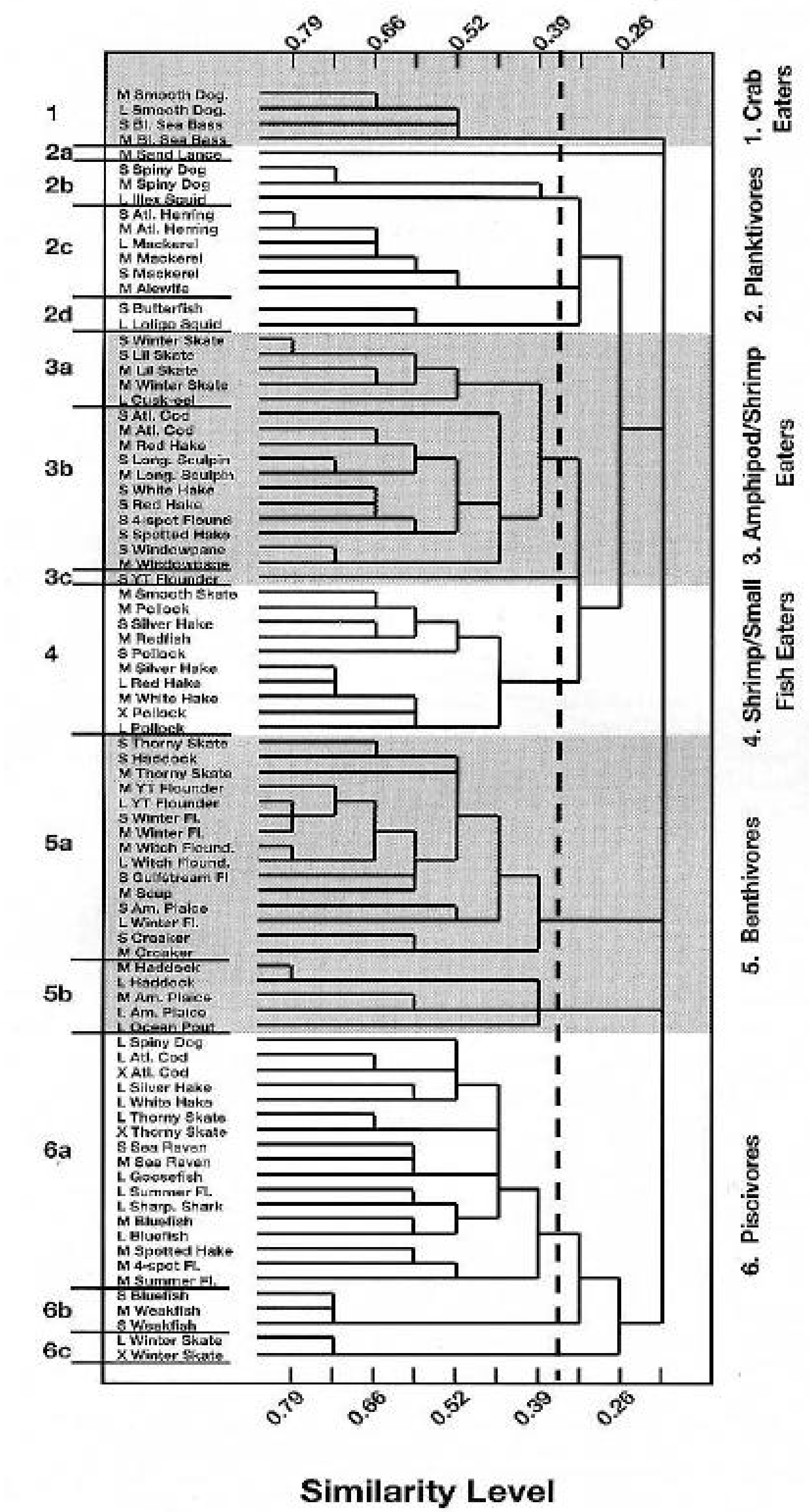


Figure 41. Dietary guild structure of Northeast finfish species

7.2.6 Essential Fish Habitat Considerations

7.2.6.1 Scallop Essential Fish Habitat

The area affected by the proposed action has been identified as EFH for species managed under the NE Multispecies; Atlantic Sea Scallop; Atlantic Monkfish; Summer Flounder; Scup and Black Sea Bass; Squid, Atlantic Mackerel and Butterfish; Atlantic Surf Clam and Ocean Quahog; Atlantic Bluefish; Atlantic Billfish; and Atlantic Tuna, Swordfish and Shark Fishery Management Plans. In general, EFH for these species includes pelagic and demersal waters, saltmarsh creeks, seagrass beds, mudflats and open bay areas, as well as mud, sand, gravel and shell sediments over the continental shelf, and structured habitat containing sponges and other biogenic organisms (NMFS 2002). Specific text descriptions and accompanying maps detailing EFH by species and life stage are included in the Habitat Omnibus Amendment, and, several FMPs developed by the Mid-Atlantic Fishery Management Council (refs), and in the Highly Migratory Species FMP (NMFS 1999). EFH descriptions and maps for Northeast region species can also be accessed at http://www.nero.nmfs.gov/ro/doc/hcd/.

The following description and map of EFH for Atlantic sea scallops (*Placopecten magellanicus*) is excerpted from the Omnibus EFH Amendment. Note that no information was available to designate the extent of EFH for scallop eggs or larvae and that juvenile and adult were combined into a single map. Essential fish habitat for Atlantic sea scallops is described as those areas of the coastal and offshore waters (out to the offshore U.S. boundary of the exclusive economic zone) that are designated on Map 32 and in the accompanying table and meet the following conditions:

Eggs: Bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to the Virginia-North Carolina border as depicted in Map 32. Eggs are heavier than seawater and remain on the seafloor until they develop into the first free-swimming larval stage. Generally, sea scallop eggs are thought to occur where water temperatures are below 17° C. Spawning occurs from May through October, with peaks in May and June in the middle Atlantic area and in September and October on Georges Bank and in the Gulf of Maine.

Larvae: Pelagic waters and bottom habitats with a substrate of gravelly sand, shell fragments, and pebbles, or on various red algae, hydroids, amphipod tubes and bryozoans in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to the Virginia-North Carolina border as depicted in Map 32. Generally, the following conditions exist where sea scallop larvae are found: sea surface temperatures below 18° C and salinities between 16.9‰ and 30‰.

Juveniles: Bottom habitats with a substrate of cobble, shells and silt in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to the Virginia-North Carolina border that support the highest densities of sea scallops as depicted in Map 32. Generally, the following conditions exist where most sea scallop juveniles are found: water temperatures below 15° C, and water depths from 18 - 110 meters.

Adults: Bottom habitats with a substrate of cobble, shells, coarse/gravelly sand, and sand in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to the Virginia-North Carolina border that support the highest densities of sea scallops as depicted in Map 32. Generally, the following conditions exist where most sea scallop adults are found: water temperatures below 21° C, water depths from 18 - 110 meters, and salinities above 16.5‰.

Spawning Adults: Bottom habitats with a substrate of cobble, shells, coarse/gravelly sand, and sand in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to the Virginia-North Carolina border that support the highest densities of sea scallops as depicted in Map 32. Generally, the following conditions exist where spawning sea scallop adults are found: water temperatures below 16° C, depths from 18 - 110 meters, and salinities above 16.5‰. Spawning occurs from May through October, with peaks in May and June in the middle Atlantic area and in September and October on Georges Bank and in the Gulf of Maine.

All of the above EFH descriptions include those bays and estuaries listed on Table 84, according to life history stage. The Council acknowledges potential seasonal and spatial variability of the conditions generally associated with this species.

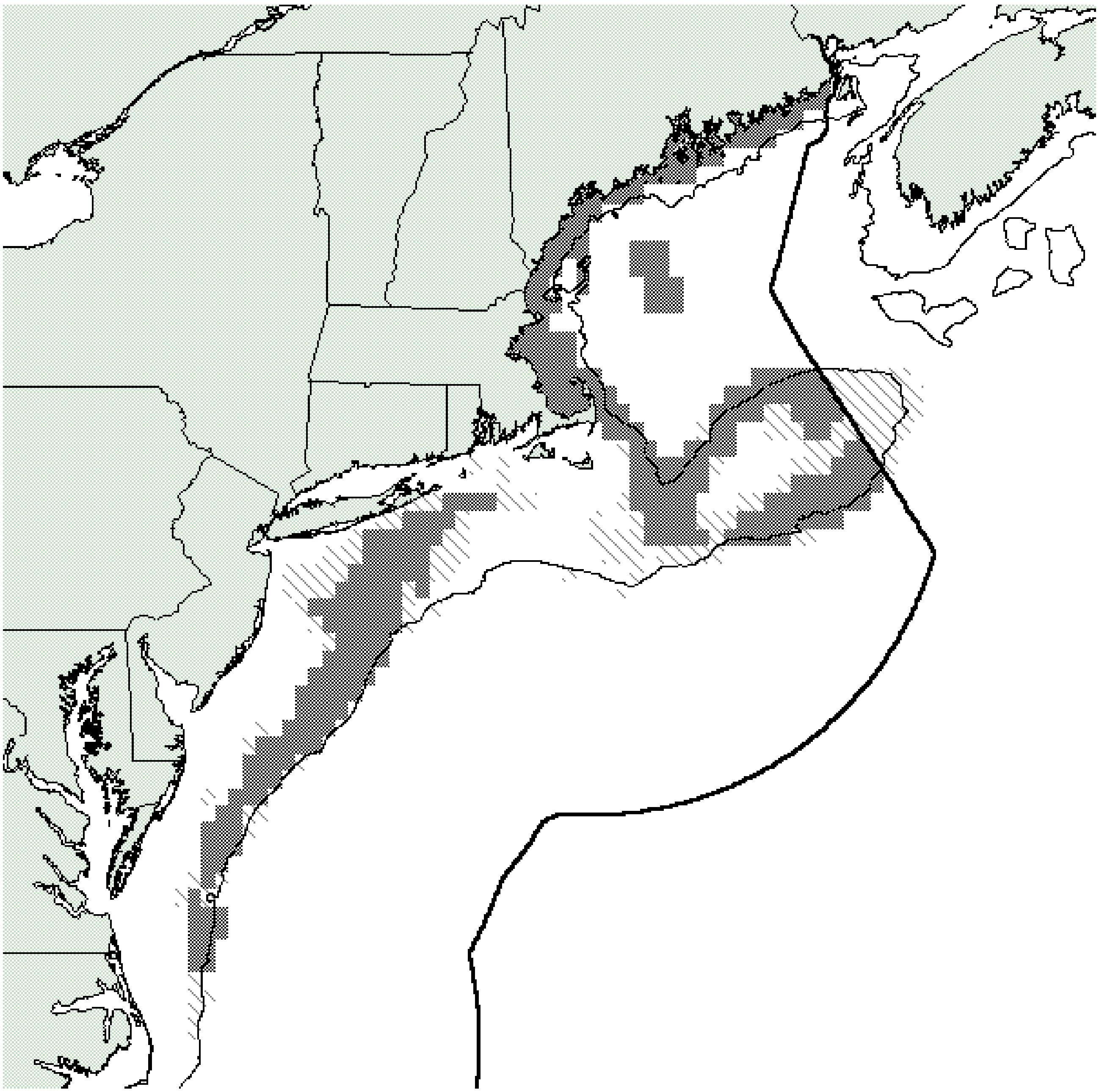
These EFH designations of estuaries and embayments are based on the NOAA Estuarine Living Marine Resources (ELMR) program (Jury *et al.* 1994; Stone *et al.* 1994). The Council recognizes the spatial and temporal variability of estuarine and embayment environmental conditions generally associated with this species.

Table 84. EFH Designation of Estuaries and Embayments -Atlantic sea scallops (*Placopecten magellanicus*)

S º The EFH designation for this species includes the seawater salinity zone of this bay or estuary (salinity > 25.0‰). M º The EFH designation for this species includes the mixing water / brackish salinity zone of this bay or estuary (0.5 < salinity < 25.0‰). F º The EFH designation for this species includes the tidal freshwater salinity zone of this bay or estuary (0.0 < salinity < 0.5‰).

Estuaries and Embayments	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Passamaquoddy Bay	s	s	s	s	s
Englishman/Machias Bay	s	s	s	s	s
Narraguagus Bay	s	s	s	s	s
Blue Hill Bay	s	s	s	s	s
Penobscot Bay	s	s	s	s	s
Muscongus Bay	s	s	s	s	s
Damariscotta River	s	s	s	s	s
Sheepscot River	s	s	s	s	s
Kennebec / Androscoggin Rivers					
Casco Bay	s	s	s	s	s
Saco Bay					
Wells Harbor					
Great Bay			s	s	
Merrimack River					
Massachusetts Bay	s	s	s	s	s
Boston Harbor					
Cape Cod Bay	s	s	s	s	s
Waquoit Bay					
Buzzards Bay					
Narragansett Bay					
Long Island Sound					
Connecticut River					
Gardiners Bay					
Great South Bay					
Hudson River / Raritan Bay					
Barnegat Bay					
Delaware Bay					
Chincoteague Bay					
Chesapeake Bay					

Map 32. The EFH designation for Atlantic sea scallops is based upon alternative 2 (75%), based on the NMFS scallop survey (1982 - 1997), plus areas identified by the fishing industry and by NMFS as important for sea scallops. The designation also includes the mid-Atlantic juvenile sea scallop closed areas (the Hudson Canyon Closed Area and the Virginia Beach Closed Area) and those bays and estuaries identified by the NOAA ELMR program as supporting sea scallops at the "common" or "abundant" level. The other alternatives were not selected because they either include too little area (less than half of the range of this overfished species), or include areas where sea scallops occur in relatively low concentrations. The light shading represents the entire observed range of Atlantic sea scallops.



Map 33. Scallop EFH and Bottom Sediments as modified from Poppe et al, 1986.

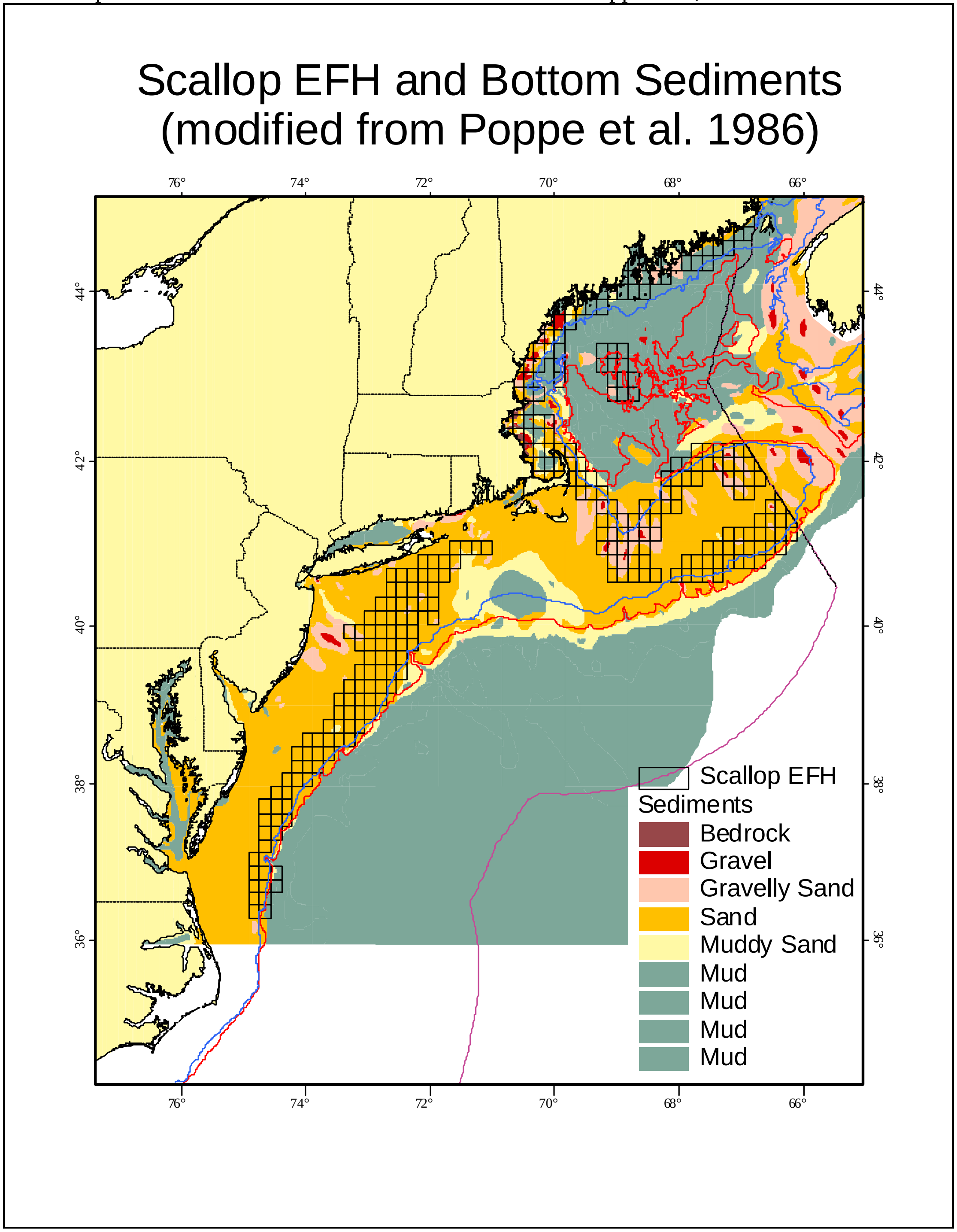


Table 85. Percent of scallop EFH (juvenile) that is designated in various sediment types as modified from Poppe et al. 1989.

	% of scallop EFH found within each sediment type	**% of each sediment type found within scallop EFH**
Bedrock	0.7%	97.9%
Gravel	1.9%	71.5%
Gravelly Sand	10.1%	50.2%
Sand	67.6%	29.8%
Muddy Sand	3.4%	10.4%
Mud	16.3%	16.7%

An analysis of the distribution of surficial sediments within the ten-minute squares of latitude and longitude that are designated as EFH for juvenile (and adult) scallops in the Northeast region was performed (see Map 33, Table 85). The sediment distribution information was based on digitized sediment data available from the U.S. Geological Survey (Poppe *et al*. 1989) and, for purposes of this analysis, the Northeast region was defined as continental shelf waters from the shoreline out to a depth of 500 fathoms. This analysis revealed that sand was the predominant bottom substrate within scallop EFH, but in proportion to the areal extent of the six different sediment types within the Northeast region, scallop EFH is disproportionately more prevalent in coarser sediments, i.e., bedrock, gravel, and gravelly sand. The fact that so much scallop EFH occurs in deeper, low-energy, sandy bottom areas (deeper than about 60 meters or 30 fathoms) that are more vulnerable to the adverse effects of dredging and trawling, and that dredges and trawls are used extensively in this type of habitat, means that a fairly large area of the Northeast shelf could be adversely affected by mobile bottom-tending gear.

Essential Fish Habitat (EFH) for sea scallops was defined based on survey abundance distribution and other data. These designations were defined in the Omnibus Amendment for EFH (NEFMC 1998). An update of this assessment and designations is planned in the near future as part of a comprehensive review of EFH designations for the Council's managed species.

7.2.6.2 Gear Effects Evaluation

7.2.6.2.1 Overview

Pursuant to the EFH regulations (50 CFR 610.815(a)(2)), FMPs must include an evaluation of the potential adverse effects of fishing on EFH, including effects of each fishing activity regulated under federal FMPs. The evaluation should consider the effects of each fishing activity on each type of habitat found within EFH. FMPs must describe each fishing activity, review and discuss all available and relevant information (such as information regarding the intensity, extent, and frequency of any adverse effect on EFH; the type of habitat within EFH that may be affected adversely; and the habitat functions that may be disturbed), and provide conclusions as to whether and how each fishing activity adversely affects EFH. The evaluation should also consider the cumulative effects of multiple fishing activities on EFH. In completing this evaluation, Councils should use the best scientific information available, as well as other appropriate information sources. Councils should consider different types of information according to their scientific rigor.

Magnuson-Stevens Act / EFH Provisions detailed in the Final Rule mandates that each FMP must: *1. Contain an evaluation of the potential adverse effects of fishing on EFH designated under the FMP, including effects of each fishing activity regulated under the FMP or other Federal FMPs, 2. Consider the effects of each fishing activity on each type of habitat found within EFH, and 3. Describe* *each fishing activity, review and discuss all available relevant information, and provide conclusions regarding whether and how each fishing activity adversely affects EFH.*

This section, considered the Gear Effects Evaluation for the Final Environmental Impact Statement for the Essential Fish Habitat Components of Amendment 10, satisfies these requirements. The SFA requires the NEFMC to minimize, to the extent practicable, the adverse impacts of fishing on the EFH associated with any federally regulated fishing activities in the Northeast region. To do this, this amendment must evaluate the effects of all fishing gears used in the region on groundfish EFH, following the guidelines indicated above. NEPA requires that each management alternative, either for improving yield or minimizing effects of fishing on scallop EFH, must be analyzed to evaluate the environmental consequences on other fishery resources and their habitats and benthic communities.

Since the implementation of the Council's Omnibus EFH Amendment of 1998 (NEFMC 1998), NMFS, NEFMC and MAFMC conducted a Gear Effects Workshop that evaluated the effects of fishing gears used in the Northeast region on mud, sand, and gravel habitats (NEREFHSC 2002). Additional sources of information include work done by the NEFMC Essential Fish Habitat Technical Team, and a National Research Council report on the Effects of Trawling and Dredging on Seafloor Habitat (NRC 2002). Additional information is included in this document.

7.2.6.2.2 Gear Descriptions

For a complete description of the gears used in the scallop fishery, as well as the entire Northeast region, refer to Appendix 6.

7.2.6.2.3 Distribution of fishing activity by gear

7.2.6.2.3.1 Overview

This section of the document includes a series of GIS figures showing the distribution of fishing activity by ten minute "squares" of latitude and longitude for the two principal gear types used in the U.S. Northeast region to harvest Atlantic sea scallops (scallop dredges and bottom trawls) and for hydraulic clam dredges, which are not used to harvest scallops, but which are operated in areas of the Northeast shelf ecosystem where scallops are found and which could potentially affect scallop EFH. Commonly-used fixed bottom-tending gears such as longlines, gill nets, and various kinds of pots were not included since they are not used to harvest scallops and because their effects on scallop EFH are negligible. Also included in this section are analyses of the distribution of fishing activity for each of the three mobile gear types among four sub-regions and by surface sediment type within each sub-region and for the region as a whole.

7.2.6.2.3.2 Methods

7.2.6.2.3.2.1 Data Sources and Processing

The data used to perform this analysis were extracted from vessel trip report and clam logbook databases maintained at the U.S. National Marine Fisheries Service (NMFS) Northeast (NE) Regional Office in Gloucester, MA. Data included in the analysis are provided by vessels operating with federal permits that participate in the following fisheries: northeast multispecies; sea scallops; surf clams and ocean quahogs; monkfish; summer flounder; scup; black sea bass; squid, mackerel, and butterfish; spiny dogfish; bluefish; Atlantic herring; and tilefish. Vessels that operate strictly within state waters (generally inside three miles from shore) are not required to have a federal permit and therefore do not submit trip reports. For this reason, fishing trips in some nearshore ten minute squares that include a significant proportion of state water are under-represented.

Permit holders are required to fill out a VTR form or make a logbook entry for each trip made by the vessel, i.e., each time the vessel leaves and returns to port. In cases where more than one statistical area is fished or the gear is changed during the same trip, a separate report is completed. Fishermen are given the choice of reporting the location of a trip as a point (latitude and longitude or Loran bearings) or just as a statistical area. Only trips that were reported as a point location and therefore could be assigned to a ten minute square were included in this analysis. Most trips are reported this way. Fishermen report the general location where most of their fishing effort occurred during a trip and the date and time that the vessel left and returned to port. They are also asked to record the number of hauls (tows or sets) made during the trip and the average tow or soak time when the gear was fishing, but this information was judged to be too unreliable and incomplete for use in this analysis. Logbook entries in the clam dredge fishery include time spent fishing: these data were used in this analysis. For the three mobile gear types, VTR and logbook data used in this analysis were compiled for the years 1995-2001. Scallop dredge and otter trawl fishing activity was calculated as the total number of days absent from port during the seven-year period. Days absent for each mobile gear trip were calculated based on the date and time of departure from and return to port in hours and converted to fractions of 24-hr days. Hydraulic clam dredge fishing activity was calculated as days (24 hrs) spent fishing based on the number of hours spent on each trip and excluded trips made by "dry" quahog dredge vessels in Maine.

Days absent calculations for trawl and dredge vessels are clearly preferable to simply summing the number of trips, but over-estimate actual fishing time since they include travel time and any other non-fishing-related activity while vessels are away from port. Thus, the GIS plots and analyses presented here do not represent fishing effort. They were only used to indicate the relative, not the absolute, distribution of fishing activity by geograhical area and sediment type. Toward this end, all GIS input data were compiled and sorted into three categories: low, medium, and high degrees of activity that corresponded to cumulative percentages of 90, 75, and 50% of the total number of days at sea, or days spent fishing for each gear type during the seven-year time period. Data reported from ten minute squares (TMS) south of Cape Hatteras, North Carolina (35° N) and north of 45° N latitude in the Gulf of Maine were excluded from analysis, as were TMS-binned data from the low end (cumulative percentages >90%) of the frequency distribution. Exclusion of "low end" data (TMS with only a few trips or days) eliminated a large number of spatially misreported trips from analysis.

Also included in this section are GIS plots (Map 38 - Map 40) of fishing activity for scallop dredge vessels operating in the limited access fishery during 1998, 1999, and 2000 which were derived from vessel monitoring systems (VMS) placed aboard each vessel (Rago and McSherry 2001). These plots provide a much more detailed depiction of fishing activity for dredge vessels during these three years than VTR data since they are collected at much higher spatial and temporal resolutions. Data were collected at 20-minute intervals during the time when vessel speed was less than 5 knots in order to differentiate between fishing activity and steaming time and then binned into one nautical mile squares. It is recognized that fishing activity includes other activities besides dredging, e.g., shucking time.

7.2.6.2.3.2.2 Data Analysis

In each plot, the number of trips or days that accounted for 90% (cumulative) of the total number of trips or days was given as "N" in the title of each figure. Depth contours shown in these figures are for 50 and 100 fathoms. The U.S.-Canada border is shown as a black line and the outer boundary of the U.S. Exclusive Economic Zone (EEZ) is also shown. Ten minute squares that account for 90% of total fishing activity (i.e., all the TMS shown in the low, medium, and high distribution plots) were overlaid as open

TMS on sediment types in a second series of GIS plots for each gear type. The surficial sediment layer was modified from a GIS data layer originally made available as a series of hard copy maps by Poppe et al. (1989) and available on a USGS CD-ROM. The original data layer included nine sediment types. For this analysis, silt and clay sediment categories were re-defined as "mud." This resulted in a simplified set of six sediment categories, which were re-named bedrock, gravel, gravelly sand, sand, muddy sand, and mud (Map 34).

Data were allocated to TMS within the Northeast region (delimited by 35° N latitude) and to four sub-regions, the Gulf of Maine (GOM), Georges Bank (GB), southern New England (SNE), and the Mid-Atlantic (MA). These sub-regions are shown in Map 35. Each sub-region, and the NE region of which each formed a part, were bounded inshore to exclude state waters and offshore by the 500 fathom depth contour. Boundaries between sub-regions were defined along ten minute parallels of latitude and meridians of longitude so that the only partial TMS were those that intersected with either the inshore or offshore limits of the region. Input files of VTR and logbook data were joined with shape files for each sub-region and the number of trips, days at sea, or days fishing, and the area (in square decimal degrees) encompassed by all the TMS – or portions of TMS – in each fishing activity category (50, 75, and 90%), were calculated.

For the "low" (90%) level of fishing activity, the percentage of the total number of trips or days that occurred in each sub-region during the six or seven-year time period was calculated. Also, the spatial extent to which each sub-region (and the entire NE region) was "fished" by each gear type was calculated as the proportion of the total area within each sub-region that was included within all the designated TMS. For bottom trawls, the amount of closed area on GB and in SNE was deducted from the total area in each sub-region. (All the other gear types had access to these areas for all or a portion of the 1995-2001 time period).

It is important to understand that all calculations involving "area fished" grossly over-estimate the amount of bottom area actually affected by fishing because bottom-tending gear in most cases are not used throughout any given TMS that was assigned to a fishing activity category. This would be particularly true for TMS at the low (90%) end of the distribution, i.e., TMS in which fishing activity is very sparse. Area analyses were only intended to reveal relative differences in the degree of fishing activity between gear types and sub-regions.

Analyses of percent area "fished" were conducted for each gear type and sub-region in terms of the percentage of the total area of each sediment type present in each sub-region was "fished" at the 90% level. These analyses were limited by the very general nature of the available sediment coverage data, and, as mentioned above, by the fact that fishing may take place within a relatively small proportion of the area within a TMS (which covers about 77 square nautical miles), and on a bottom type that either makes up a small proportion of the whole TMS or isn't even represented in the sediment database.

7.2.6.2.3.3 Results

7.2.6.2.3.3.1 Bottom Trawls

Bottom trawling in federal waters in the Northeast region during 1995-2001 accounted for more than twice as many days absent as scallop dredging and was represented in more than twice as much area (see Figure 42). Significant areas were closed to bottom trawlers during the seven-year period: 15% of GB and 5% in SNE. These areas account for the large gaps in the distribution of trawling activity on GB and SNE (Map 36). Bottom trawling, more than any other gear type, was also conducted to a greater extent in deeper water in the GOM, north of GB, and along the shelf break in SNE and the MA. A continuous area of high trawling activity occurred from the central GOM west to the coast, then through the southwestern GOM, down the west side of the Great South Channel and east across the top of closed area I on GB. Trawling was also reported west and south of closed area II on eastern GB, on the southern portion of GB, throughout most of SNE in inner, mid, and outer shelf waters, along the shelf break in the MA, and in North Carolina coastal waters. There was a large area with no significant amount of trawling in the middle and inner portions of the MA shelf from the NewYork Bight south to the North Carolina border.

Analysis of VTR data by region showed that trawling activity was fairly evenly distributed among the four regions of the Northeast shelf (Figure 42). The GOM and GB regions, however, ranked somewhat higher than SNE and the MA in most cases. In terms of the area included in TMS that accounted for 90% of the reported number of days absent from port, a larger proportion of the SNE region was trawled than was trawled in any of the other regions and the MA region the least affected. Trawling was distributed over a high proportion of total area in all regions except the MA where it was no more extensive than scallop dredging and only slightly more extensive than hydraulic clam dredging.

Bottom trawling was widely distributed on a variety of substrates in the NE region, but appeared to be more widespread on mud bottom in the GOM and on sand and gravel in the other three regions where coarser substrates are more common (Figure 43). Analysis of VTR data according to sediment type indicated that bottom trawling was less common on sandy substrates in the NE region than dredging and more common on mud and muddy sand than the other two mobile gear types (Figure 44). In terms of the total amount of each sediment type present in the NE region, trawling was distributed over a much higher percentage of mud and muddy sand bottom than dredges and also ranked higher than dredges on sand and gravel and about the same as scallop dredges on gravelly sand. Trawling activity was extensively distributed over all five sediment types in the GOM, GB, and SNE regions (Figure 43). In the MA region, a much smaller proportion of sand and gravelly sand was trawled and no trawling was reported in the very small amount of gravel present in this region.

Otter trawls are used in the mid-Atlantic to harvest scallops (Map 37). The primary fishing ground is located along the shelf break between 37° and 40°N latitude on sandy bottom.

7.2.6.2.3.3.2 Scallop Dredges

Scallop dredging in federal waters in the Northeast region during 1995-2001 accounted for less than half as many days absent as bottom trawling, but nearly ten times more time at sea than was spent dredging with hydraulic clam dredges (Figure 42). Portions of the three areas on GB that were closed in 1995 to all bottom-tending gears capable of catching groundfish (including scallop dredges) were opened to scallop dredges in 1999 and 2000. (These areas were therefore included in the spatial calculations of scallop dredging activity for the whole time period). Scallop dredging during 1995-2001 was reported in TMS along the eastern Maine coast, in the extreme southwestern “corner” of the GOM north of Cape Cod, along the western side of the Great South Channel, along the northern edge of GB and on its southeastern flank, and in a very large continuous area reaching from the eastern end of Long Island south across the shelf and in outer shelf waters as far south as the North Carolina border (Map 36). Large expanses of bottom area in the outer GOM, on the top of GB, in SNE, and in inner shelf waters of the MA did not support any scallop dredging at the 50-90% activity levels. Unlike bottom trawling, scallop dredging was almost completely confined to depths shallower than 50 fathoms. Analysis of VTR data by sub-region showed that about half of the reported scallop dredging days at sea were in the MA region, about 30% in the GB region (the same proportion as for trawls), 10% in SNE, and 5% or less in the GOM (Figure 42). Expressed as a percentage of the total area included within the 90% TMS in each region, the MA region again ranked first, followed by GB, SNE, and the GOM, as before.

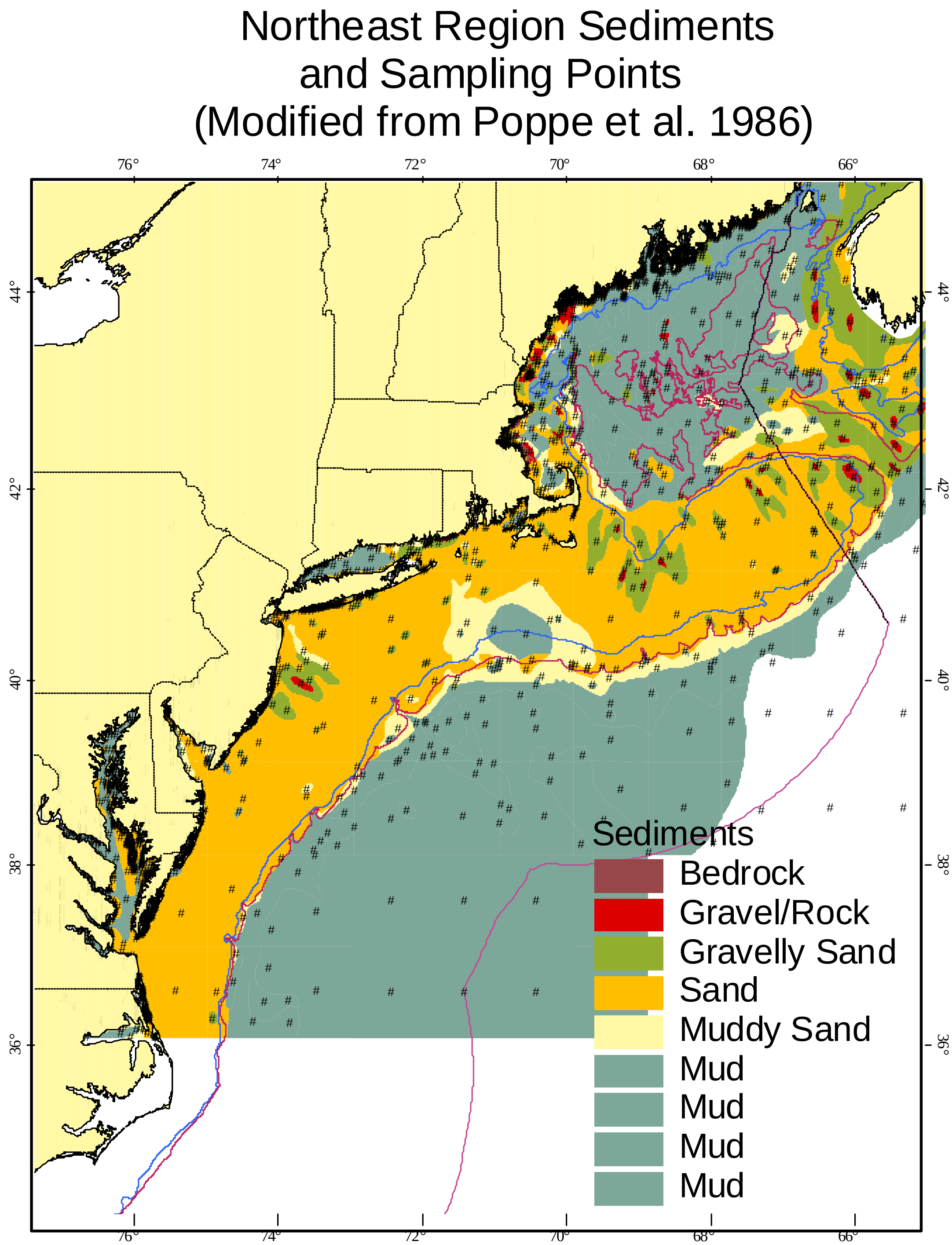
Scallop dredging was confined mostly to sandy substrates in the MA region, was common on sand, gravel, and gravelly sand on GB, and (apparently) on mud and sand bottom areas in the GOM (Figure 3). Large areas of sand in shallower water on GB, and sand, muddy sand, and mud in SNE were not dredged during 1995-2001. Throughout the NE region, scallop dredging was reported for TMS that included a high proportion of sand and very low proportions of any other sediment type (Figure 44). In the two sub-regions where most scallop dredging occurred (GB and MA), fishing was increasingly more common on coarser substrates (Figure 43). The same trend was observed for the entire Northeast region (Figure 44). In the GOM, a very low percentage of mud in the entire region was dredged: sand ranked the highest, with intermediate values for muddy sand, gravelly sand and gravel. In SNE, only sand and gravelly sand supported any significant amount of scallop dredging.

7.2.6.2.3.3.3 Hydraulic Clam Dredges

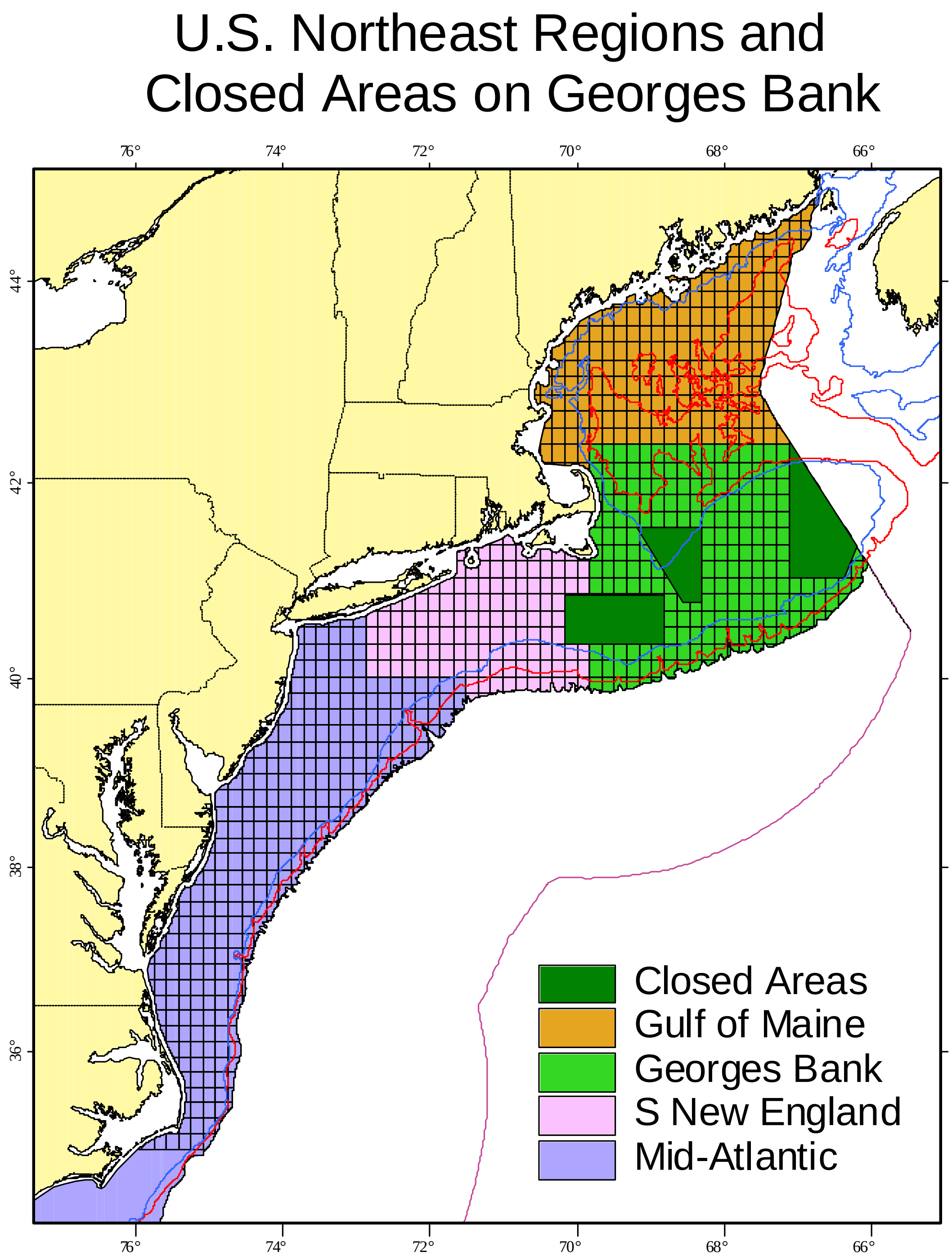
Fishing activity by hydraulic clam dredge vessels was compiled as time spent fishing and so could not be directly compared with time at sea for scallop dredge and bottom trawl vessels. Nevertheless, clam dredging activity was clearly less intensive during 1995-2001 than for either of the other two major types of mobile gear (Figure 42). The area represented by TMS that accounted for 90% of the total clam dredging activity was about half the area where most scallop dredging was reported and one-fourth the area where most bottom trawling was reported. Hydraulic dredging accounted for a higher percentage of days fished and area in the MA region than in SNE. Hydraulic dredges were used in a larger percentage of SNE than scallop dredges, and a smaller percentage of the MA. Hydraulic clam dredging took place in SNE and the MA, generally in shallower shelf waters than scallop dredging and trawling. A cluster of TMS off the New Jersey coast was heavily fished, as were other TMS further out toward the edge of the shelf, south of Long Island, and in SNE waters (Figure 42). Clam dredges do not operate on GB because ocean quahogs on the bank contain red tide-causing micro-organisms and can not be harvested. Hydraulic clam dredging is restricted to sandy and muddy sand substrates because the gear can be damaged in hard bottom areas (NEREFHSC 2001). For this reason, hydraulic dredges are not used in the GOM.

Like the other two mobile gears, hydraulic dredges were used primarily on sandy bottom in the NE region (Figure 44). Relative to the amount of each sediment type available in the NE region, hydraulic dredges were used more on sand and gravelly sand than on gravel and muddy sand. Sand and gravelly sand were more extensively dredged than muddy sand in SNE and gravel and gravelly sand more extensively than sand and muddy sand in the MA region (Figure 43).

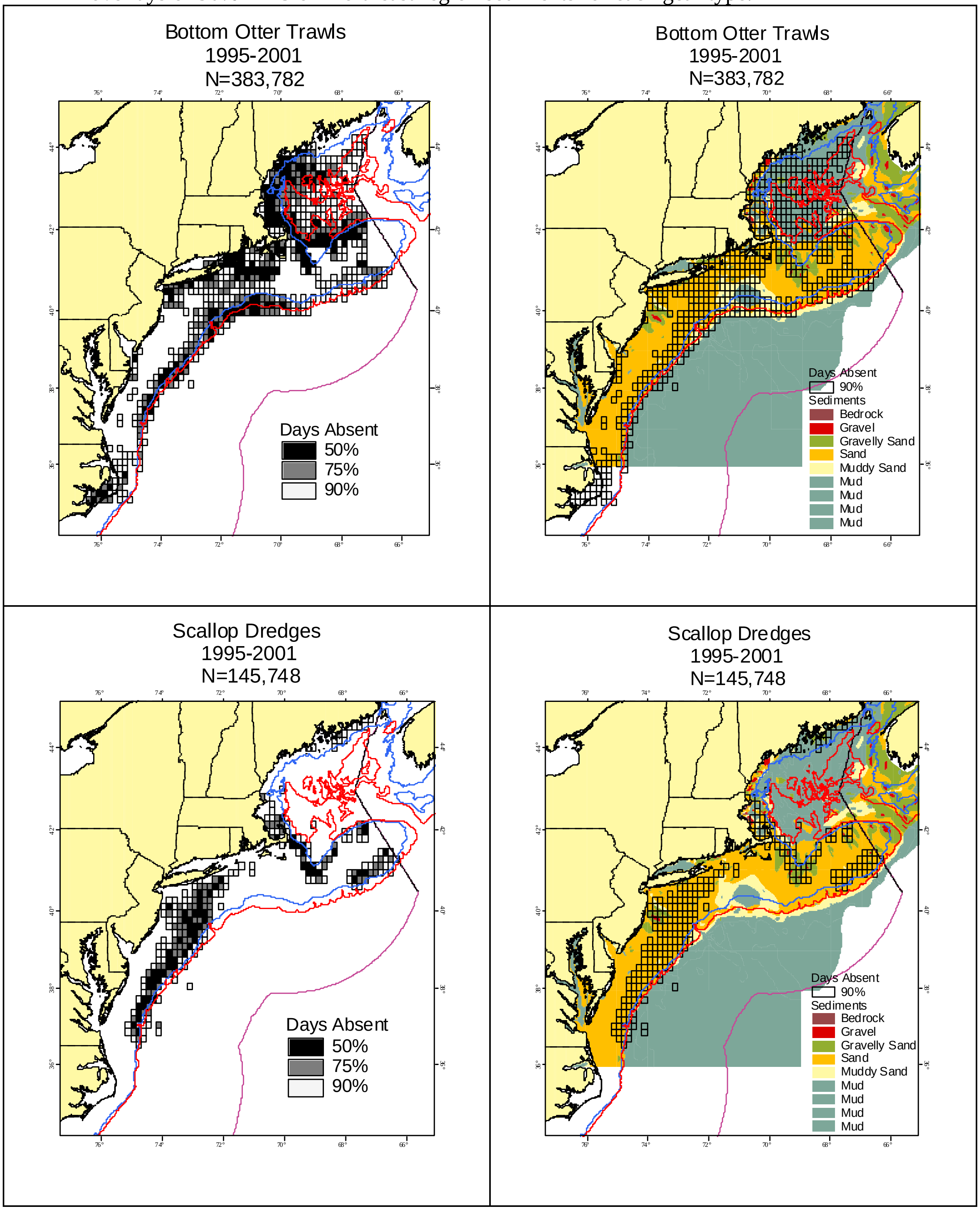
Map 34. Distribution of surficial sediments and sampling locations in the U.S. Northeast region (modified from Poppe et al. (1989)

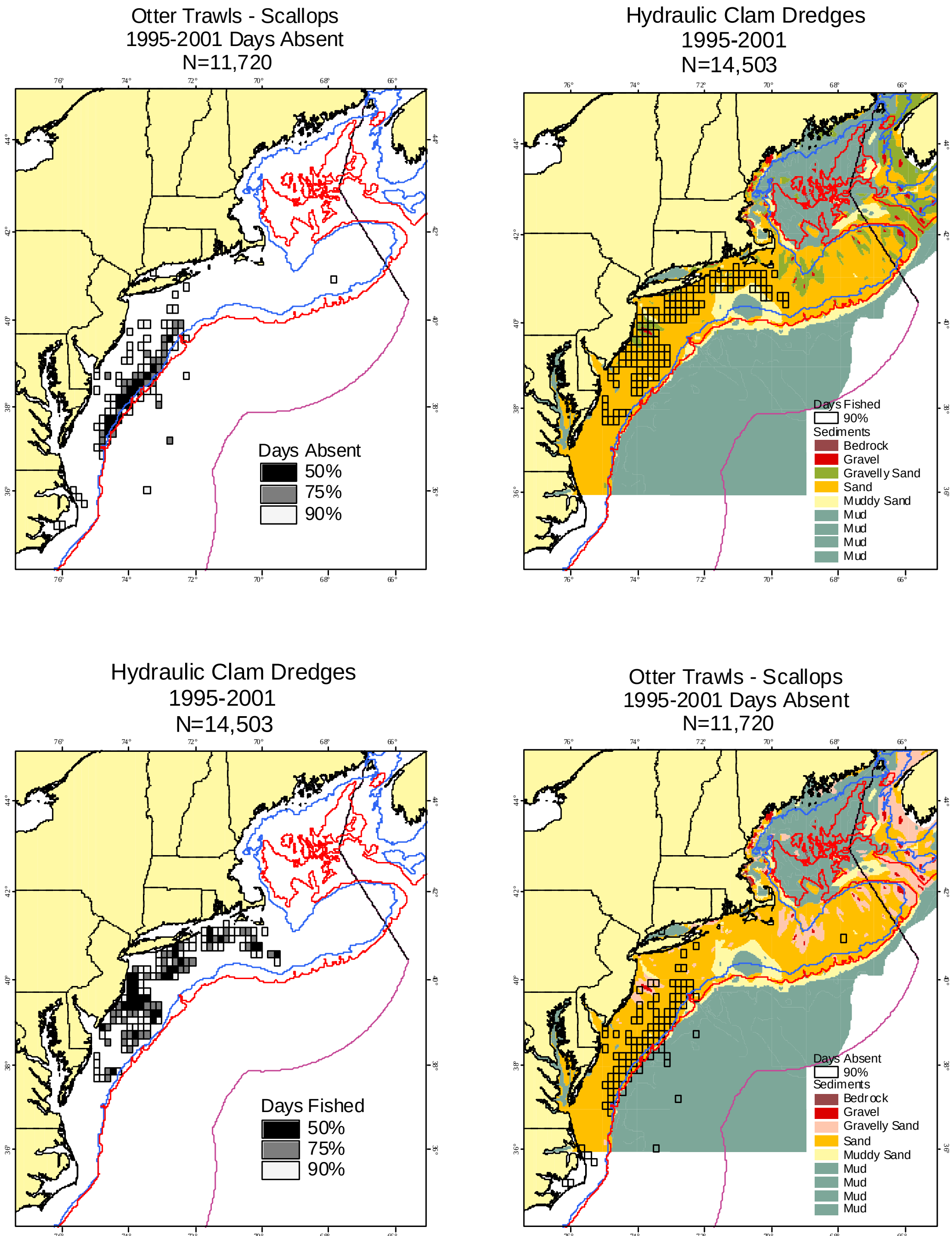


Map 35. Sub-regions of the U.S. Northeast shelf and areas on Georges Bank closed to bottom trawling since 1995.



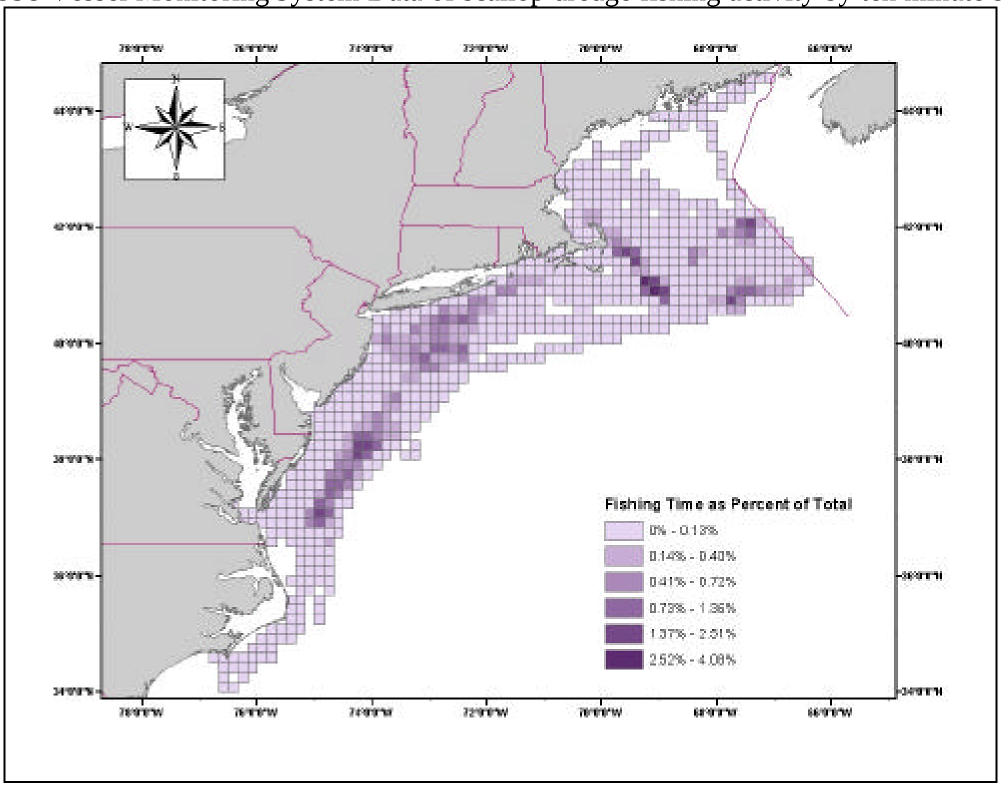
Map 36. Distribution of ten minute squares (TMS) of latitude and longitude that account for high (50%), medium (75%), and low (90%) cumulative percentages of the total number of days absent from port for all bottom trawl and scallop dredge vessels from 1995-2001 vessel trip reports and overlays of 90% TMS on Northeast region sediments for each gear type.



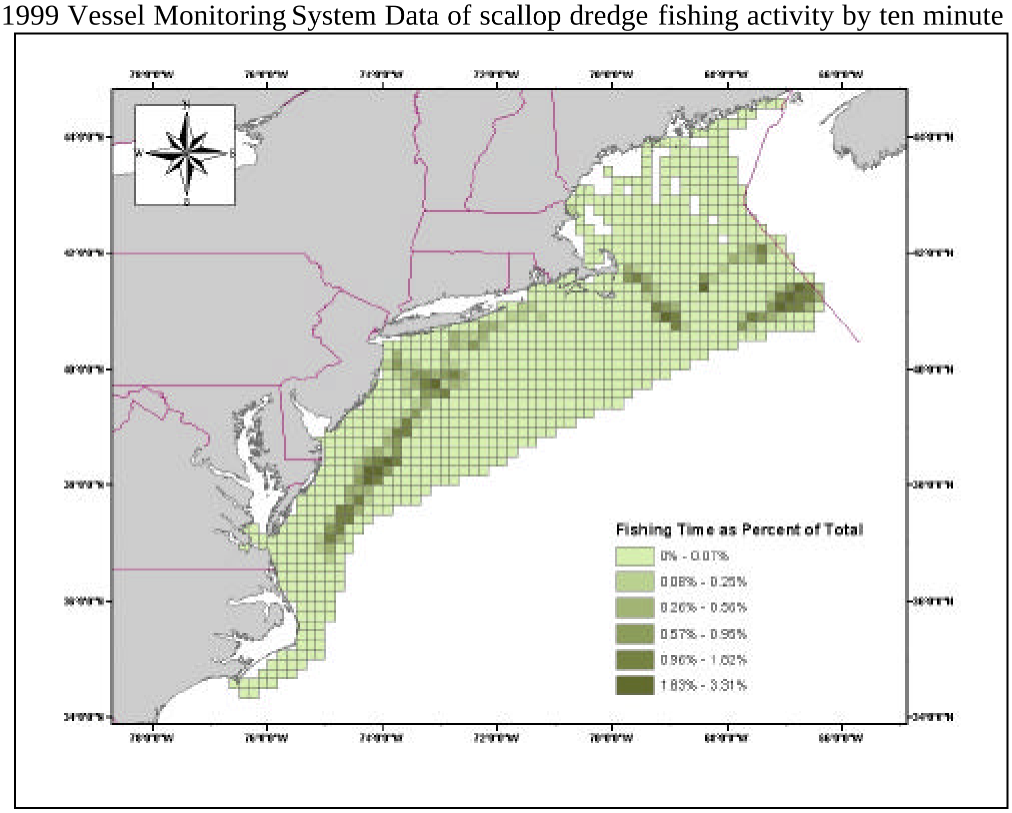


Map 37. Distribution of ten minute squares (TMS) of latitude and longitude that account for high (50%), medium (75%), and low (90%) cumulative percentages of the total number of days absent from port for scallop trawl vessels and days fishing for hydraulic clam dredge vessels from 1995-2001 VTR and logbook data and overlays of 90% TMS on Northeast region sediments for these two gear types.

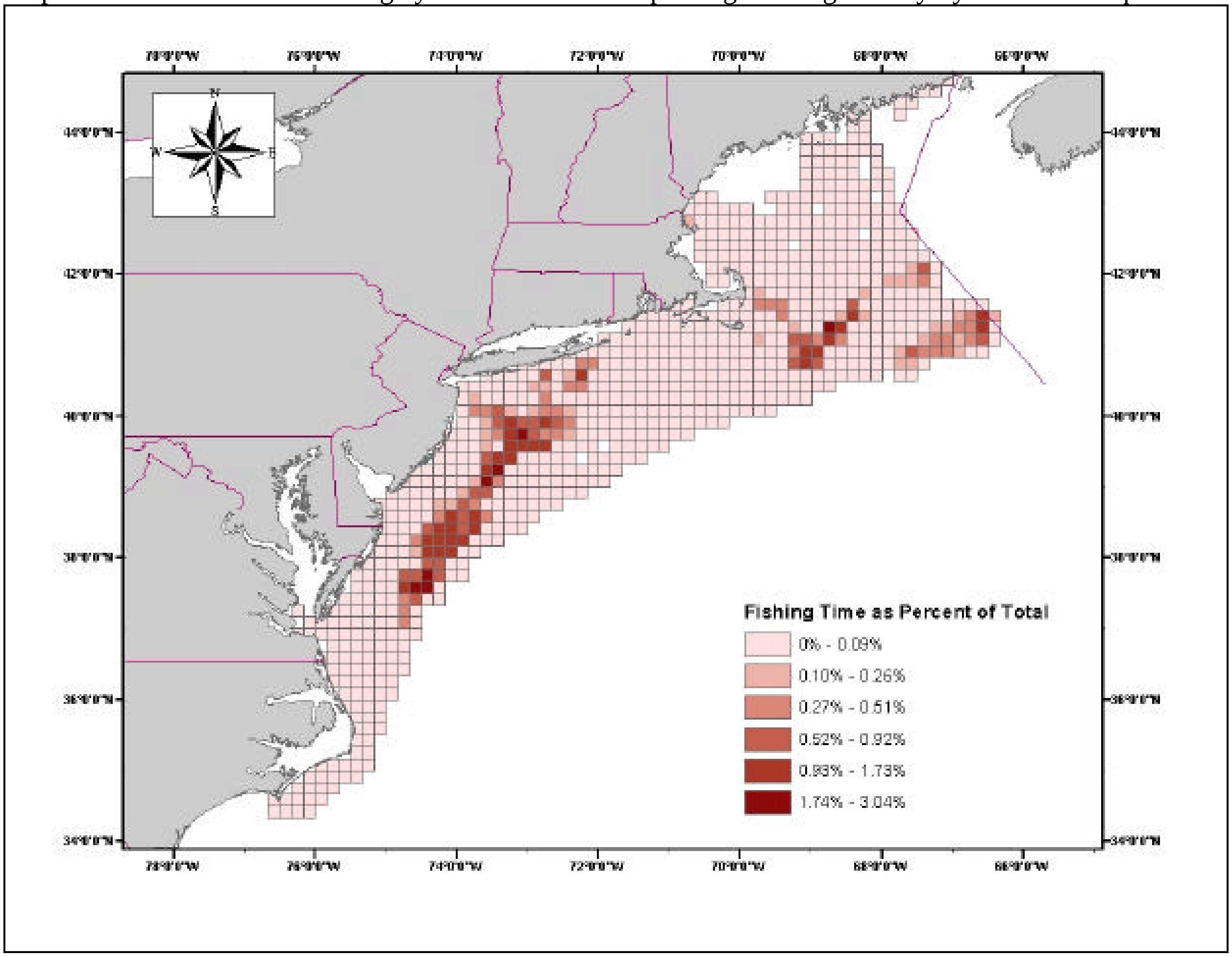
Map 38. 1998 Vessel Monitoring System Data of scallop dredge fishing activity by ten minute square.

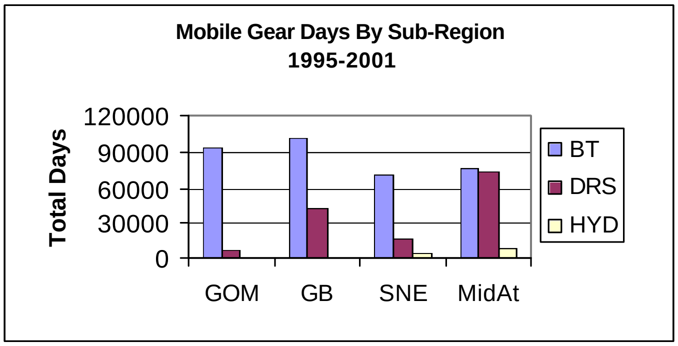


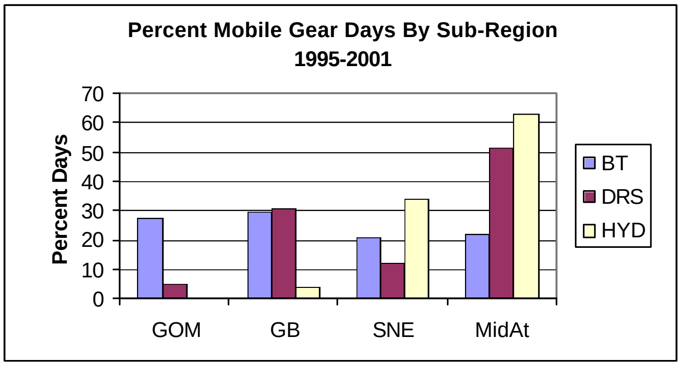
Map 39. 1999 Vessel Monitoring System Data of scallop dredge fishing activity by ten minute square.



Map 40. 2000 Vessel Monitoring System Data of scallop dredge fishing activity by ten minute square.







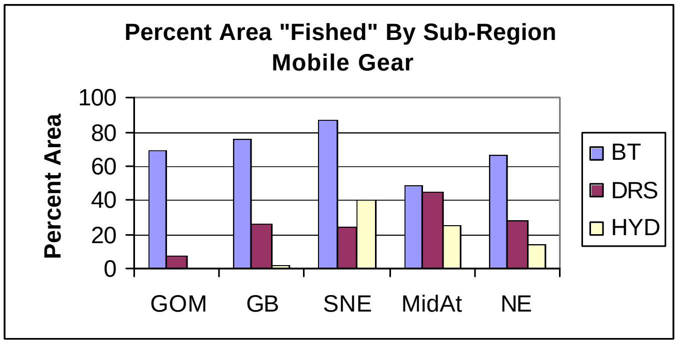


Figure 42. Total and percent days absent from port or spent fishing for the three principal mobile gear types used in the Northeast region by sub-region (top two graphs) and percent of the total area within each sub-region and in the entire NE region represented by TMS that account for 90% of total fishing activity by each gear type (bottom graph). GOM = Gulf of Maine, GB = Georges Bank, SNE = southern New England, and MA = Mid-Atlantic. BT = bottom trawls, DRS = scallop dredges, HYD = hydraulic clam dredges.

Figure 43. Relative distribution of fishing activity by sediment type for bottom trawl (BT), scallop dredge (DRS), and hydraulic clam dredge (HYD) vessels as a percentage of the area covered by TMS that accounted for 90% of the total number of days absent from port or days spent fishing during 1995-2001 in four sub-regions of the U.S. Northeast region. GOM = Gulf of Maine, GB = Georges Bank, SNE = southern New England, and MA = Mid-Atlantic.

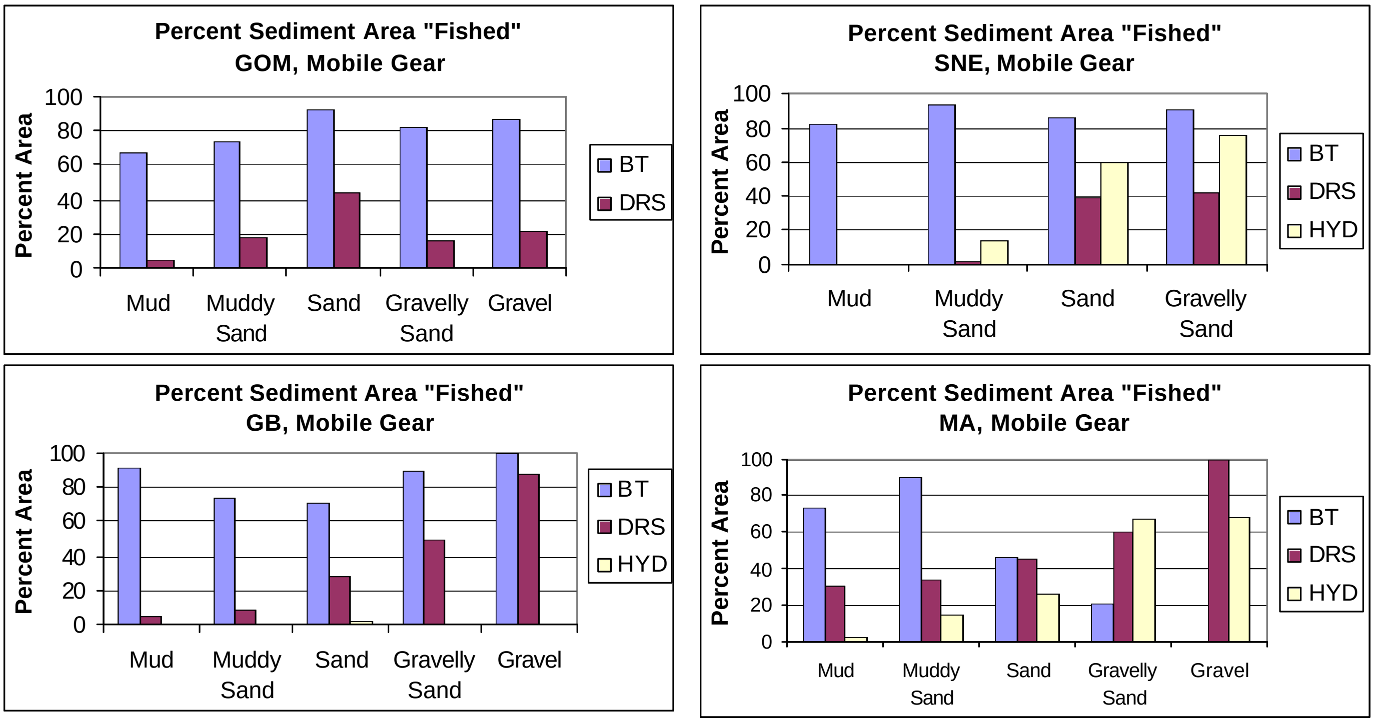
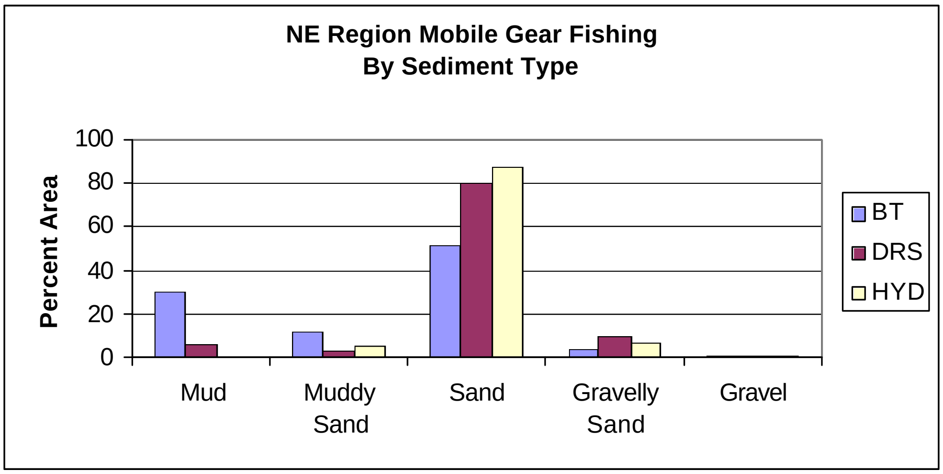
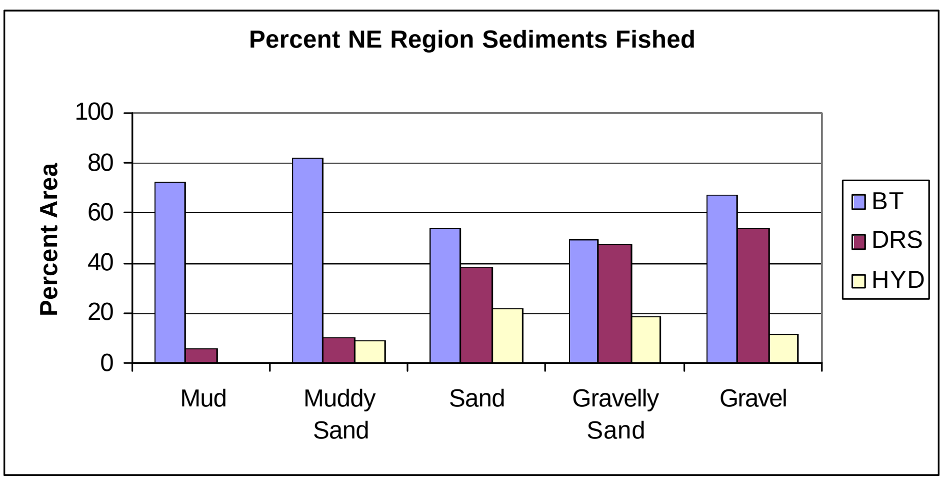


Figure 44. Percent area fished by sediment type for mobile gear in the U.S. Northeast region (top) and percentage of the total area attributed to each sediment type in the NE region that was fished by mobile gear (bottom) during 1995-2001. "Area fished" estimates are based on the area included in TMS that accounted for 90% of total fishing activity by bottom trawl (BT), scallop dredge (DRS), and hydraulic clam dredge (HYD) vessels.





7.2.6.2.4 Types of Gear Effects

7.2.6.2.4.1 Overview of Existing Information

A number of authors have reviewed, to varying extents, existing scientific literature on the effects of fishing on habitat (e.g., Auster et al. 1996, Cappo et al. 1998, Collie 1998, Jennings and Kaiser 1998, Rogers et al. 1998, Auster and Langton 1999, Hall 1999, Collie et al. 2000, Lindeboom and de Groot 2000, Barnette 2001, National Research Council 2002). The following summary of the conclusions reached by these authors is extracted from a recent NOAA report (Johnson 2002).

A number of review papers have focused specifically on the physical effects of bottom trawls. In Europe, an ICES working committee (ICES 1973) concluded that otter trawls, beam trawls and dredges all have similar effects on the seabed, but the magnitude of disturbance increases from shrimp to beam trawls with tickler and stone guards, to Rapido trawls, to mollusc (e.g., scallop) dredges. Kaiser et al. (1996) and Collie et al. (2000) state that, because beam trawls are used almost exclusively in areas that are adapted to frequent wave/tidal action, they are less likely to adversely affect bottom habitats. As mentioned elsewhere in this DEIS, scallop dredges used in Europe and Australia are designed differently than the sweep dredge used in the Northeast region of the U.S. Specifically, they have a row of teeth that penetrate several inches into the bottom and therefore have a greater impact on benthic habitats than the sweep dredge. Beam trawls and Rapido trawls are not used in the U.S. groundfish fishery.

Auster et al. (1996) conducted three studies of mobile fishing gear in the Gulf of Maine and concluded that mobile fishing gear alters the seafloor, and reduces habitat complexity, sedimentary structures, and emergent epifauna. Collie (1998) reviewed studies from New England and concluded that hard bottom benthic habitats (e.g., boulders and gravel pavement) experience significant impacts of mobile bottom-tending fishing gear, while mobile sand habitats are less vulnerable. Jennings and Kaiser (1998) concluded that fishing activities lead to changes in the structure of marine habitats and influence the diversity, composition, biomass, and productivity of the associated biota. They further concluded that these effects vary according to gears used, habitats fished, and the magnitude of natural disturbance, but tend to increase with depth and the stability of the substrate. Auster and Langton (1999) reviewed 22 studies from a wide geographic range and concluded that mobile fishing gear reduces habitat complexity by: (1) directly removing epifauna or damaging epifauna leading to mortality, (2) smoothing sedimentary bedforms and reducing bottom roughness, and (3) removing taxa which produce structure (i.e., taxa which produce burrows and pits). They also concluded that for fixed gear, the area impacted per unit effort is smaller than for mobile gear, but the types of damage to emergent benthos appear to be similar (but not necessarily equivalent per unit effort).

Collie et al. (2000) analyzed 39 published studies to compile and evaluate current findings regarding fishing gear effects on different types of benthic habitat. They found: (1) 89% of the studies were undertaken at depths less than 60 m; (2) otter trawl gear is the most frequently studied; (3) most studies have been done in Northern Europe and Eastern North America. The authors reached several conclusions regarding the effects of fishing: (1) intertidal dredging and scallop dredging have the greatest initial effects on benthic biota, followed by otter trawling and then beam trawling (although beam trawling studies were conducted in dynamic sandy areas, where effects might be less apparent); (2) fauna in stable gravel, mud and biogenic habitats are more adversely affected than those in less consolidated coarse sediments; (3) recovery appears most rapid in less physically stable habitats (inhabited generally by more opportunistic species); (4) we may accurately predict recovery rates for small-bodied taxa, but communities often contain one or two long-lived, vulnerable species; (5) large-bodied organisms are more prevalent before trawling; and (6) the mean initial response to fishing impacts is negative (55% reduction of individual taxa). Based on these findings, the authors suggested that the scientific community abandon short-term small-scale experiments and undertake larger scale experiments that mimic the timing and frequency of disturbance typical of commercial fishing activities.

A working committee of the International Council for the Exploration of the Seas (ICES) issued, in November 2000, a report on the "Effects of Different Types of Fisheries on North Sea and Irish Sea Benthic Ecosystems." This report (ICES 2000) was a summary of findings based on a comprehensive report of the same title edited by Lindeboom and de Groot (1998). The ICES report identified a number of possible effects of beam trawls and bottom otter trawls on benthic habitats and species. Two general conclusions were: 1) low-energy environments are more affected by bottom trawling; and 2) bottom trawling can affect the potential for habitat recovery (i.e., after trawling ceases, benthic communities and habitats may not always return to their original pre-impacted state). Regarding direct habitat effects, the committee concluded that:

<u>Bottom trawls can cause the loss or dispersal of physical features</u> such as peat banks or boulder reefs. These changes are always permanent and lead to an overall change in habitat diversity. This, in turn, can lead to the local loss of species and species assemblages dependant on such features.

<u>Bottom trawling can cause the loss of structure-forming organisms</u> (e.g., colonial bryozoans, Sabellaria, hydroids, seapens, sponges, mussel beds, and oyster beds). These changes may be permanent and can lead to an overall change in habitat diversity. This, in turn, can lead to the local loss of species and species assemblages dependant on such biogenic structures.

<u>Bottom trawling can cause a reduction in complexity</u> by redistributing and mixing surface sediments as well as degrading habitat and biogenic features. This can lead to a decrease in the physical patchiness of the sea floor. These changes are not likely to be permanent.

<u>Bottom trawling can alter the detailed physical structure of the sea floor</u> by reshaping seabed features such as sand ripples and damaging burrows and associated structures. These features provide important habitats for smaller animals and can be used by fish to reduce their energy requirements. These changes are not likely to be permanent.

The committee also identified a number of possible effects of bottom trawling on species.

1. Bottom trawling can cause the loss of species from part of their normal range.
2. Bottom trawling can cause a decrease in populations which have low rates of turnover.
3. The relative abundance of species is altered by bottom trawling.
4. Fragile species are more affected by bottom trawling than robust species Surface-living species are more affected by bottom trawling than deep-burrowing species.
5. Bottom trawling can have sub-lethal effects on individuals.
6. Bottom trawling can cause an increase in populations which have high rates of turnover.
7. Bottom trawling favors populations of scavenging species.

Direct habitat effects of fishing have also been summarized by Johnson (2002) in four categories: alteration of physical structure, sediment suspension, chemical modifications, and benthic community changes. Most of the effects mentioned below can also be found in the review of the existing gear effects literature that is included in the Gear Effects Evaluation of this DSEIS.

For the purposes of this gear effects evaluation, recovery refers to the return of the seafloor or benthic communities to pre-disturbance conditions and was evaluated as the time required for this to happen.

7.2.6.2.4.2 Alteration of Physical Structure

Physical effects of fishing gear can include scraping, plowing, burial of mounds, smoothing of sand ripples, removal of stones or dragging and turning of boulders, removal of taxa that produce structure, and removal or shredding of submerged aquatic vegetation (Fonseca et al.1984, Messieh et al. 1991, Black and Parry 1994, Gordon et al. 1998, Kaiser et al. 1998, Lindeboom and de Groot 1998, Schwinghamer et al. 1998, Auster and Langton 1999, Kaiser et al. 1999, Ardizzone et al. 2000). These physical alterations reduce the heterogeneity of the sediment surface, alter the texture of the sediments, and reduce the structure available to biota as habitat. As mobile gear is dragged across the seafloor, parts of some gears can penetrate up to 5-30 cm into the substrate under usual fishing conditions, and likely to greater depths under unusual conditions (Drew and Larsen 1994). This action can leave tracks or even trenches in the seafloor, depending on the sediment type. It is unknown whether or to what extent these human-made features might compensate for the sediment smoothing actions of the gear.

7.2.6.2.4.3 Sediment Suspension

Re-suspension of sediments occurs as fishing gear is dragged along the seafloor. Effects of sediment suspension can include reduction of light available for photosynthetic organisms, burial of benthic biota, smothering of spawning areas, and negative effects on feeding and metabolic rates of organisms. If re-suspension occurs over a large enough area it can actually cause large scale re-distribution of sediments (Messieh et al. 1991, Black and Parry 1994). Re-suspension may also have important implications for nutrient budgets due to burial of fresh organic matter and exposure of deep anaerobic sediment, upward flux of dissolved nutrients in porewater, and change in metabolism of benthic infauna (Mayer et al. 1991, Pilskaln et al. 1998).

Effects of sediment re-suspension are site-specific and depend on sediment grain size and type, water depth, hydrological conditions, faunal influences, and water mass size and configuration (Hayes et al. 1984, LaSalle 1990, Barnes et al. 1991, Coen 1995). Effects are likely more significant in waters that are normally clear compared with areas that are already highly perturbed by physical forces (Kaiser 2000). Schoellhamer (1996) concluded that re-suspension by natural mechanisms in a shallow estuary in west-central Florida was less frequent and of smaller magnitude than anthropogenic mechanisms (e.g., fishing) and that sediments disturbed by fishing were more susceptible to re-suspension by tidal currents. Modeling by Churchill (1989) revealed that re-suspension by trawling is the primary source of suspended sediment over the outer continental shelf of the eastern U.S., where storm-related stresses are weak. In the Kattegat Sea (Sweden), sandy sediments above the halocline were more affected by wind-induced impacts than by fishing, but mud sediments below the halocline experienced an increase in frequency of 90% in the spring and summer and of 75-85% in the autumn and winter due to fishing (Floderus and Pihl 1990). Thus, even when recovery times are fast, persistent disturbance by fishing could lead to cumulative impacts. In contrast, Dyekjaer et al. (1995) found that in Denmark, although local effects of short duration might occur, annual release of suspended particles by mobile fishing gear is relatively unimportant compared with that resulting from wind and land runoff.

Chronic suspension of sediments and resulting turbidity can also affect aquatic organisms through behavioral, sublethal and lethal effects, depending on exposure. Species reaction to turbidity depends on life history characteristics of the species. Mobile organisms can move out of the affected area and quickly return once the disturbance dissipates (Simenstad 1990, Coen 1995). Even if species experience high mortality within the affected area, species with short life history stages and high levels of recruitment or high mobility can repopulate the affected area quickly. However, if effects are protracted and occur over a large area, recovery through recruitment or immigration will be hampered. Furthermore, chronic re-suspension of sediments may lead to shifts in species composition by favoring those species that are better suited to recover or those that can take advantage of the pulsed nutrient supply as nutrients are released from the seafloor to the euphotic zone (Churchill 1989).

7.2.6.2.4.4 Changes in Chemistry

Fishing can produce changes to the chemical makeup of both the sediments and overlying water mass through mixing of subsurface sediments and porewater. In shallow water this mixing might be insignificant in relation to that produced by tidal and storm surge and wave action, but in deeper, more stable waters, this mixing can have significant effects (Rumohr 1998). In a shallow, eutrophic sound in the North Sea, fishing caused an increase in average ammonia content (although horizontal variations prevented interpretations of these increases) and a decrease in oxygen due to the mixing of reduced particles from within the sediments (Riemann and Hoffman 1991). Also in the North Sea, fishing enhances the phosphate released from sediment by 70-380 metric tons per year for otter trawls and by 10,000-70,000 metric tons per year for beam trawlers (ICES 1992). These pulses are partially compensated by lower fluxes after the trawl passes. It is important to remember that these releases recycle existing nutrients, rather than adding new nutrients, such as nutrients derived from rivers and land runoff (ICES 1992). During seasons when nutrients are low, mixing of the sediments could cause increased primary production and/or eutrophication.

7.2.6.2.4.5 Changes to Benthic Communities

Benthic communities are affected by fishing gear through damage to the benthos in the path of the gear and disturbance of the seafloor to a depth of up to 30 cm. Many kinds of epibenthic animals are crushed or buried, while infauna is excavated and exposed on the seabed. This is in addition to smothering addressed above.

Specific impacts from fishing depend on the life history, ecology and physical characteristics of the biota present (Bergman and Van Santbrink 2000). Mobile species that exhibit high fecundities and rapid generation times will recover more quickly than non-mobile, slow-growing organisms. In Mission Bay, California, polychaetes with reduced larval phases and postlarval movements had small-scale dispersal abilities that permitted rapid re-colonization of disturbed patches that maintained high infaunal densities (Levin 1984). Those with long-lived larvae were only available for successful re-colonization if the timing of disturbance coincided with periods of peak larval abundance; however, these species were able to colonize over much larger distances. Rijnsdorp and Van Leeuwen (1996) found that increased growth in the smallest size classes of plaice in the North Sea correlated to eutrophication and seabed disturbance caused by beam trawls. The authors hypothesized that trawling caused a shift in the benthic community from low-productive, long-lived species to high-productive, short-lived species that benefited from increased nutrient availability. This potentially could have led to increased prey availability, and thus, higher growth rates for the juvenile plaice.

The physical structure of biota also affects their ability to sustain and recover from physical impacts with fishing gear. Thin-shelled bivalves and starfish show higher damage than solid-shelled bivalves in fished areas (Rumohr and Krost 1991). Animals that are able to retract below the surface of the seafloor or live below the penetration depth of the fishing gear will sustain much less damage than epibenthic organisms that inhabit the sediment surface. Animals that are more elastic and can bend upon contact with fishing gear will suffer much less damage than those that are hard and inflexible (Eno et al. 2001). Kaiser et al. (2000) found that chronic fishing around the Isle of Man, in the Irish Sea, has removed large-bodied fauna such that benthic communities are now dominated by smaller-bodied organisms that are less susceptible to physical disturbance. Off the northwest shelf of Australia, a switch of dominant fish species from lethrinids and lutjanids (which are almost exclusively associated with habitats supporting large epibenthos) to saurids and nemipterids (which were found on open sand) occurred after removal of epibenthic fauna by trawling (Sainsbury et al. 1993, 1994) has been documented.

Increased fishing pressure can also lead to changes in distribution of species, either through movement of animals away from or towards the fished area (Kaiser and Spencer 1993, 1996, Ramsay et al. 1996, Kaiser and Ramsay 1997, Ramsay et al. 1998, Bradshaw et al. 2000, Demestre et al. 2000). Frid and Hall (1999) found higher prevalence of fish remains and scavengers and a lower abundance of sedentary polychaetes in stomach contents of dabs in the North Sea in areas of higher fishing effort. Kaiser and Spencer (1994) document that gurnards and whiting aggregate over beam trawl tracks and have higher numbers of prey items in their stomachs shortly after trawling. Based on these studies, researchers have speculated that mobile fishing may lead to increased populations of species that exhibit opportunistic feeding behavior. Fonds and Groenewold (2000) modeled results for the southern North Sea indicating that the annual amount of food supplied by beam trawling is approximately 7% of the food demand of common benthic predators. This level could help maintain populations but is insufficient to support further population growth.

The most recent and comprehensive summary of gear effects on benthic marine habitats was prepared by the National Research Council. This report, entitled “Effects of Trawling and Dredging on Seafloor Habitat” (NRC 2002) reiterated four general conclusions regarding the types of habitat modifications caused by trawls and dredges.

1. Trawling and dredging reduce habitat complexity.
2. Repeated trawling and dredging result in discernable changes in benthic communities.
3. Bottom trawling reduces the productivity of benthic habitats.
4. Fauna that live in low natural disturbance regimes are generally more vulnerable to fishing gear disturbance.

The NRC report also summarized the indirect effects of mobile gear fishing on marine ecosystems. It did not consider the effects of all gear types, only the two (trawls and dredges) that are considered to most affect benthic habitats. It also provided detailed information from only a few individual studies.

An additional source of information used in this DEIS is the report of a gear effects workshop sponsored by the New England and Mid-Atlantic Fishery Management Councils in October 2001 (NREFHSC 2002). This report includes conclusions reached by a panel of experts on the effect of different gears on benthic habitat types in the Northeast U.S. and is appended to this document (Appendix IV). Refer to the following tables in that report for conclusions on these gear types: Clam Dredges, Scallop Dredges, Otter Trawls, Pots and Traps, and Sink Gill Nets and Bottom Longlines. The results of the workshop have been considered in the next section, which includes a review of the relevant fishing gear effects literature.

7.2.6.2.4.6 Review of Fishing Gear Effects Literature Relevant to the U.S. Northeast Region

Forty-four publications were reviewed for this document. They included all known studies (written in English) that examined the effects of the three principal mobile, bottom-tending fishing gears used in the Northeast U.S. on benthic marine habitats. Only publications that evaluated the direct habitat effects of fishing by these gears were reviewed (i.e., modifications to the physical structure of the seafloor or effects on benthic organisms that live in or on the seafloor). Effects of fishing on resource populations were not included, nor were studies that evaluated the indirect effects of fishing on marine ecosystems caused by the selective removal of species targeted by the gear or which are caught incidentally (as by-catch) during fishing.

Both peer-reviewed and non-peer-reviewed publications were included, but most were peer-reviewed. To be included, accounts of research projects had to be complete and describe methods and results. Abstracts and poster presentations were not included. The summaries in this document are, in all cases, based on primary source documents. Two bottom-tending mobile gear types that are widely used in other parts of the world, but not in the Northeast U.S. – beam trawls and toothed scallop dredges – were not included even though considerable research has been conducted on their habitat effects. Also excluded were studies done on the effects of other gear types used strictly in inshore state waters in habitats where sea scallops are not found (e.g., escalator dredges in submerged aquatic vegetation) and any research relating to fixed and pelagic gear effects. Fixed bottom gears used in the Northeast region (e.g., lobster pots, bottom longlines and gill nets) have minimal impacts on benthic habitats (Eno et al. 2001, NREFHSC 2002).

The review is organized by gear and substrate type. The four substrate types were mud, sand, gravel/rock, and mixed substrate for studies that were conducted in more than a single sediment type. Nine of the 44 studies that were reviewed included information for more than one gear type or for one gear type in more than one substrate or study area and were therefore summarized in more than a single gear/substrate category. Thirty of the 53 individual research accounts were for bottom otter trawls, six were for scallop dredges, and seven for hydraulic dredges. In addition, ten addressed the combined effects of more than one gear type and are referred to as "multiple gears." Twenty-four of the studies were done in sandy substrate, 11 in mud, 5 in gravel and rocky bottom, and 13 in mixed substrate. Geographically, 18 were conducted in the Northeast U.S. (North Carolina to Maine), 13 elsewhere in North America (U.S. and Canada), 16 in Europe and Scandinavia, and 6 in Australia and New Zealand.

Each gear/substrate category includes a table summarizing the main points of each study. These include the location, depth, sediment, results, recovery information, and methodological approach of each study. Results summarized in the tables include positive and negative results, e.g., increases and decreases in abundance of non-resource benthic organisms caused by fishing, as well as instances when there were no detectable effects of fishing. Blank cells in the recovery column indicate that the study was not designed to provide information on recovery times. Information in the last column includes the nature of the research (experimental or observational), whether or not the study area was being commercially fished at the time of the study, and how the experimental fishing was conducted (single or multiple tows, discrete or repeated disturbance events, and – if known – the average number of tows to which any given area of bottom was exposed).

Results are summarized for all the studies in each gear-substrate category. Each summary begins with an introductory paragraph that includes general information, such as:

1. The number of studies that examined physical and biological effects;

2. How many studies were done in different geographic areas and depth ranges;
3. How many examined recovery of affected habitat features;
4. The number of studies performed in areas that were closed to commercial fishing vs. areas that were commercially fished at the time of the study;
5. How many involved single vs. multiple tows; and
6. How many were conducted either during a single, discrete time period or during a more prolonged period of time that was intended to simulate actual commercial fishing activity.

Physical and biological effects for each gear-substrate category are then summarized in separate paragraphs. When necessary, biological effects are presented separately for single disturbance and repeated disturbance experimental studies, and for observational studies.

7.2.6.2.4.6.1 Otter Trawls

7.2.6.2.4.6.1.1 Otter Trawls – Mud

Results of 11 studies are summarized (Table 86). All of them were conducted during the last 11 years, five in North America, four in Europe, and one in Australia. One was performed in an inter-tidal habitat, one in very deep water (250 m), and the rest in a depth range of 14-90 meters. Seven of them were experimental studies, three were observational, and one was both. Two examined physical effects, six of them assessed biological effects, and three studies examined physical and biological effects. One study evaluated geochemical sediment effects. In this habitat type, biological evaluations focused on infauna: all nine biological assessments examined infaunal organisms and four of them also included epifauna. Habitat recovery was monitored on five occasions. Two studies evaluated the long-term effects of commercial trawling, one by comparing benthic samples from a fishing ground with samples collected near a shipwreck, while another evaluated changes in macrofaunal abundance during periods of low, moderate, and high fishing effort during a 27-year time period. Four of the experimental studies were done in closed or previously un-trawled areas and three in commercially fished areas. One study examined the effects of a single tow and six involved multiple tows, five restricted trawling to a single event (e.g., one day) and two examined the cumulative effects of continuous disturbance.

Physical Effects
Note that citations are numbered and refer to the references listed in Table 86.

Trawl doors produce furrows up to 10 cm deep and berms 10-20 cm high on mud bottom. Evidence from four studies (2,3,7,9) indicates that there is a large variation in the duration of these features (2-18 months). There is also evidence that repeated tows increase bottom roughness (11), fine surface sediments are re-suspended and dispersed (7), and rollers compress sediment (2). A single pass of a trawl did not cause sediments to be turned over (7), but single and multiple tows smoothed surface features (4,7).

Biological Effects
Single disturbance experimental studies

Two single-event studies (2,9) were conducted in commercially trawled areas. Experimental trawling in intertidal mud habitat in the Bay of Fundy (Canada) disrupted diatom mats and reduced the abundance of nematodes in trawl door furrows, but recovery was complete after 1-3 months (2). There were no effects on infaunal polychaetes. In a sub-tidal mud habitat (30-40 m deep), benthic infauna were not affected (9). In two assessments performed in areas that had not been affected by mobile bottom gear for many years (4,10), effects were more severe. In both cases, total infaunal abundance and the abundance of individual polychaete and bivalve species declined immediately after trawling (4,10). In one of these studies (10), there were also immediate and significant reductions in the number of species and species diversity. Positive effects included reduced porosity, increased food value, and increased chlorophyll production in surface sediments. Most of these effects lasted less than 3.5 months. In the other (4), two tows removed 28% of the epifauna on mud and sand substrate and epifauna in all trawled quadrats showed signs of damage. These results were not reported separately for mud bottom.

Repeated disturbance experimental studies

Two studies of the effects of repeated trawling were conducted in areas that had been closed to fishing for six years and >25 years. In one (6), multiple tows were made weekly for a year and, in the other (11), monthly for 16 months. In one case, 61% of the benthic species sampled tended to be negatively affected, but significant reductions were only noted for brittlestars (6). In the other, repeated trawling had no significant effect on the numbers of infaunal individuals or biomass (11). In this study, the number of infaunal species increased by the end of the disturbance period. Some species (e.g., polychaetes) increased in abundance, while others (e.g., bivalves) decreased. Community structure was altered after five months of trawling and did not fully recover until 18 months after trawling ended.

Observational studies

An analysis of benthic sample data collected from a fishing ground over a 27-year period of high, medium, and low levels of fishing effort showed an increased abundance of organisms belonging to taxa that were expected to increase at higher disturbance levels, whereas those that were expected to decrease did not change in abundance (5). Results of another study indicated that a trawling ground had fewer benthic organisms and fewer species than an un-exploited site near a shipwreck (1). Trawling in deep water apparently dislodged infaunal polychaetes, causing them to be suspended in near-bottom water (8).

Table 86. Effects of Otter Trawls on Mud Substrate Habitat: Summary of Published Studies
S = statistically significant; U = undisturbed; D = disturbed; HT = heavily trawled; LT = lightly trawled

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1	Ball et al. 2000	Irish Sea	75 m	Sandy silt	Reduced infaunal and epifaunal richness, diversity, number of species and individuals in fishing ground compared to wreck site.		Experimental trawling in heavily fished prawn fishing ground, unfished area near a shipwreck used as control.

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
2	Brylinsky et al. 1994	Bay of Fundy, , Nova Scotia, Canada	Inter-tidal	Silt and coarse sand overlain with silty layer	Door tracks in sediment, rollers compressed sediment; S decrease in nematodes and benthic diatoms in door tracks, no effects on larger infaunal organisms (mostly polychaetes).	Furrows visible 2-7 months; nematodes recovered in 1-1.5 mos, diatoms in about 1-3 mos.	Four trawling experiments (repeated tows during a single day) at two locations in a trawled area, effects evaluated for 1.5-4 mos.
3	DeAlteris et al. 1999	Narragansett Bay, Rhode Island, USA	14 m	Mud	Doors produced tracks 5-10 cm deep and adjacent berm 10-20 cm high.	No changes in hand dug trenches for > 60 days.	Diver observations
4	Drabsch et al. 2001	Gulf of St. Vincent, South Australia	20 m	Fine silt	Trawl door tracks, smoothing of topographic features, S decrease in total infaunal abundance and one group of polychaetes, damaged epifauna.		Experimental trawling (2 tows per unit area in 1 day) in area with no trawling for 15 years (1 site), effects evaluated after 1 week.
5	Frid et al. 1999	NE England (North Sea)	80 m	Silt/clay	S increase in total number of individuals in taxa predicted to increase at high fishing effort and number of errant polychaetes, no effect of increasing effort on total number of individuals expected to decrease, but S decline in sea urchins.		Related changes in benthic fauna in a heavily trawled location to low, high, and moderate fishing activity and changes in phytoplankton production over 27 yrs.

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
6	Hansson et al. 2000	Fjord on the west coast of Sweden	75-90 m	Clay	61% infaunal species negatively affected and S reductions in brittlestars during last 6 mos of disturbance period, S reductions in total biomass and number of individuals in trawled and control sites, abundance of polychaetes, amphipods and molluscs not affected.		Experimental trawling for 1 year (2 tows per wk, 24 tows per unit area) in area closed to fishing for 6 yrs (3 treatment and 3 control sites), effects evaluated during last 5 mos of experiment.
7	Mayer et al. 1991	Maine coast, USA	20 m	Mud	Dispersal of fine surface sediment, doors made furrows several cm deep, some planing of surface features, but no plowing of bottom or burial of surface sediments.		Experimental trawling (single tow), examined immediate effects on sediment composition and food value to sediment depth of 18 cm.
8	Pilskaln et al. 1998	Gulf of Maine (USA)	250 m	Mud	Greater abundance of suspended infaunal polychaetes in more heavily-trawled area.		Deployed sediment traps in fishing grounds 25-35 m above substrate.

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
9	Sanchez et al. 2000	Coast of Spain, Mediterranean Sea	30-40 m	Mud	Door tracks in sediment, no change in number of infaunal individuals or taxa or abundance of individual taxa, no changes in community structure.	Door tracks still clearly visible after 150 hrs.	Experimental trawling in trawled area at 2 sites swept once and twice in a single day, effects evaluated after 24, 72, 102, and 150 hrs.
10	Sparks-McConkey & Watling 2001	Penobscot Bay, Maine (USA)	60 m	Mud	S decline in porosity, increased food value, and increased chlorophyll production of surface sediments, S reductions in number of infaunal individuals and species, species diversity, and abundances of 6 polychaete and bivalve species, S increase in nemerteans.	All geochemical sediment properties and all but one polychaete/bivalve species recovered within 3.5 mos, nemerteans still more abundant after 5 mos.	Experimental trawling (4 tows in 1 day) in untrawled area, pre-trawl sampling of sediments and infauna for a year, recovery monitored for 5 mos.

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
11	Tuck et al. 1998	West coast of Scotland	30-35 m	Fine silt	Tracks in sediment, increased bottom roughness, no effect on sediment characteristics; S increase in number of infaunal species after 16 mos and during 18 mo recovery period, no change in biomass or number of individuals; S increase in polychaetes, decrease in bivalves; S alteration in community structure after 5 mos, S reduction in diversity during first 22 mos.	Door tracks still evident after 18 months, bottom roughness recovered after 6 mos; nearly complete recovery of infaunal community within 12 mos, complete after 18 mos	Experimental trawling for 1 day/mo (1.5 tows per unit area) for 16 mos in area closed to fishing for >25 years, recovery monitored after 6, 12, and 18 mos

7.2.6.2.4.6.1.2 Otter Trawls – Sand

Results of 14 studies are summarized (Table 87). One of them was described in a 1980 publication, all the rest have been published since 1998. Six studies were conducted in North America (three in a single long-term experiment on the Grand Banks), four in Australia, and four in Europe. Ten are experimental studies. Eight of them were done in depths less than 60 m, one at 80 m, and four in depths greater than 100 m. Three studies examined the physical effects of trawling, ten were limited to biological effects, and one examined both. Five of the biological studies were restricted to epifauna, one only examined infauna, and five included epifauna and infauna. The only experiment that was designed to monitor recovery was the one on the Grand Banks, although surveys conducted in Australia documented changes in the abundance of benthic organisms five years after closed areas were established. Two studies compared benthic communities in trawled areas of sandy substrate with undisturbed areas near a shipwreck. Six studies were performed in commercially exploited areas, five in closed areas, two compared closed and open areas, and one was done in a test tank. All the experimental studies examined the effects of multiple tows (up to 6 per unit area of bottom) and observational studies in Australia assessed the effects of 1-4 tows on emergent epifauna. Trawling in four studies was limited to a single event (1 day to 1 week), whereas the Grand Banks experiment was designed to evaluate the immediate and cumulative effects of annual 5-day trawling events in a closed area over a three-year period.

Physical effects

A test tank experiment showed that trawl doors produce furrows in sandy bottom that are 2 cm deep, with a berm 5.5 cm high (7). In sandy substrate, trawls smoothed seafloor topographic features (4,14), re-suspended and dispersed finer surface sediment (7), but had no lasting effects on sediment composition (14). Trawl door tracks lasted up to one year in deep water (14), but only for a few days in shallow water (3). Seafloor topography recovered within a year (14).

Biological effects

Single disturbance experimental studies

Two single-event studies (2,6) were conducted in commercially trawled areas. In one of these studies (2), otter trawling caused high mortalities of large sedentary and/or immobile epifaunal species. In the other (6), there were no effects on benthic community diversity. Neither of these studies investigated effects on total abundance or biomass. Two studies were performed in un-exploited areas. One study documented effects on attached epifauna. In one (11), single tows reduced the density of attached macrobenthos (>20 cm) by 15% and four tows by 50%. In the other (4), two tows removed 28% of the epifauna on mud and sand substrate and epifauna in all trawled quadrats showed signs of damage. These results were not reported separately for sand bottom. Total infaunal abundance was not affected, but the abundance of one family of polychaetes was reduced.

Repeated disturbance experimental studies

Intensive experimental trawling on the Grand Banks reduced the total abundance and biomass of epibenthic organisms and the biomass and average size of a number of epibenthic species (12). Significant reductions in total infaunal abundance and the abundance of 15 taxa (mostly polychaetes) were detected during only one of three years, and there were no effects on biomass or taxonomic diversity (9).

Observational studies

Changes in macrofaunal abundance in a lightly trawled location in the North Sea were not correlated with historical changes in fishing effort (5), but there were fewer benthic organisms and species in a trawling ground in the Irish Sea than in an un-exploited site near a shipwreck (1). In the other "shipwreck study," however, changes in infaunal community structure at increasing distances from the wreck were related to changes in sediment grain size and organic carbon content (8). The Alaska study (10) showed that epifauna attached to sand were less abundant inside a closed area, significantly so for sponges and anemones. A single tow in a closed area in Australia removed 89% of the large sponges in the trawl path (13).

Table 87. Effects of Otter Trawls on Sand Substrate Habitat: Summary of Published Studies
S = statistically significant; U = undisturbed; D = disturbed; HT = heavily trawled; LT = lightly trawled

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1	Ball et al. 2000	Irish Sea	35 m	Muddy sand	Lower number of infaunal and epifaunal species and individuals, species diversity and richness compared to wreck site.		Experimental trawling in heavily fished prawn fishing ground, unfished area near a shipwreck used as control.
2	Bergman and Santbrink 2000	Southern North Sea (Dutch coast)	<30-50 m	Silty sand and sand	High (20-50%) mortalities for 6 sedentary and/or immobile megafaunal (>1 cm) species, <20% for 10 others, from a single pass of the trawl, S effects on 11 of 54 occasions.		Experimental trawling (1.5 tows per unit area) in commercially trawled area, effects assessed after 24-48 hrs.
3	DeAlteris et al. 1999	Narragansett Bay, Rhode Island (USA)	7 m	Sand	No tracks.	Hand dug trenches not visible after 1-4 days.	Diver observations.
4	Drabsch et al. 2001	Gulf of St. Vincent, South Australia	20 m	Coarse sand with shells.	Trawl door tracks, smoothing of topographic features, removal of and damage to epifauna, no S effects on total infaunal abundance, S reduction in density for one family of polychaetes after 1 week.		Experimental trawling (2 tows per unit area) in area with no trawling for 15 years, effects assessed after 1 week (site 1) and 3 mos (site 2).

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
5	Frid et al. 1999	NE England (North Sea)	55 m	Sand	Total abundance of benthic macrofauna increased as phytoplankton abundance increased, no correlation with fishing effort.		Related changes in benthic fauna in a lightly trawled location to low, high, and moderate fishing activity and changes in phytoplankton production over 27 yrs.
6	Gibbs et al. 1980	Botany Bay, New South Wales, Australia	Shallow estuary	Sand with 0-30% silt/clay	Sediment plume, no consistent effects on benthic community diversity, very little disturbance of seafloor.		Sampling before, immediately after, and 6 mos after 1 week of experimental trawling in fished location, control area located 200 km away.
7	Gilkinson et al. 1998	Test tank to simulate Grand Banks of Newfoundland		Sand	Trawl door created 5.5 cm berm adjacent to 2 cm furrow, bivalves displaced.		Observed effects of commercial otter door model in test tank.
8	Hall et al. 1993	North Sea	80 m	Coarse sand	Abundance of infauna related to changes in sediment type and organic content, not distance from shipwreck.		Sampled infauna at increasing distance from a shipwreck (proxy for increasing fishing effort).

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
9	Kenchington et al. 2001	Grand Banks, Newfoundland	120-146 m	Fine to medium grain sand	S short-term reductions in total abundance and abundance of 15 infaunal taxa (mostly polychaetes) in only 1 of 3 years , no short-term effects on biomass or taxonomic diversity, no long-term effects.	Infaunal organisms that were reduced in abundance in 1994 had recovered a year later.	Experimental trawling (3-6 tows per unit area) in closed area 1, 2 and 3 years after closure, lightly exploited for >10 yrs, effects evaluated within several hrs or days after trawling and after one year.
10	McConnaughey et al. 2000	Eastern Bering Sea, Alaska	44-52 m	Sand with ripples	Reduced abundance (S for sponges and anemones), more patchy distribution, and S decrease in species diversity of sedentary epifauna, mixed responses of motile taxa and bivalves.		Compared abundance of epifauna caught in small-mesh trawl inside and outside an area closed to trawling for almost 40 years.
11	Moran & Stephenson 2000	Northwest Australia	50-55 m	Not given, presumed to be sand	Single tow reduced density of macrobenthos (>20 cm) by 15%, 4 tows by 50%.		Video surveys before and after 4 experimental trawling events (1 tow per unit area) at 2-day intervals in unexploited area.

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
12	Prena et al. 1999	Grand Banks, Newfoundland	120-146 m	Fine to medium grain sand	24% average decrease in epibenthic biomass, S reductions in total and mean individual epifaunal biomass and biomass of 5 of 9 dominant species, damage to echinoderms.		Experimental trawling (3-6 tows per unit area) in closed area 1, 2 and 3 years after closure, lightly exploited for >10 yrs.
13	Sainsbury 1997	Northwest Australia	< 200 m	Calcareous sands	Decreased abundance of benthic organisms and fish associated with large epifauna, removal of attached epifauna (single tow removed 89% of sponges >15 cm).	Increased catch rates of fish associated with large epifauna and small (<25 cm) benthos within 5 yrs, recovery of large epifauna takes >5 yrs.	Compared historical survey data (before and after fishing started) to data collected in area that remained open to commercial trawlers and area closed for 5 years.

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
14	Schwinghamer et al. 1998	Grand Banks, Newfoundland	120-146 m	Fine and medium grain sand	Tracks in sediment, increased bottom roughness, sediment re-suspension and dispersal, smoothing of seafloor and removal of flocculated organic material, organisms and shells organized into linear features.	Tracks last up to 1 year, recovery of seafloor topography within 1 year.	Experimental trawling (3-6 tows per unit area) in closed area 1, 2 and 3 years after closure, lightly exploited for >10 yrs.

7.2.6.2.4.6.1.3 Otter Trawls – Gravel/Rocky Substrate

Three studies of otter trawl effects on gravel and rocky substrates are summarized in this report (Table 88). All three were conducted in North America. Two were done in glacially-affected areas in depths of about 100 to 300 meters using submersibles and the third was done in a shallow coastal area in the southeast U.S. One involved observations made in a gravel/boulder habitat in two different years before and after trawling affected the bottom. The other two were experimental studies of the effects of single trawl tows. One of these was done in a relatively un-exploited gravel habitat and the other on a smooth rock substrate in an area not affected by trawling. Two studies examined effects to the seafloor and on attached epifauna and one only examined effects on epifauna. There were no assessments of effects on infauna. Recovery was evaluated in one case for a year.

Physical effects

Trawling displaced boulders and removed mud covering boulders and rocks (1) and rubber tire ground gear left furrows 1-8 cm deep in less compact gravel sediment (2).

Biological effects

Trawling in gravel and rocky substrate reduced the abundance of attached benthic organisms (e.g., sponges, anemones, and soft corals) and their associated epifauna (1,2,3) and damaged sponges, soft corals, and brittle stars (2,3). Sponges were more severely damaged by a single pass of a trawl than soft corals, but 12 months after trawling all affected species – including one species of stony coral – had fully recovered to their original abundance and there were no signs of damage (3).

Table 88. Effects of Otter Trawls on Gravel/Rock Substrate Habitat: Summary of Published Studies
S = statistically significant; U = undisturbed; D = disturbed; HT = heavily trawled; LT = lightly trawled

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1	Auster et al. 1996	Gulf of Maine (Jeffreys Bank)	94 m	Gravel/boulder with thin mud veneer.	Gravel base exposed, boulders moved, reduced abundance of erect sponges and associated epifaunal species.		Submersible and video observations in same location in 1987 and 1993, changes attributed to trawling.
2	Freese et al. 1999	Gulf of Alaska	206-274 m	93% pebble, 5% cobble, 2% boulder.	Boulders displaced, groundgear left furrows 1-8 cm deep in less compact sediment, layer of silt removed, S reductions in abundance of sponges, anemones, and sea whips, damage to sponges, sea whips and brittle stars.		Video observations from a submersible 2-5 hr after single trawl tows in area exposed to little or no commercial trawling for about 20 years.
3	Van Dolah et al. 1987	Georgia, SE U.S. coast	20 m	Smooth rock with thin layer of sand and attached epifauna.	Reduced abundance of and damage to large sponges and soft corals, esp barrel sponges and stick corals; no S effects on abundance of vase/finger sponges, or stony corals.	Full recovery of damaged organisms and abundance within 12 mos.	Experimental study using diver counts of large sponges and corals before, immediately after, and 12 mos after a single trawl tow in an un-exploited area.

7.2.6.2.4.6.1.4 Otter Trawls – Mixed Substrates

Three studies of the effects of otter trawls on mixed substrates are summarized (Table 89). All three were conducted in North America and relied on sonar and observations made by divers or from a submersible. One of them (2) combined submersible observations and benthic sampling to compare the physical and biological effects of trawling in a lightly fished and heavily fished location in California with the same depth and variety of sediment types. One was a survey of seafloor features produced by trawls in a variety of bottom types (1) and the other primarily examined the physical effects of single trawl tows on sand and mud bottom (3).

Physical effects

Trawl doors left tracks in sediments that ranged from less than 5 cm deep in sand to 15 cm deep in mud (1,3). In mud, fainter marks were also made between the door tracks, presumably by the footgear (1). A heavily trawled area had fewer rocks, shell fragments, and biogenic mounds than a lightly trawled area (2).

Biological effects

The heavily trawled area in California had lower densities of large epifaunal species (e.g., sea slugs, sea pens, starfish, and anemones) and higher densities of brittle stars and infaunal nematodes, oligochaetes, and one species of polychaete (2). There were no differences in the abundance of molluscs, crustaceans, or nemerteans between the two areas. However, since this was not a controlled experiment, these differences could not be attributed to trawling. Single trawl tows in Long Island Sound attracted predators and suspended epibenthic organisms into the water column (3).

Table 89. ffects of Otter Trawls on Mixed Substrate Habitat: Summary of Published Studies
S = statistically significant; U = undisturbed; D = disturbed; HT = heavily trawled; LT = lightly trawled

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1	Canadian DFO 1993	Bras d'Or Lakes, Nova Scotia (Canada)	10-500 m	Mud, sand, gravel, and boulders	Trawl doors left parallel marks (furrows and berms), fainter marks from footgear, primarily in mud.		Side scan sonar survey after area was closed to mobile gear for 1 yr.
2	Engel and Kvitek 1998	California (USA)	180 m	Gravel, sand, silt, and clay	S fewer rocks, shell fragments, rocks and mounds in HT area; lower densities of large epibenthic taxa in HT area (S for seapens, seastars, anemones, and sea slugs), higher densities of nematodes, oligochaetes, brittlestars and one species of polychaete in HT area, no differences between areas for crustaceans, molluscs, or nemerteans.		Used a submersible and grab samples (3 yrs) to compare lightly trawled (LT) and heavily trawled (HT) commercial fishing sites with same sediments and depth.
3	Smith et al. 1985	Long Island Sound, New York (USA)	Not given	Sand and mud	Tracks in sediment (<5 cm in sand, 5-15 cm in mud), attraction of predators, suspension of epibenthic organisms.	Tracks "naturalized" by tidal currents.	Video and diver observations.

7.2.6.2.4.6.2 New Bedford Scallop Dredges

7.2.6.2.4.6.2.1 New Bedford Scallop Dredges – Sand

Three studies of the effects of New Bedford scallop dredges on sand substrate are summarized, all performed since 1990 (Table 90). One was conducted in an estuary on the Maine coast (3) and two on offshore banks in the Gulf of Maine (1,2). Two of them were observational in nature, but did not include any direct observations of dredge effects. The other one was a controlled experiment conducted in an unexploited area in which a single dredge was towed repeatedly over the same area of bottom during a single day. One study examined physical effects and two examined physical and biological effects. One of them included an analysis of geochemical effects to disturbed silty-sand sediments.

Physical effects
Dredging disturbed physical and biogenic benthic features (sand ripples and waves, shell deposits [1], and amphipod tube mats [2]), caused the loss of fine surficial sediment (3), and reduced the food quality of the remaining sediment (3). Sediment composition was still altered six months after dredging, but the food quality of the sediment had recovered by then.

Biological effects
There were significant reductions in the total number of infaunal individuals in the estuarine location immediately after dredging and reduced abundances of some species (particularly one family of polychaetes and photid amphipods), but no change in the number of taxa (3). Total abundance was still reduced four months later, but not after six months. The densities of two megafaunal species (a tube-dwelling polychaete and a burrowing anemone) on an offshore bank were significantly reduced after commercial scallop vessels had worked the area (2).

Table 90. Effects of New Bedford Scallop Dredges on Sand Habitat: Summary of Published Studies
S = statistically significant; U = undisturbed; D = disturbed; HT = heavily trawled; LT = lightly trawled

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1	Auster et al. 1996	Stellwagen Bank, Gulf of Maine (USA)	20-55 m	Coarse sand	Disturbance of storm sand ripples and low sand waves, dispersal of shell deposits in wave troughs.		Examined gear tracks in side-scan sonar images.
2	Langton & Robinson 1990	Fippennies Ledge, Gulf of Maine (USA)	80-100 m	Gravelly sand with some gravel, shell hash, and small rocks	Coarser substrate, disruption of amphipod tube mats, piles of small rocks and scallop shells dropped from surface, S reductions in densities of tube dwelling polychaete and burrowing anemone.		Submersible observations made two years apart, before and after commercial dredging of area.
3	Watling et al. 2001	Damariscotta River, Maine (USA)	15 m	Silty sand	Loss of fine surficial sediments, lowered food quality of sediment, reduced abundance of	No recovery of fine sediments, full recovery of benthic fauna and	Experimental study (23 tows in one day), effects on macrofauna (mostly infauna)

					some taxa, no changes in number of taxa, S reductions in total number of individuals 4 mos after dredging.	food value within 6 mos.	evaluated 1 day and 4 and 6 mos after dredging.

7.2.6.2.4.6.2.2 New Bedford Scallop Dredges - Mixed Substrates

Three studies have been conducted on mixed glacially-derived substrates, two of them over 20 years ago and one 10 years ago (Table 91). All were done in the northwest Atlantic (one in the U.S. and two in Canada) at depths of 8 to 50 m. Two observational studies examined physical effects and one experimental study examined effects on sediment composition to a sediment depth of 9 cm. The experimental study evaluated the immediate effects of a single dredge tow. None of these studies evaluated habitat recovery or biological effects, although one (3) examined geochemical effects.

Physical effects

Direct observations in dredge tracks in the Gulf of St. Lawrence documented a number of physical effects to the seafloor, including bottom features produced by dredge skids, rings in the chain bag, and the tow bar (1,2). Gravel fragments were moved and overturned and shells and rocks were dislodged or plowed along the bottom (2). Sampling one day after a single dredge tow revealed that surficial sediments were re-suspended and lost and that the dredge tilled the bottom, burying surface sediments and organic matter to a depth of 9 cm, increasing the grain size of sediments above 5 cm, and disrupting a surface diatom mat (3). Microbial biomass at the sediment surface increased as a result of dredging.

Table 91. Effects of New Bedford Scallop Dredges on Mixed Substrate Habitat: Summary of Published Studies

S = statistically significant; U = undisturbed; D = disturbed; HT = heavily trawled; LT = lightly trawled

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1	Caddy 1968	Northumberland Strait, Gulf of St. Lawrence, Canada	20 m	Mud and sand	Drag tracks (3 cm deep) produced by skids, smooth ridges between them produced by rings in drag belly, dislodged shells in dredge tracks.		Diver observations of physical effects of two tows.
2	Caddy 1973	Chaleur Bay, Gulf of St. Lawrence, Canada	40-50 m	Gravel over sand, with occasional boulders	Suspended sediment, flat track, marks left by skids, rings and tow bar, gravel fragments less frequent (many overturned),		Submersible observations of tow tracks made less than 1 hr after single dredge tows.

					rocks dislodged or plowed along bottom.		
3	Mayer et al. 1991	Coastal Gulf of Maine (USA)	8 m	Mud, sand and shell hash	Lowered sediment surface by 2 cm,injection of organic matter and finer sediment into lower 5-9 cm, increased mean grain size in upper 5 cm, disruption of surface diatom mat, increased microbial biomass at sediment surface.		Experimental study, compared dragged and undragged sites before and 1day after a single dredge tow.

7.2.6.2.4.6.3 Hydraulic Clam Dredges

7.2.6.2.4.6.3.1 Hydraulic Clam Dredges – Sand

Results of six hydraulic dredge studies in sandy substrates are summarized (Table 92). Five of them (2-6) examined the effects of "cage" dredges of the type used in the Northeast region of the U.S. and one (1) examined the effects of escalator dredges, which affect sandy bottom habitats similarly to "cage" dredges. Three of them were published prior to 1990, and three since then. Three were performed in North America (two in the U.S. and one in Canada), one in the Adriatic Sea and two in Scotland. There have been no published studies in North America since 1982. One of the North American studies was conducted on the U.S. continental shelf at a depth of 37 m and two in near shore waters and depths of 7 – 12 m. The two European studies were done in even shallower water (1.5 – 7 m). The North American studies were all observational in nature and the European studies were controlled experiments. One study compared effects in commercially dredged and un-dredged areas and four were conducted in un-dredged areas. The sixth study compared infaunal communities in an actively dredged, a recently dredged, and an un-dredged location off the New Jersey coast. All six studies examined physical and biological effects of dredging. Recovery was evaluated in four cases for periods ranging from just a few minutes (sediment plumes) to 11 weeks.

Physical effects

Hydraulic clam dredges created steep-sided trenches 8-30 cm deep that started deteriorating immediately after they were formed (1, 3-6). Trenches in a shallow, inshore location with strong bottom currents filled in within 24 hours (4). Trenches in shallow, protected, coastal lagoons were still visible two months after they were formed (5). Hydraulic dredges also fluidized sediments in the bottom and sides of trenches (6), created mounds of sediment along the edges of the trench (6), re-suspended and dispersed fine sediment (4), and caused a re-sorting of sediments that settled back into trenches (2). In one study (6), sediment in the bottom of trenches was initially fluidized to a depth of 30 cm and in the sides of the trench to 15 cm. After 11 weeks, sand in the bottom of the trench was still fluidized to a depth of 20 cm. Silt clouds only last for a few minutes or hours (3,4). Complete recovery of seafloor topography, sediment grain size, and sediment water content was noted after 40 days in a shallow, sandy environment that was exposed to winter storms (1).

Biological effects

Some of the larger infaunal organisms (e.g., polychaetes, crustaceans) retained on the wire mesh of the conveyor belt used in an escalator dredge, or that drop off the end of the belt, presumably die (1). Benthic organisms that are dislodged from the sediment, or damaged by the dredge, temporarily provided food for foraging fish and invertebrates (1,4). Hydraulic dredging caused an immediate and significant reduction in the total number of infaunal organisms in two studies (1,6) and in the number of macrofaunal organisms in a third study (5). There were also significant reductions in the number of infaunal species in one case (6) and in the number of macrofaunal species and biomass in another (5). In this study (5), polychaetes were most affected. One study failed to detect any reduction in the abundance of individual taxa (1). Evidence from the study conducted off the New Jersey coast indicated that the number of infaunal organisms and species, and species composition, were the same in actively dredged and un-dredged locations (2).

Recovery times for infaunal communities were estimated in three studies. All of them (1,5,6) were conducted in very shallow (1.5-7 m) water . Total infaunal abundance and species diversity had fully recovered only five days after dredging in one location where tidal currents reach maximum speeds of three knots (6). Some species had recovered after 11 weeks. Total abundance recovered 40 days after dredging in another location exposed to winter storms, when the site was re-visited for the first time (1). Total infaunal abundance (but not biomass) recovered within two months at a protected, commercially exploited site (5), where recovery was monitored at three-week intervals for two months, but not at a nearby, unexploited site. The actual recovery time at the exposed sub-tidal site (1) was probably much quicker than 40 days, the only point in time when the post-experimental observations were made.

Table 92. Effects of Hydraulic Clam Dredges on Sand Substrate Habitat: Summary of Published Studies
S = statistically significant; U = undisturbed; D = disturbed; HT = heavily trawled; LT = lightly trawled

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1	Hall et al. (1990)	Scotland	7 m	Fine sand	Shallow trenches (25 cm deep) and large holes, sediment "almost fluidized," S increase in median grain size in trenches, S reductions in numbers of infaunal organisms, no effect on abundance of individual species, some mortality (not assessed) of large polychaetes and crustacea retained on conveyor belt or	Complete recovery of physical features and benthic community after 40 days, filling of trenches and holes accelerated by winter storms.	Experimental study in unexploited area to evaluate effects of commercial escalator dredging activity, recovery evaluated after 40 days.

					returned to sea surface.		
2	MacKenzie, 1982	Southern New Jersey (USA)	37 m	Very fine to medium sand	Re-sorting of sediments, no effect on number of infaunal individuals or species, or on species composition.		Comparison of actively fished, recently fished and never fished areas on the continental shelf.
3	Medcof & Caddy 1971	Southern Nova Scotia (Canada)	7-12 m	Sand and sand-mud	Smooth tracks with steep walls, 20 cm deep; sediment cloud.	Sediment plume lasted 1 minute; dredge tracks still clearly visible after 2-3 days.	SCUBA & submersible observations of the effects of individual tows.
4	Meyer et al. 1981	Long Island, New York (USA)	11 m	Very fine to medium sand	>20 cm deep trench, mounds on either side of trench, silt cloud, attraction of predators.	Trench nearly indistinct, predator abundance normal after 24 hours; silt settled in 4 minutes.	SCUBA observations following a single tow in a closed area, effects evaluated after 24 hrs.
5	Pranovi & Giovanardi 1994	Adriatic Sea (Italy)	1.5-2 m	Sand	8-10 cm deep trench; S decrease in total abundance, biomass, and diversity of benthic macrofauna in fishing ground; no S effects outside fishing ground.	After 2 mos, dredge tracks still visible, densities (especially of small species and epibenthic species) in fishing ground recovered, biomass did not.	Experimental dredging (single tow) in previously dredged and undredged areas in coastal lagoon, recovery monitored every 3 weeks for 2 mos.
6	Tuck et al. 2000	Outer Hebrides, Scotland	2-5 m	Medium to fine sand	Steep-sided trenches (30 cm deep), sediments fluidized up to 30 cm, S decrease in total abundance and number of infaunal species, polychaetes most affected.	Trenches no longer visible but sand still fluidized after 11 weeks, species diversity and total abundance recovered within 5 days,	Experimental dredging (individual tows at 6 sites) in area closed to commercial dredging, recovery evaluated after 11 weeks.

						abundance of some species recovered after 11 weeks.	

7.2.6.2.4.6.3.2 Hydraulic Clam Dredges - Mixed Substrates

An in situ evaluation of hydraulic dredge effects in sand, mud, and coarse gravel in the mid-Atlantic Bight indicated that trenches fill in quickly, within several days in fine sediment and more rapidly than that in coarse gravel (Table 93). Dredging dislodged benthic organisms from the sediment, attracting predators.

Table 93. Effects of Hydraulic Clam Dredges on Mixed Substrate Habitat: Summary of Published Studies
S = statistically significant; U = undisturbed; D = disturbed; HT = heavily trawled; LT = lightly trawled

Reference	Location	Depth	Sediment	Effects	Recovery	Approach
Murawski & Serchuk 1989	Mid-Atlantic Bight, USA	Not given	Sand, mud and coarse gravel	Trench cut, temporary increase in turbidity, disruption of benthic organisms in dredge path, attraction of predators.	Trenches filled quickly in coarse gravel, but took several days in fine sediments.	Submersible observations following hydraulic cage dredge tows.

7.2.6.2.4.6.4 Multiple Gear Types

7.2.6.2.4.6.4.1 Multiple Gear Types – Sand

The results of a single observational study of multiple gear types on sand habitats (at depths that varied from 15 to 70 m) are summarized in this report (Table 94). This study (2) compared sandy shallow and deep water sites on the south coast of England that were exposed to low, medium, and high levels of fishing effort by mobile and fixed gear. Low effort areas that were closed to trawls and dredges had more emergent epifauna (soft corals and hydroids) and were dominated by relatively high-biomass epifauna and infauna, whereas high effort areas fully exposed to fixed and mobile gear had higher abundances of small-bodied organisms. Deep (53-70 m) coarse-medium sand offshore sites were more affected by fishing than deep, medium sand or shallow (15-17 m), inshore, fine sand sites.

Table 94. Effects of Multiple Gears on Sand Substrate Habitat: Summary of Published Studies

Reference	Location	Depth	Sediment	Effects	Recovery	Approach
Kaiser et al. 2000b	England (South Devon Coast)	15-70 m	Fine, medium, and coarse sand	No S effect of high fishing effort on numbers of infaunal or epifaunal species or individuals; reduced abundance of larger, less mobile, and emergent epifauna, higher abundance of more mobile species, fewer		Compared benthic communities in areas of high, medium and low fishing intensity by fixed and mobile gears.

				high-biomass organisms and more smaller-bodied species in high effort areas, infauna in deeper coarse-medium sand habitat most affected by fishing.		

7.2.6.2.4.6.4.2 Multiple Gear Types – Gravel/Rock

Two recent observational studies of mobile gear effects on sediments and epifauna in gravel bottom on the northern edge of eastern Georges Bank (42-90 m) are summarized (Table 95). Study sites were distinguished by depth and the presence or absence of fishing disturbance. Sediments in undisturbed sites were slightly coarser with more sand and cobble. There were significantly more organisms, higher biomass, and greater species diversity at the undisturbed sites in both depths, but there were also significantly higher values in disturbed and undisturbed deep sites than in disturbed and undisturbed shallow sites. Percent cover of an encrusting colonial polychaete was also significantly higher at these sites, but emergent hydroids and bryozoans were significantly more abundant in deep, undisturbed sites and at shallow, disturbed sites. Overall, emergent epifauna was more abundant in deep water, but there was no significant disturbance effect.

Table 95. Effects of Multiple Gear Types on Gravel/Rocky Substrate: Summary of Published Studies
S = statistically significant; U = undisturbed; D = disturbed; HT = heavily trawled; LT = lightly trawled

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1,2	Collie et al. 1997, 2000	Eastern Georges Bank (U.S. and Canada)	42-90 m	Pebble/cobble "pavement" with some overlying sand	S higher total densities, biomass, and species diversity in undisturbed sites, but also in deeper water (i.e. effects of fishing could not be distinguished from depth effects), 6 species abundant at U sites, rare or absent at D sites; sediments in U sites slightly coarser with more sand and cobble; percent cover of tube-dwelling polychaetes, hydroids, and bryozoans S higher in deep water, but no disturbance effect.		Benthic sampling, video and still photos in two shallow (42-47 m) and four deep (80-90 m) sites disturbed (D) and undisturbed (U) by trawls and scallop dredges.

7.2.6.2.4.6.4.3 Multiple Gear Types - Mixed Substrates

Six observational studies of the effects of multiple gear types on mixed substrates are summarized (Table 96). Surveys were conducted in the Gulf of Maine inside and outside an inshore area closed to mobile fishing gear and in an offshore area that was disturbed by mobile fishing gear (1). A series of three publications examined long-term (100+ years) changes in benthic habitats and communities in the Wadden Sea, some of which were attributed to fishing (2-4). A study in New Zealand (5) tested ten predictions of how increasing fishing activity affects benthic communities by comparing benthic samples and underwater video footage from areas exposed to varying degrees of commercial fishing effort. A sixth study (6) examined areas on eastern Georges Bank that were affected by mobile bottom gear.

Significant increases were observed in the abundance of sea cucumbers and emergent epifauna, and in the number of bottom depressions created by organisms such as lobsters, scallops, and crabs, on sand-cobble-shell substrate inside the Gulf of Maine closed area (1). Side scan sonar and ROV surveys of Stellwagen Bank revealed evidence that otter trawls and New Bedford scallop dredges disturb sand waves and ripples, disperse shell deposits, remove emergent epifauna, and disturb microalgal cover (1). Disturbed sand and gravel areas of Georges Bank were characterized by trawl and dredge tracks, sparse epifauna, mounds of gravel presumably produced by fishing gear, and smoother bottom (6). In the New Zealand study (5), there were four significant effects of increased fishing activity by bottom trawls, Danish seines, and toothed scallop dredges in mud and sand substrates that were consistent across all sampling methodologies. These were reduced density of large epifauna, echinoderms, and long-lived surface dwelling organisms, and an increased density of small, opportunistic species. The loss of biogenic reefs and changes in benthic community composition (fewer mollusk and amphipod species and more polychaete species) in the Wadden Sea were in part attributed to fishing activity (2-4).

Table 96. Effects of Multiple Gears on Mixed Substrate Habitat: Summary of Published Studies
S = statistically significant; U = undisturbed; D = disturbed; HT = heavily trawled; LT = lightly trawled

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1	Auster et al. 1996	Coastal Gulf of Maine (USA)	30-40 m	Sand-shell	S more sea cucumbers and bottom depressions inside closed area.		ROV and video observations inside and outside an area closed to mobile gear for 10 years.
1	Auster et al. 1996	Coastal Gulf of Maine (USA)	30-40 m	Cobble-shell	S more emergent epifauna inside closed area.		ROV and video observations inside and outside an area closed to mobile gear for 10 years.
1	Auster et al. 1996	Stellwagen Bank (Gulf of Maine, USA)	20-55 m	Sand with gravel and shell	Disturbed sand ripples and sand waves, dispersed shell deposits, absence of epifauna and reduced microalgal cover in trawl and dredge tracks.		Side-scan sonar survey and ROV observations.
2,3,4	Reise and Schubert, 1987; Riesen and Reise 1982; Reise 1982	Wadden Sea (Netherlands)	<23 m	Mud, coarse sand and some pebbles	Loss of oyster and Sabelleria reefs, decrease in abundance of 28 species (molluscs and amphipods), 23 "new" species (mostly polychaetes).		Compared benthic surveys conducted during time period when oysters were over-exploited and trawl fishery developed on Sabellaria reefs (1869-1986).

5	Thrush et al. 1998	Hauraki Gulf, New Zealand	17-35 m	Mud and sand	S reductions in density of large epifauna, echinoderms, and long-lived surface dwellers; S increases in density of small, opportunistic species; 15-20% variability in macrofaunal community composition attributed to fishing pressure.		Tested ten predictions of the effects of increasing fishing intensity on benthic community structure by comparing samples and video images from 18 stations exposed to varying degrees of commercial fishing pressure by bottom trawls, Danish seines, and scallop dredges.
6	Valentine and Lough 1991	Eastern Georges Bank		Sand and gravel	Trawl and dredge tracks in sediments, sparse epifauna, gravel mounds and smoother bottom in disturbed areas.		Side scan sonar and submersible observations of area presumed to be disturbed by trawls and scallop dredges.

7.2.6.2.5 Vulnerability of Benthic EFH to Bottom-Tending Fishing Gears

The purpose of this section is to evaluate the vulnerability of benthic EFH for all species and life history stages managed by the New England and Mid-Atlantic Fishery Management Councils to the effects of fishing by federally managed bottom-tending fishing gears used in the Northeast region of the U.S. The EFH final rule, 50 CFR 600.815(a)(2)(i), requires the evaluation of the potential adverse effects of fishing on EFH. It is suggested that the evaluation consider the effects of each fishing activity on each type of habitat found within EFH. The EFH Final rule further recommends that information be reviewed such as: intensity, extent, and frequency of any adverse effects on EFH; the types of habitat within EFH that may be affected adversely; habitat functions that may be disturbed; and conclusions regarding whether and how each fishing activity adversely affects EFH.

The EFH final rule requires EFH to be designated based upon the best available information, which may range quantitatively from Level 1 (distribution data are available for some portion of the range of the species) to Level 4 (production rates by habitat are available for the species). EFH in the Northeast was based primarily on Level 2 information (habitat-related densities of the species are available). This level of information is less than that required to determine the consequences of habitat alterations for resource populations in the Northeast because it is currently unknown how the productivity of any of these populations is affected by changes in habitat conditions. Therefore, the following evaluations (Table 97 - Table 135) are qualitative, not quantitative. *For the purposes of this section, vulnerability is defined as the likelihood that the functional value of EFH would be adversely affected as a result of fishing with different gear types.* The conclusions in this section were derived in a risk-averse manner, i.e., in cases where it was not certain which rank to assign, the higher rank was selected.

Information used to perform this evaluation included: 1) the EFH designations adopted by the NEFMC and MAFMC; 2) the results of a fishing gear effects workshop convened in Fall 2001 (NEREFHSC 2002); 3) an evaluation of the information provided in this gear effects evaluation section of this document, including the effects of fishing gear on habitat from existing scientific studies, and the geographic distribution of fishing gear use in the Northeast Region; and 4) the habitats utilized by each species and life stage as indicated in their EFH designation and supplemented by other references.

Five fishing gear classifications were evaluated including otter trawls (OT), New Bedford style scallop dredges (SD), hydraulic clam dredges (CD), pots and traps (PT), and combined sink gill nets and bottom long lines (NL). Vulnerability was divided into four broad categories, including: none (0); low (L); moderate (M); and high (H), based upon a matrix analysis of habitat function, habitat sensitivity and gear use. The matrix analysis allowed for the criteria to be consistently applied to each species and life stage. This analysis was performed for all benthic life stages of all species. The methodology and the matrix analysis (Table 137) are also provided later in this document (Section 7.2.6.2.5.1).

In general, a number of criteria were considered in the evaluation of the vulnerability of EFH for each life stage. The rationale for each determination is outlined at the bottom of each table. First, the value of the habitat to each species was characterized to the extent possible, including its function in shelter, food and/or reproduction. For example, if the habitat provided shelter for juvenile or other life stages susceptible to predation, gear impacts that could reduce shelter were considered to be of greater concern. In cases where a food source is closely associated with the benthos (e.g. infauna), the ability of a species to use other food sources was evaluated. Additionally, macrofaunal benthos may also require shelter to reduce predation mortality and maintain prey populations for species of interest. Therefore, gear impacts that could effect prey resources for benthivorous species or life stages were of greater concern than if the species or life stages were piscivorous. In most cases the species habitat usage was determined from the information provided in the EFH Source Documents (NOAA Technical Memorandum NMFS-NE issues 123-153).

Another criterion evaluated was the sensitivity of the habitat to disturbance and its ability to recover from disturbance, with consideration of a range of natural disturbances experienced in the environment. These considerations took into account any available information on the energy level of the natural environment, including the degree of disturbance from tidal and storm related currents. In general, high-energy sand habitats were considered to be less vulnerable to fishing gear effects than low energy deep-water habitats or highly complex habitats. This concept is adopted from the models developed by Auster and Langton (1999) and the Northeast fishing gear effects workshop (NEREFHSC 2002).

Lastly, since detailed fishing effort information is not available, spatial distribution of fishing activity for individual gears was considered. Maps of fishing activity by ten minute squares of latitude and longitude, expressed as the number of trips for fixed gear and either the number of hours absent from port of the numbers of hours fishing, were derived from NMFS 1995-2000 vessel trip reports and clam logbook databases (see 7.2.6.2.3). This evaluation included the predominant substrates and depth ranges in which each gear is used, as discussed in the fishing gear section of this report. Habitats that are not normally fished with a particular gear were considered to be less vulnerable to that gear.

The pot/trap and net/line gear types were considered to have the least impact of the five gear types evaluated. Based on the limited information available (Eno et al. 2001, NEREFHSC 2002), the vulnerability of all EFH to pot and trap usage is considered to be low. It is conceivable that pots and traps may provide some benefit for certain species in the form of structural habitat. For the purpose of this document, the vulnerability of EFH to pots and traps for all benthic species and life stages is rated as low (L), and is not discussed in detail in the species accounts. Likewise, there is little scientific information that evaluates the effects of gill nets and long-lines, and none evaluates these effects in the Northeast Region. Although Krieger (2001) shows that longline gear can have an adverse effect on coral habitats, fixed gears will have a much smaller footprint in comparison to mobile gear. The panel of experts that met in October 2001 ranked their concern over impacts from this gear type well below concern about mobile benthic gears (NEREFHSC 2002). Like pots and traps, the vulnerability of EFH for all benthic species and life stages to nets and lines is rated as low (L) and is not discussed in detail in the species accounts.

The vulnerability of benthic EFH to mobile bottom-tending gears is of greatest concern. These gear types include otter trawls, New Bedford scallop dredges, and hydraulic clam dredges. Otter trawls are used in a variety of substrates, depths and areas throughout the Northeast Region, and are responsible for most of the fisheries landings in the region, while scallop dredges are utilized on substrates of sand and gravel, and hydraulic dredges are only used in sand, shell, and small gravel in well-defined areas (see 7.2.6.2.2). EFH for pelagic life stages (such as eggs and larvae of most species) is not considered applicable to this evaluation and is so indicated in the tables.

Table 97. American Plaice EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	GOME, GB and estuaries from Passamaquoddy Bay to Saco Bay, ME and from Mass. Bay to Cape Cod Bay, MA	30 - 90	All year in GOME Dec - June on GB Peaks April & May both	Surface waters	NA	NA	NA	NA	NA
Larvae	GOME, GB, Southern NE and estuaries from Passamaquoddy Bay to Saco Bay, ME and from Mass Bay to Cape Cod Bay, MA	30-130	Between January and August, with peaks in April and May	Surface Waters	NA	NA	NA	NA	NA
Juveniles	GOME and estuaries from Passamaquoddy Bay to Saco Bay, ME and from Mass Bay to Cape Cod Bay, MA	45-150		Bottom habitats with fine-grained sediments or substrate of sand or gravel	M	M	0	L	L
Adults	GOME, GB and estuaries from Passamaquoddy Bay to Saco Bay, ME and from Mass Bay to Cape Cod Bay, MA	45-175		Bottom habitats with fine-grained sediments or a substrate of sand or gravel	H	H	0	L	L
Spawning Adults	GOME, GB and estuaries from Passamaquoddy Bay to Saco Bay, ME and from Mass Bay to Cape Cod Bay, MA	<90	March through June	Bottom habitats of all substrate types	H	H	0	L	L

Rationale: American Plaice *(Hippoglossoides platessoides*) juveniles, adults, and spawning adults are concentrated in the Gulf of Maine, where they occupy a variety of habitat types with substrates of gravel or fine grained sediments including sand. Plaice avoid rocky and hard bottom areas and prefer fine, sticky but gritty sand mixtures and mud, as well as oozy mud in deep basins (Klein-MacPhee 2002a). Plaice have been caught a considerable distance off the bottom and move off the bottom at night (Klein-MacPhee 2002a). They feed primarily on epi-benthic invertebrates (mostly echinoderms and amphipods), so there is a potential that prey resources may be affected adversely by otter trawls and scallop dredges, particularly in areas of lower energy and expected slower habitat recovery. EFH vulnerability to these gears is rated as high for adults and moderate for juveniles primarily because spawning occurs on the bottom. Since hydraulic clam dredges do not typically operate in the Gulf of Maine, vulnerability for this gear was rated as none.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year;
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT Pots and Traps; NL - Gill Nets and Longlines; NA - not applicable;
0 –No vulnerability; L - Low vulnerability; M - Moderate vulnerability; H - High vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 98. Atlantic Cod EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	GOME, GB, eastern portion of continental shelf off southern NE and following estuaries: Englishman/ Machias Bay to Blue Hill Bay; Sheepscot R., Casco Bay, Saco Bay, Great Bay, Mass Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	<110	Begins in fall, peaks in winter and spring	Surface Waters	NA	NA	NA	NA	NA
Larvae	GOME, GB, eastern portion of continental shelf off southern NE and following estuaries: Passamaquoddy Bay to Penobscot Bay; Sheepscot R., Casco Bay, Saco Bay, Great Bay, Mass Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	30-70	Spring	Pelagic waters	NA	NA	NA	NA	NA
Juveniles	GOME, GB, eastern portion of continental shelf off southern NE and following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	25 - 75		Bottom habitats with a substrate of cobble or gravel	H	H	0	L	L
Adults	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	10-150		Bottom habitats with a substrate of rocks, pebbles, or gravel	M	M	L	L	L
Spawning Adults	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and following estuaries: Englishman/ Machias Bay to Blue Hill Bay; Sheepscot R., Mass Bay, Boston Harbor, Cape Cod Bay, MA	10-150	spawn during fall, winter, and early spring	Bottom habitats with a substrate of smooth sand, rocks, pebbles, or gravel	M	M	L	L	L

Rationale: Atlantic Cod (*Gadus morhua*) are distributed regionally from Greenland to Cape Hatteras, NC, from nearshore to depths greater than 400 m. In U.S. waters, they are concentrated on Georges Bank and in the Gulf of Maine, on rough bottom from 10 - 150 m (Klein-MacPhee 2002b; Fahay et al. 1999). Eggs and larvae are pelagic so EFH Vulnerability is not applicable.

Juvenile cod are found mostly in nearshore shoal waters or on offshore banks. Cobble is preferred over finer grained sediments, and this life stage appears to use benthic structure and cryptic coloration to escape from predation (Fahay et al. 1999). Juvenile cod may benefit, perhaps strongly, from physical and biological complexity (Lindholm et al. 2001) (see discussion habitat characterization section). Otter trawls and scallop dredges have been shown to reduce habitat complexity (see Gear Effects section of the report), and EFH vulnerability to these gear types is rated as high since the gear may affect the functional value of EFH for this life stage. Vulnerability to clam dredges is rated as none since this gear is not operated in juvenile cod EFH (see distribution of fishing activity section).

Adults and spawning adults occupy a variety of hard bottom habitat types including rock, pebbles, and gravel, and tend to avoid finer sediments. Cod are euryphagus, eating a wide variety of prey including fish, decapods, amphipods, and polychaetes (Fahay et al. 1999). Although adult cod are primarily found on rough bottom, the scientific literature does not indicate that this habitat type serves the same function as it does for juvenile cod. Based on the variable diet and lack of evidence for direct function of benthic habitat, EFH vulnerability to otter trawls and scallop dredges is rated as moderate. Adult cod may use areas where clam dredges operate, such as the nearshore waters of New Jersey, on a seasonal basis. Clam dredges operate only in sand, and the recovery of benthic communities from the effects of dredging in this habitat type has been documented as rapid (Table 5.15). Clam beds are not chronically disturbed by dredging since the population of clams, which are benthic infauna, must recover before fishing is again profitable (NREFHSC 2002). Based on this information and the rationale described for otter trawls and scallop dredges, habitat vulnerability for hydraulic clam dredges was rated as low. EFH vulnerability for adults applies to spawning adults as well.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year: OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 – No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 99. Atlantic Halibut EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	GOME, GB		Between late fall and early spring, peak Nov and Dec.	Pelagic waters to the sea floor	0	0	0	0	0
Larvae	GOME, GB			Surface waters	NA	NA	NA	NA	NA
Juveniles	GOME, GB	20 - 60		Bottom habitats with a substrate of sand, gravel, or clay	M	M	0	L	L
Adults	GOME, GB	100-700		Bottom habitats with a substrate of sand, gravel, or clay	M	M	0	L	L
Spawning Adults	GOME, GB	<700	Between late fall and early spring, peaks in Nov. and Dec.	Bottom habitats with a substrate of soft mud, clay, sand, or gravel; rough or rocky bottom locations along slopes of the outer banks	M	M	0	L	L

Rationale: Atlantic Halibut (*Hippoglossus hippoglossus*) are found in the boreal and subarctic Atlantic, south to New Jersey, and were once fairly common from Nantucket Shoals to Labrador (Munroe 2002). They have been found at depths from 25 m to 1000 m, but 700 - 900 m is probably the deepest they are found in any numbers.

Atlantic halibut eggs are bathy-pelagic and are fertilized on the bottom (Klein-MacPhee 2002a, Cargnelli et al. 1999g). The eggs are bathypelagic so they are close to but not on the bottom, therefore, EFH vulnerability from scallop dredges and otter trawls and hydraulic clam dredges are not expected to affect the habitat?s functional value for this life stage and is rated as none.

Juvenile, adult and spawning adult halibut occupy a variety of habitat types north of Nantucket Shoals. Adults are not found on soft mud or on rock bottom (Cargnelli et al. 1999g). Spawning is occasionally associated with complex habitats. Juvenile halibut feed mostly on annelid worms and crustaceans then transition to a diet of mostly fish as adults (Klein-MacPhee 2002a). Adults are piscivorous. EFH vulnerability from scallop dredges, otter trawls was rated as moderate for juveniles and adults. EFH Vulnerability for clam dredges was rated as none since this gear type does not operate in halibut EFH.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 100. Atlantic Herring EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	GOME, GB and following estuaries: Englishman/ Machias Bay, Casco Bay, & Cape Cod Bay	20 - 80	July through November	Bottom habitats with a substrate of gravel, sand, cobble, shell fragments & aquatic macrophytes.	L	L	0	L	L
Larvae	GOME, GB, Southern NE and following estuaries: Passamaquoddy Bay to Cape Cod Bay, Narragansett Bay, & Hudson R./ Raritan Bay	50 - 90	Between August and April, peaks from Sept. - Nov.	Pelagic waters	NA	NA	NA	NA	NA
Juveniles	GOME, GB, Southern NE and Middle Atlantic south to Cape Hatteras and following estuaries: Passamaquoddy Bay to Cape Cod Bay; Buzzards Bay to Long Island Sound; Gardiners Bay to Delaware Bay	15-135		Pelagic waters and bottom habitats	NA	NA	NA	NA	NA
Adults	GOME, GB, southern NE and middle Atlantic south to Cape Hatteras and following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Cape Cod Bay; Buzzards Bay to Long Island Sound; Gardiners Bay to Delaware Bay; & Chesapeake Bay	20-130		Pelagic waters and bottom habitats	NA	NA	NA	NA	NA
Spawning Adults	GOME, GB, southern NE and middle Atlantic south to Delaware Bay and Englishman/ Machias Bay Estuary	20 - 80	July through November	Bottom habitats with a substrate of gravel, sand, cobble and shell fragments, also on aquatic macrophytes	L	L	0	L	L

Rationale: Atlantic Herring (*Clupea harengus*) is a coastal pelagic species ranging from Labrador to Cape Hatteras in the western Atlantic (Reid et al. 1999, Munroe 2002). For most pelagic life stages (larvae, juvenile, adult) EFH vulnerability to benthic fishing gear is not applicable. Atlantic herring eggs are laid in high energy, benthic habitats on rocky, pebbly, gravelly or shell substrates or macrophytes at depths up to 300 m (Reid et al. 1999, Munroe 2002). These high energy habitat types are less susceptible to fishing gear impacts since they have evolved under the natural disturbance regime of a high energy environment. Vulnerability of herring egg EFH to scallop dredges and otter trawls is considered to be low. Although these gears may directly effect the eggs, only the effect of the gear on the functional value of the habitat was considered for this evaluation. EFH vulnerability from clam dredges were considered to be none since this gear does not operate in areas of herring egg EFH.

Spawning adults are closely associated with the bottom. Effects on the functional value of habitat from mobile gears is unknown and was rated as low since spawning does occur on the bottom. EFH vulnerability from clam dredges was rated as none as described above. Spawning could be disrupted by noise associated with these gears, but this issue was not addressed as a habitat related issue.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls ; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 101. Atlantic Salmon EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	Rivers from CT to Maine: Connecticut, Pawcatuck, Merrimack, Cocheco, Saco, Androscoggin, Presumpscot, Kennebec, Sheepscot, Ducktrap, Union, Penobscot, Narraguagus, Machias, East Machias, Pleasant, St. Croix, Denny?s, Passagassawaukeag Aroostook, Lamprey, Boyden, Orland Rivers, and the Turk, Hobart & Patten Streams; and the following estuaries for juveniles and adults: Passamaquoddy Bay to Muscongus Bay; Casco Bay to Wells Harbor; Mass Bay, Long Island Sound, Gardiners Bay to Great South Bay. All aquatic habitats in the watersheds of the above listed rivers, including all tributaries to the extent that they are currently or were historically accessible for salmon migration.	30-31 cm	Between October and April	Bottom habitats with a gravel or cobble riffle (redd) above or below a pool in rivers	NA	NA	NA	NA	NA
Larvae			Between March and June for alevins/fry	Bottom habitats with a gravel or cobble riffle (redd) above or below a pool in rivers	NA	NA	NA	NA	NA
Juveniles		10- 61 cm		Bottom habitats of shallow gravel/cobble riffles interspersed with deeper riffles and pools in rivers and estuaries Water velocities between 30 - 92cm/sec	NA	NA	NA	NA	NA
Adults				Oceanic adult Atlantic salmon are primarily pelagic and range from waters of the continental shelf off southern NE north throughout the GOME Dissolved oxygen above 5ppm for migratory pathway.	NA	NA	NA	NA	NA
Spawning Adults		30- 61 cm	October and November	Bottom habitats with a gravel or cobble riffle (redd) above or below a pool in rivers	NA	NA	NA	NA	NA

Rationale: Atlantic Salmon (*Salmo salar*) eggs and larvae are found in riverine areas where the fishing gear under consideration are not used, so EFH vulnerability is not applicable. It is important to note that these life stages are particularly vulnerable to non-fishing related impacts such as point source discharges and polluted runoff. Juveniles and adults are pelagic in nature, and vulnerability of EFH to benthic fishing gear is not applicable for these life stages.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0- No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 102. Atlantic Sea Scallop EFH - Vulnerability to Benthic Fishing Gear Effects

Life Stage	Geographic Area of EFH	Depth[1] (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability				
					OT	SD	CD	PT	NL
Eggs	GOME, GB, southern NE and middle Atlantic south to Virginia-North Carolina border and following estuaries: Passamaquoddy Bay to Sheepscot R.; Casco Bay, Mass Bay, and Cape Cod Bay		May through October, peaks in May and June in middle Atlantic area, and in Sept. and Oct. on GB and GOME	Bottom habitats	L	L	L	L	L
Larvae	GOME, GB, southern NE and middle Atlantic south to Virginia-North Carolina border and following estuaries: Passamaquoddy Bay to Sheepscot R.; Casco Bay, Mass Bay, and Cape Cod Bay			Pelagic waters[1] and bottom habitats[2] with a substrate of gravelly sand, shell fragments, pebbles, or on various red algae, hydroids, amphipod tubes and bryozoans	NA[1] L[2]	NA[1] L[2]	NA[1] L[2]	NA[1] L[2]	NA[1] L[2]
Juveniles	GOME, GB, southern NE and middle Atlantic south to Virginia-North Carolina border and following estuaries: Passamaquoddy Bay to Sheepscot R.; Casco Bay, Great Bay, Mass Bay, and Cape Cod Bay	18-110		Bottom habitats with a substrate of cobble, shells, and silt	L	L	L	L	L
Adults	GOME, GB, southern NE and middle Atlantic south to Virginia-North Carolina border and following estuaries: Passamaquoddy Bay to Sheepscot R.; Casco Bay, Great Bay, Mass Bay, and Cape Cod Bay	18-110		Bottom habitats with a substrate of cobble, shells, coarse/gravelly sand, and sand	L	L	L	L	L
Spawning Adults	GOME, GB, southern NE and middle Atlantic south to Virginia-North Carolina border and following estuaries: Passamaquoddy Bay to Sheepscot R.; Casco Bay, Mass Bay, and Cape Cod Bay	18-110	May through October, peaks in May and June in middle Atlantic area, and in Sept. and Oct. on GB and in GOME	Bottom habitats with a substrate of cobble, shells, coarse/gravelly sand, and sand	L	L	L	L	L

Life Stage	Geographic Area of EFH	Depth[1] (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability				
					OT	SD	CD	PT	NL

[1] Depth range given in EFH description.

Juvenile and adult sea scallops (***Placopecten magellanicus***) are found on the continental shelf of the northwest Atlantic, from the Gulf of St. Lawrence south to Cape Hatteras typically between 18 and 110 m, but also as shallow as 2 m in estuaries and embayments along the Maine coast and as deep as 384 m (Packer et al. 1999a). In the Gulf of Maine, populations have been reported at depths of 170-180 m. Scallops are rarely found at depths <55 m in "southern areas."

Rationale: Scallop eggs are slightly heavier than seawater and are thought to remain on the bottom during development, but bottom habitats have no known functional value for eggs and therefore their vulnerability to fishing was rated as low for all gear types. There are four pelagic larval stages and EFH vulnerability to fishing gear impacts for these larval stages is not applicable. However, the last larval stage is benthic; at this stage larvae settle to the bottom (as "spat") and attach to hard surfaces (Packer et al. 1999a). Settlement occurs in areas of gravelly sand with shell fragments. Spat are very delicate and do not survive on shifting sand bottoms. The availability of suitable surfaces on which to settle appears to be a primary requirement for successful reproduction (Packer et al. 1999a). There is a close association between the bryozoan, *Eucratea loricata*, and spat. *Eucratea* attach to adult scallops, and have been found to contain large numbers of spat. EFH for benthic phase larvae was given a low rating for vulnerability to all three mobile gear types because any disturbance of the bottom they would cause would most likely re-distribute bottom sediments suitable for settlement (gravel, pebbles, shell fragments), but not reduce their availability. Juveniles are found mainly on gravel, small rocks, shells, and silt. During their second growing season (5-12 mm) they become mobile and leave the original substrate on which they settled and re-attach to shells and bottom debris. Otter trawls, scallop dredges and hydraulic clam dredges are used in bottom habitats occupied by juvenile scallops, but the disturbance of the seafloor caused by these gears does not adversely affect the functional value of the habitat and therefore the vulnerability of juvenile scallop EFH to mobile benthic gears was rated as low. The same conclusion was reached for fixed gear which cause negligible disturbance to the seafloor. Juveniles and adults are found in benthic habitats with at least some water movement, which is critical for feeding, oxygen and removal of waste; optimal growth for adults occurs at 10 cm/sec (Packer et al. 1999a). Adult scallops inhabit coarse substrates, usually gravel, shell, and rock. Because fine clay particles interfere with feeding activity, scallops are not usually found on muddy bottom. No scientific information exists that indicates mobile fishing gears have a negative impact on the functional value of adult scallop EFH. The vulnerability of adult scallop EFH to mobile benthic gears was therefore rated as low.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England;
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat

Table 103. Haddock EFH - Vulnerability to Effect of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	GB southwest to Nantucket Shoals and coastal areas of GOME and the following estuaries: Great Bay, Mass Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	50 - 90	March to May, peak in April	Surface waters	NA	NA	NA	NA	NA
Larvae	GB southwest to the middle Atlantic south to Delaware Bay and the following estuaries: Great Bay, Mass Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay, and Narragansett Bay	30 - 90	January to July, peak in April and May	Surface waters	NA	NA	NA	NA	NA
Juveniles	GB, GOME, middle Atlantic south to Delaware Bay	35-100		Bottom habitats with a substrate of pebble gravel	H	H	L	L	L
Adults	GB and eastern side of Nantucket Shoals, throughout GOME, *additional area of Nantucket Shoals, and Great South Channel	40-150		Bottom habitats with a substrate of broken ground, pebbles, smooth hard sand, and smooth areas between rocky patches	H	H	L	L	L
Spawning Adults	GB, Nantucket Shoals, Great South Channel, throughout GOME	40-150	January to June	Bottom habitats with a substrate of pebble gravel or gravelly sand	H	H	L	L	L

Rationale: Haddock (*Melanogrammus aeglefinus*) are found from Greenland to Cape Hatteras and are common throughout the Gulf of Maine, Georges Bank, and southern New England (Cargnelli et al. 1999f, Klein-MacPhee 2002b). Juveniles older than 3 months, and adults are demersal and generally found in waters from 10 to 150 m in depth. Demersal juveniles are usually found in waters shallower than 100 m. Haddock spawn over pebble gravel substrate, and avoid ledges, rocks, kelp and soft mud (Cargnelli et al. 1999f). Haddock eggs and larvae are pelagic, and EFH vulnerability to fishing gear is not applicable.

Juvenile haddock, like juvenile cod, may benefit, perhaps strongly, from physical and biological complexity (see discussion in Habitat Characterization section). In general, haddock have a stronger benthic affinity than cod (Klein-MacPhee 2002b). Juvenile haddock are chiefly found over pebble gravel substrates (Cargnelli et al. 1999f). Once demersal, they feed on benthic fauna, and their primary prey items are crustaceans and polychaetes. The habitat complexity that appears to be important to juvenile haddock can be reduced by otter trawls and scallop dredges, and benthic prey may be affected. Juvenile haddock EFH is considered to be highly vulnerable to these two gear types. Vulnerability to clam dredges was rated as low since there is some use of this gear in juvenile EFH.

Adult haddock are found on broken ground, gravel, pebbles, clay, smooth sand, and sticky sand of gritty consistency, with a preference for smooth areas around rock patches (Klein-MacPhee 2002b). They feed indiscriminately on benthic invertebrates, and occasionally on fish. Adults (including spawning adults) occupy a variety of habitat types which may be affected by otter trawls and scallop dredges. These life stages may be less closely linked to complex habitats then juveniles, but there is still some association. Haddock are expected to be more strongly linked than cod since haddock primarily feed on benthic invertebrates while cod are primarily piscivorous. Benthic prey resources for haddock may be adversely affected by scallop dredges or otter trawls in areas of lower energy and expected slower habitat recovery. Overall, adult EFH vulnerability to these gear types is rated as high. Clam dredges operate only in sand and the associated recovery period is short (Table 5.15). Moreover, clam dredging is not expected to be a chronic disturbance in these areas since the population of clams, which are benthic infauna, must recover before fishing is again profitable therefore, habitat vulnerability for clam dredges is rated as low.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 104. Monkfish EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	**SD**	**CD**	**PT**	**NL**
Eggs	GOME, GB, southern NE, middle Atlantic south to Cape Hatteras, North Carolina	15-1000	March to September	Surface waters	NA	NA	NA	NA	NA
Larvae	GOME, GB, southern NE, middle Atlantic south to Cape Hatteras, North Carolina	25-1000	March to September	Pelagic waters	NA	NA	NA	NA	NA
Juveniles	Outer continental shelf in the middle Atlantic, mid-shelf off southern NE, all areas of GOME	25-200		Bottom habitats with substrates of a sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud	L	L	L	L	L
Adults	Outer continental shelf in the middle Atlantic, mid-shelf off southern NE, outer perimeter of GB, all areas of GOME	25-200		Bottom habitats with substrates of a sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud	L	L	L	L	L
Spawning Adults	Outer continental shelf in the middle Atlantic, mid-shelf off southern NE, outer perimeter of GB, all areas of GOME	25-200	February to August	Bottom habitats with substrates of a sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud	L	L	L	L	L

Rationale: Monkfish (*Lophius americanus*), are demersal anglerfish found from Newfoundland south to Florida, but are common only north of Cape Hatteras (Steimle et al. 1999c). Juveniles are primarily found at depths between 40-75 m while adults are concentrated between 50-100 m. In the Gulf of Maine, adults occur primarily between the depths of 130 - 260 m. Occasionally, adults are seen at the surface. Both juveniles and adults (including spawning adults) occur on substrates ranging from mud to gravelly sand, algae and rocks. A monkfish has been observed digging depressions in the bottom substrate with its pectoral fins until its back was almost flush with the surrounding bottom (Caruso 2002).

The monkfish is a sight predator which uses its highly modified first dorsal fin as an angling apparatus to lure small fishes towards its mouth (Collette and Klein-MacPhee 2002). Monkfish eat a wide array of prey items, but mainly fish and cephalopods. Monkfish have been reported to ingest a variety of seabirds. There are no indications in the literature that any monkfish life stage is habitat limited or could be limited by any functional impacts to habitat caused by fishing gear. Vulnerability of adult and juvenile EFH to mobile fishing gear was rated as low. Monkfish eggs and larvae are pelagic, and vulnerability to benthic fishing gear is not applicable.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 105. Ocean Pout EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay and Cape Cod Bay	<50	Late fall and winter	Bottom habitats, generally hard bottom sheltered nests, holes, or crevices where they are guarded by parents	H	H	H	L	L
Larvae	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay and Cape Cod Bay	<50	Late fall to spring	Bottom habitats in close proximity to hard bottom nesting areas	H	H	H	L	L
Juveniles	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay, Boston Harbor and Cape Cod Bay	<80		Bottom habitats, often smooth bottom near rocks or algae	H	H	H	L	L
Adults	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay, Boston Harbor and Cape Cod Bay	<110		Bottom habitats. (Dig depressions in soft sediments which are then used by other species)	H	H	H	L	L
Spawning Adults	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay, and Cape Cod Bay	<50	Late summer to early winter, peaks in Sept. and October	Bottom habitats with a hard bottom substrate, including artificial reefs and shipwrecks	H	H	H	L	L

Rationale: Ocean Pout (***Zoarces americanus***) is a demersal species found in the western Atlantic from Labrador south to Cape Hatteras. (Steimle et al. 1999e). It can occur in deeper waters south of Cape Hatteras, and has been found as deep as 363 m (Klein-MacPhee and Collette 2002a). It is found in most estuaries and embayments in the Gulf of Maine, and is caught in greatest abundance by the NEFSC trawl survey off southern New England (Steimle et al. 1999e).

Ocean pout eggs are laid in nests in crevices, hard bottom or holes and protected by the female parent for 2.5 to 3 months until they hatch (Klein-MacPhee and Collette 2002a). During this time, the females do not feed. Potential impacts to habitat from otter trawls and scallop dredges and clam dredges include knocking down boulder piles, removing biogenic structure and disrupting depressions, which may disturb nests and/or leave these areas less suitable for pout nests. In addition, fishing may frighten parents from nests leaving eggs open to predation. Egg EFH is considered to have a high vulnerability to all bottom-tending mobile gear.

Ocean pout have a relatively short larval stage, and in fact some authors (Klein-MacPhee and Collette 2002a) suggest that there is no larval stage (Steimle et al. 1999e). Since the NEFMC designated EFH for this life stage, it considered here as such. Larvae (hatchlings) remain near the nest site; however, there is little information on their use of habitats. Larvae do not appear to be as closely associated with the bottom as eggs or juveniles however, it is anticipated that loss of structure may impact larvae to some degree. Larval EFH was determined to have high vulnerability to the mobile gears.

Juvenile pout are found under rocks, shells and algae, in coastal waters and are closely associated with the bottom (Steimle et al. 1999e). They feed on benthic invertebrates such as gammarid amphipods and polychaetes. It is expected that loss of structure may be a fairly significant impact to juvenile EFH. Vulnerability of juvenile EFH to all mobile gear was determined to be high.

Adult pout are found in sand and gravel in winter and spring, and in rocky/hard substrate areas for spawning and nesting (Klein-MacPhee and Collette 2002a). They create burrows in soft sediments, and their diet consists mainly of benthic invertebrates including mollusks, crustaceans and echinoderms. Because of the strong benthic affinity of ocean pout, it is anticipated that vulnerability of adult EFH to all mobile gear is high.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 106. Offshore Hake EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	Outer continental shelf of GB and southern NE south to Cape Hatteras, North Carolina	<1250	Observed all year and primarily collected at depths from 110 - 270m	Pelagic waters	NA	NA	NA	NA	NA
Larvae	Outer continental shelf of GB and southern NE south to Chesapeake Bay	<1250	Observed all year and primarily collected at depths from 70 - 130m	Pelagic waters	NA	NA	NA	NA	NA
Juveniles	Outer continental shelf of GB and southern NE south to Cape Hatteras, NC	170-350		Bottom habitats	L	L	0	L	L
Adults	Outer continental shelf of GB and southern NE south to Cape Hatteras, NC	150 - 380		Bottom habitats	L	L	0	L	L
Spawning Adults	Outer continental shelf of GB and southern NE south to the Middle Atlantic Bight	330 - 550	Spawn all throughout the year	Bottom habitats	L	L	0	L	L

Rationale: Offshore Hake (*Merluccius albidus*), are distributed over the continental shelf and slope of the northwest Atlantic, ranging from the Grand Banks south to the Caribbean and Gulf of Mexico (Chang et al. 1999a, Klein-MacPhee 2002c). Juveniles and adults are found in deeper waters, and are most abundant at depths between 150 - 380 m. They are an important component in the slope community off Florida, and are reportedly caught near the outer edge of the Scotian shelf, and on the slopes of deep basins in the Gulf of Maine and the continental slope from the southeastern edge of Georges Bank south. Because of their depth preference, very little is known about the offshore component of the stock. Moreover, offshore hake are similar in appearance to silver hake, and may have been misidentified in earlier studies. They are taken commercially as by-catch in the silver hake fishery. No information is available on substrate preferences for juveniles and adults. Eggs and larvae are pelagic, and EFH vulnerability to fishing gears is not applicable.

Juvenile and adult offshore hake appear to feed at or near the bottom, and are primarily piscivorous (particularly clupeids, anchovies, and lanternfishes) but also eat crustaceans and squid (Klein-MacPhee 2002c) . There is evidence of adult diel vertical migration. Only limited information exists about this species, and none of it indicates that offshore hake has a very strong bottom affinity, or that impacts from fishing gear would affect the habitat?s function and value for this species. Although spawning occurs near the bottom, the actual use of benthic habitat during spawning is unknown. The vulnerability of adult and juvenile EFH to otter trawls and scallop dredges is expected to be low. Vulnerability to clam dredges is rated as none since the gear does not operate in this EFH.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 107. Pollock EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	GOME, GB and the following estuaries: Great Bay to Boston Harbor	30-270	October to June, peaks in November to February	Pelagic waters	NA	NA	NA	NA	NA
Larvae	GOME, GB and the following estuaries: Passamaquoddy Bay, Sheepscot R., Great Bay to Cape Cod Bay	10-250	September to July, peaks from Dec. to February	Pelagic waters	NA	NA	NA	NA	NA
Juveniles	GOME, GB and the following estuaries: Passamaquoddy Bay to Saco Bay; Great Bay to Waquoit Bay; Long Island Sound, Great South Bay	0 - 250		Bottom habitats with aquatic vegetation or a substrate of sand, mud or rocks	L	L	L	L	L
Adults	GOME, GB, southern NE, and middle Atlantic south to New Jersey and the following estuaries: Passamaquoddy Bay, Damariscotta R., Mass Bay, Cape Cod Bay, Long Island Sound	15-365		Hard bottom habitats including artificial reefs	M	M	L	L	L
Spawning Adults	GOME, southern NE, and middle Atlantic south to New Jersey includes Mass Bay	15-365	September to April, peaks December to February	Bottom habitats with a substrate of hard, stony, or rocky bottom includes artificial reefs	M	M	L	L	L

Rationale: Pollock (*Pollachius virens*), range from the Hudson straits to North Carolina (Klein-MacPhee 2002b), and are most common on the Scotian Shelf, Georges Bank, the Great South Channel and Gulf of Maine (Cargnelli et al. 1999d). They segregate into schools by size, and avoid water warmer than about 15EC (Klein-MacPhee 2002b). They are active fish that live at any level between the bottom and surface depending upon food supply. They are associated with coastal areas and offshore shoals, and are found from shore out to depths of about 325 m, but are most common from 75-175 m (Cargnelli et al. 1999d). Juveniles frequently occupy the rocky intertidal zone, which may serve as a nursery area (Klein-MacPhee 2002c). Neither adults nor juveniles are selective in substrate type.

Pollock are opportunistic, and the diet of both juveniles and adults consists mainly of euphausiid crustaceans, but fish can also comprise a significant portion, along with other crustaceans and squids (Cargnelli et al. 1999d, Klein-MacPhee 2002c). Adults spawn over broken bottom and the slopes of offshore banks, and eggs are pelagic. Based on food habits, distribution, and behavior of pollock, vulnerability of juvenile EFH to benthic mobile gear is characterized as low. Since pollock spawn on the bottom, the vulnerability of adult EFH to otter trawls and scallop dredges has been rated as moderate. EFH vulnerability from clam dredges has been rated as low for juveniles and adults since there is limited use of this gear in pollock EFH. Pollock eggs and larvae are pelagic, and EFH vulnerability to fishing gear is not applicable

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 108. Red Hake EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	GOME, GB, continental shelf off southern NE, and middle Atlantic south to Cape Hatteras		May to November, peaks in June and July	Surface waters of inner continental shelf	NA	NA	NA	NA	NA
Larvae	GOME, GB, continental shelf off southern NE, and middle Atlantic south to Cape Hatteras and following estuaries: Sheepscot R., Mass Bay to Cape Cod Bay; Buzzards Bay, Narragansett Bay & Hudson R./ Raritan Bay	<200	May to December, peaks in Sept. and October	Surface waters	NA	NA	NA	NA	NA
Juveniles	GOME, GB, continental shelf off southern NE, and middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Saco Bay; Great Bay, Mass Bay to Cape Cod Bay; Buzzards Bay to Conn. R.; Hudson R./ Raritan Bay, & Chesapeake Bay	<100		Bottom habitats with substrate of shell fragments, including areas with an abundance of live scallops	H	H	H	L	L
Adults	GOME, GB, continental shelf off southern NE, and middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Saco Bay; Great Bay, Mass Bay to Cape Cod Bay; Buzzards Bay to Conn. R.; Hudson R./ Raritan, Delaware Bay, & Chesapeake Bay	10-130		Bottom habitats in depressions with a substrate of sand and mud	M	M	L	L	L
Spawning Adults	GOME, southern edge of GB, continental shelf off southern NE, and middle Atlantic south to Cape Hatteras and following estuaries: Sheepscott R., Mass Bay, Cape Cod Bay, Buzzards Bay, & Narragansett Bay	<100	May to November, peaks in June and July	Bottom habitats in depressions with a substrate of sand and mud	M	M	L	L	L

Rationale: Red Hake (*Urophycis chuss*) is a demersal species that ranges from southern Newfoundland to North Carolina, and is most abundant between Georges Bank and New Jersey (Steimle et al. 1999e). They occur at depths between 35 - 980 m, and are most common between 72 - 124 m (Klein-MacPhee 2002b). Larvae, juveniles, and adults have been found in estuaries from Maine through Chesapeake Bay (NEFMC 1998). Eggs and larvae are pelagic, and EFH vulnerability to fishing gear is not applicable.

Juvenile red hake are found in live Atlantic sea scallops or dead clappers, and are also associated with other objects such as other shells, sponges, and rocks (Klein-MacPhee 2002b). Shelter appears to be a critical habitat requirement for this life stage (Able and Fahay 1998), and physical complexity including biogenic structure other than scallop shells may be important (Auster et al. 1991, 1995). Their diet consists mainly of amphipods and other infauna and epifauna. Juvenile hake EFH is considered to be highly vulnerable to all three mobile gear groups.

Adult red hake feed mainly on euphausiids, and also consume other invertebrates and fish (Klein-MacPhee 2002b). They are found mainly on soft bottoms (sand and mud) where they create depressions or use existing depressions. They are also found on shell beds, but not on open, sandy bottom. Otter trawls and scallop dredges operate in these soft bottom and shellbed areas and have been shown to effect the structural components of these habitats. Offshore Maryland and northern Virginia, adult red hake are found on temperate reefs and hard bottom areas. There is a potential that otter trawls could operate in hard bottom areas and cause some impact that would affect the functional value of these reef habitats. Vulnerability of red hake EFH to otter trawls and scallop dredges is assessed as moderate. Clam dredges would not typically operate in these hard bottom areas, nor in the softer sediments with which red hake are usually associated in their northern extent but there is some overlap between adult EFH and clam dredge use in sandy habitats. EFH vulnerability to clam dredges is characterized as low.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
analysis – see Determination of Adverse Impacts Section of Amendment 13 document.									

Table 109. Redfish EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	Viviparous (eggs are retained in mother, released as larvae)				NA	NA	NA	NA	NA
Larvae	GOME, southern GB	50-270	March to October, peak in August	Pelagic waters	NA	NA	NA	NA	NA
Juveniles	GOME, southern edge of GB	25-400		Bottom habitats with a substrate of silt, mud, or hard bottom	H	H	0	L	L
Adults	GOME, southern edge of GB	50-350		Bottom habitats with a substrate of silt, mud, or hard bottom	M	M	0	L	L
Spawning Adults	GOME, southern edge of GB	5 -350	April to August	Bottom habitats with a substrate of silt, mud, or hard bottom	M	M	0	L	L

Rationale: Redfish *(Sebastes spp.)* refers to both the Acadian redfish (*Sebastes fasciatus*) and the deepwater redfish (*Sebastes mentella*) which are difficult to discriminate at all life stages, hence are usually combined (Pikanowski et al. 1999). Acadian redfish range from Iceland to New Jersey, and deepwater redfish occur from the Gulf of Maine north. Where the species overlap, the deepwater redfish occurs in deeper water. They range in depth from 25 - 592 m (Klein-MacPhee and Collette 2002b), with adults most common from 125 - 200 m and juveniles between 75 and 175 m (Pikanowski et al. 1999). In general, information about redfish is very limited. Females bear live young and larvae are pelagic, so habitat vulnerability is not applicable to eggs or larvae.

Redfish are found chiefly on silt, mud or hard bottom and rarely over sand (Pikanowski et al. 1999). On the Scotian shelf they are strongly associated with fine-grained clay/silt bottom (Klein-MacPhee and Collette 2002b), as well as deposits of gravel and boulders (Pikanowski et al. 1999). It is hypothesized that redfish do not prefer a particular bottom type, but may be more exposed to predation over a featureless bottom due to their sedentary nature. There is limited evidence that juveniles use anemones and boulders for cover (Pikanowski et al. 1999). Early demersal phase Acadian redfish have been observed to occur primarily in piled boulder habitats while late-juvenile redfish occur in both piled boulder, gravel and dense cerianthid anemone habitats (Auster et al. 1998, in prep.). Habitat vulnerability from otter trawls and scallop dredges in boulder habitats is high as gear can overturn boulders and reduce crevice resources as well as reduce cerianthid cover.

Redfish are benthic during the day, and become more active at night when they rise off the bottom, following the vertical migration of their primary euphausiid prey (Pikanowski et al. 1999). They also eat some benthic fish. Adult EFH was determined to be moderately vulnerable to impacts from otter trawls and scallop dredges. Clam dredges do not operate in areas of redfish EFH so vulnerability was rated as none.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 110. White Hake EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	GOME, GB, southern NE and the following estuaries: Great Bay to Cape Cod Bay		August to September	Surface waters	NA	NA	NA	NA	NA
Larvae	GOME, southern edge of GB, southern NE to middle Atlantic and the following estuaries: Mass Bay, to Cape Cod Bay		May - mid-Atlantic area Aug. & Sept. - GOME, GB area	Pelagic waters	NA	NA	NA	NA	NA
Juveniles	GOME, southern edge of GB, southern NE to middle Atlantic and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Cape Cod Bay	5 - 225	May-Sep - pelagic	Pelagic stage - pelagic waters; Demersal stage - Bottom habitat with seagrass beds or substrate of mud or fine-grained sand	M	M	0	L	L
Adults	GOME, southern edge of GB, southern NE to middle Atlantic and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Cape Cod Bay	5 - 325		Bottom habitats with substrate of mud or fine-grained sand	L	L	0	L	L
Spawning Adults	GOME, southern edge of GB, southern NE to middle Atlantic	5 - 325	April to May - southern part of range; August - Sept.- northern part of range	Bottom habitats with substrate of mud or fine-grained sand in deep water.	L	L	0	L	L

Rationale: White Hake *(Urophycis tenuis)* adults co-occur geographically with red hake, and their habits are similar, but white hake are distributed in a wider range of depths and temperatures (Chang et al. 1999c, Klein-MacPhee 2002b). They are found from Labrador south to North Carolina, and occasionally stray as far as Florida and Iceland. They occur from the estuaries across the continental shelf to the submarine canyons along the upper continental shelf, and in the basins of the Gulf of Maine. Adult distribution in the region is focused in the Gulf of Maine and along the southern slope of Georges Bank. All life stages are found in estuaries in the vicinity of the Gulf of Maine (NEFMC 1998).

Most pelagic juveniles cross the shelf and enter estuaries from Canada south to the Mid-Atlantic although some may descend to as yet unknown shelf habitats (Klein-MacPhee 2002b). Demersal juveniles are found in nearshore waters out to a depth of about 225 m (Chang et al. 1999c). Eelgrass is an important habitat for juveniles, but its functional importance is unknown, and this life stage is not necessarily dependent upon structure (Able and Fahay 1998). Young-of-the-year white hake feed mainly on shrimp, mysids and amphipods. Since otter trawls, scallop dredges can negatively impact eelgrass (Stephan et al. 2000) in estuaries, vulnerability of juvenile white hake EFH to these gears is characterized as moderate. Hydraulic clam dredges are not utilized in estuaries of the Gulf of Maine so vulnerability to this gear is rated as none.

Adults prefer benthic deposits of fine grained, muddy sediments (Chang et al. 1999c). They feed primarily on fish, cephalopods, and crustaceans. Since they are not benthivores and have not been documented to use benthic habitats for cover, EFH vulnerability to otter trawls and scallop dredges is characterized as low. Clam dredges are not operated in areas of adult EFH and vulnerability to this gear is rated as none.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 111. Silver Hake EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Merrimack R. to Cape Cod Bay	50-150	All year, peaks June to October	Surface waters	NA	NA	NA	NA	NA
Larvae	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Mass Bay to Cape Cod Bay	50-130	All year, peaks July to September	Surface waters	NA	NA	NA	NA	NA
Juveniles	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Casco Bay, Mass Bay to Cape Cod Bay	20-270		Bottom habitats of all substrate types	M	M	M	L	L
Adults	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Casco Bay, Mass Bay to Cape Cod Bay	30-325		Bottom habitats of all substrate types	L	L	L	L	L
Spawning Adults	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Mass Bay and Cape Cod Bay	30-325		Bottom habitats of all substrate types	L	L	L	L	L

Rationale: Whiting or Silver Hake *(Merluccius bilinearis)* range from Newfoundland south to Cape Fear, NC, and are most common from Nova Scotia to New Jersey (Morse et al. 1999). They are distributed broadly, and are found from nearshore shallows out to a depth of 400 m (Klein-MacPhee 2002c). All life stages have been found in estuaries from Maine to Cape Cod Bay (Morse et al. 1999). The vertical movement of offshore hake is governed chiefly by their pursuit of prey; both juveniles and adults show a vertical migration off the bottom at night when feeding activity is greatest.

In the Mid-Atlantic Bight, juvenile whiting have been found in greater densities in areas with greater amphipod tube cover (Auster et al.1997). Further, silver hake size distributions in sand wave habitats are positively correlated with sand wave period suggesting energetic or prey capture benefits to particular habitat structures in sand wave environments (Auster et al in press). Juveniles are primarily found on silt or sand substrate and feed mainly on crustaceans, including copepods, amphipods, euphausiids, and decapods (Morse et al. 1999). The vulnerability of juvenile EFH to mobile gear was rated as moderate because of the potential connection between structure and habitat suitability for this life stage.

Adult whiting rest on the bottom in depressions by day, primarily over sand and pebble rock, and rarely over rockier areas. In the Mid-Atlantic, adults were found on flat sand, sand wave crests, shell, and biogenic depressions, but were most often found on flat sand. At night, adults feed on anchovies, herring, lanternfish, and other fishes (Klein-MacPhee 2002c). Piscivory increases with size for this species. Vulnerability of adult whiting EFH to the three mobile gear types was rated as low because of whiting?s piscivorous food habits and preference for higher energy sand environments which recover quickly from fishing gear impacts. Eggs and larvae of this species are pelagic, so habitat vulnerability to fishing gear is not applicable.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 112. Windowpane Flounder EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	GOME, GB, southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Delaware Inland Bays	<70	February to November, peaks May and October in middle Atlantic July - August on GB	Surface waters	NA	NA	NA	NA	NA
Larvae	GOME, GB, southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Delaware Inland Bays	<70	February to November, peaks May and October in middle Atlantic July - August on GB	Pelagic waters	NA	NA	NA	NA	NA
Juveniles	GOME, GB, southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Chesapeake Bay	1 - 100		Bottom habitats with substrate of mud or fine grained sand	L	L	L	L	L
Adults	GOME, GB, southern NE, middle Atlantic south to Virginia - NC border and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Chesapeake Bay	1 - 75		Bottom habitats with substrate of mud or fine grained sand	L	L	L	L	L
Spawning Adults	GOME, GB, southern NE, middle Atlantic south to Virginia -NC border and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Delaware Inland Bays	1 - 75	February - December, peak in May in middle Atlantic	Bottom habitats with substrate of mud or fine grained sand	L	L	L	L	L

Rationale: Windowpane flounder *(Scopthalmus aquosus)* is distributed coastally from the Gulf of St. Lawrence to Florida, and are most abundant on Georges Bank and in the New York Bight (Klein-MacPhee 2002d). Windowpane are abundant in estuaries from Maine through the Chesapeake Bay (NEFMC 1998). They are a shoal water fish, with a depth range of up to 200 m, but are most abundant in waters less than 50 m deep. Both juveniles and adults are found on muddy sediments in the Gulf of Maine, and fine, sandy sediments on Georges Bank and in New England and the Mid-Atlantic Bight.

Mysids are the main prey item of juveniles (Klein-MacPhee 2002d). Adults have been shown to feed exclusively on nekton and show little need for bottom structure (Chang et al 1999b). EFH vulnerability to the three types of mobile gear was rated as low for both these lifestages. Windowpane eggs and larvae are pelagic, so EFH vulnerability to fishing gear is not applicable.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 113. Winter Flounder EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	GB, inshore areas of GOME, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Delaware Inland Bays	<5	February to June, peak in April on GB	Bottom habitats with a substrate of sand, muddy sand, mud, and gravel	L	L	L	L	L
Larvae	GB, inshore areas of GOME, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Delaware Inland Bays	<6	March to July, peaks in April and May on GB	Pelagic and bottom waters	L	L	L	L	L
Juveniles	GB, inshore areas of GOME, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Chincoteague Bay	0.1 - 10 (1 – 50, age 1+)		Bottom habitats with a substrate of mud or fine grained sand	L	L	L	L	L
Adults	GB, inshore areas of GOME, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Chincoteague Bay	1 - 100		Bottom habitats including estuaries with substrate of mud, sand, gravel	M	M	M	L	L
Spawning Adults	GB, inshore areas of GOME, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Delaware Inland Bays	<6	February to June	Bottom habitats including estuaries with substrate of mud, sand, gravel	M	M	M	L	L

Rationale: Winter Flounder *(Pseudopleuronectes americanus)* range from Labrador to Georgia, and are most abundant from the Gulf of St. Lawrence to Chesapeake Bay (Klein-MacPhee 2002a). All lifestages are common in estuaries from Maine through Chesapeake Bay. Juveniles and adults are found in waters less than 100 m deep, and most are from shore to 30 m. They range far upstream in estuaries, and have been found in freshwater.

Winter flounder lay demersal adhesive eggs in shallow waters less than 5 m in depth, with the exception of spawning areas on Georges Bank and Nantucket shoals (Pereira et al. 1999). Substrates include sand, muddy sand, mud and gravel, with sand the most common. Although otter trawls, scallop dredges and clam dredges may affect the eggs directly, this was not considered a habitat impact. Since there is no indication that the eggs rely on any structure, egg EFH vulnerability to these three gears was rated as low. Since early larvae are associated with the bottom and are at times demersal (Able and Fahay 1998) the vulnerability to all gears were also rated as low instead of none.

Juvenile and adult winter flounder are found on mud and sand substrates, and adults are also seen on cobble, rocks and boulders (Pereira et al. 1999). Both life stages can be opportunistic feeders, however their main prey items are infaunal invertebrates. Because of their reliance on infauna and their ability to use alternative food supplies, EFH vulnerability to the three mobile gear types for these life stages was ranked as moderate.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 114. Witch Flounder EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras	Deep	March to October	Surface waters	NA	NA	NA	NA	NA
Larvae	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras	Deep	March to November, peaks in May - July	Surface waters to 250m	NA	NA	NA	NA	NA
Juveniles	GOME, outer continental shelf from GB south to Cape Hatteras	50-450 to 1500m		Bottom habitats with fine-grained substrate	M	L	0	L	L
Adults	GOME, outer continental shelf from GB south to Chesapeake Bay	25-300		Bottom habitats with fine-grained substrate	M	L	L	L	L
Spawning Adults	GOME, outer continental shelf from GB south to Chesapeake Bay	25-360	March to November, peaks in May-August	Bottom habitats with fine-grained substrate	M	L	L	L	L

Rationale: Witch Flounder (*Glyptocephalus cynoglossus*) range from Newfoundland south to Cape Hatteras. In U.S. waters, this species is common throughout the Gulf of Maine, and is found in deeper areas of and adjacent to Georges Bank and along the continental shelf edge and upper slope (Cargnelli et al 1999, Klein-MacPhee 2002a).

Juvenile and adult witch flounder are found mainly over fine muddy sand, clay or mud. Their diet is comprised mainly of polychaetes, and they feed on other invertebrates as well (Cargnelli et al. 1999e). Since these life stages occur in areas of lower natural disturbance and rely on infauna, EFH vulnerability to impacts from otter trawls were rated as moderate. Impacts from scallop dredging may be less, since scallop dredges are not usually used in muddy habitat; however, vessel trip reports indicated scallop dredging in areas of witch flounder EFH, therefore, vulnerability to scallop dredges was rates as low. Juvenile EFH vulnerability to clam dredges was rated as none since clam dredges are not used in mud or in water depths where juvenile witch flounder are primarily found. However, EFH vulnerability to clam dredges for adults was rates as low since clam dredges do operate in adult EFH. Eggs and larvae of witch flounder are pelagic, so vulnerability of EFH to fishing gear impacts are not applicable.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 115. Yellowtail Flounder EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	GB, Mass Bay, Cape Cod Bay, southern NE continental shelf south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Saco Bay; Great Bay to Cape Cod Bay	30 - 90	Mid-March to July, peaks in April to June in southern NE	Surface waters	NA	NA	NA	NA	NA
Larvae	GB, Mass Bay, Cape Cod Bay, southern NE continental shelf, middle Atlantic south to Chesapeake Bay and the following estuaries: Passamaquoddy Bay to Cape Cod Bay	10 - 90	March to April in New York bight; May to July in south NE and southeastern GB	Surface waters	NA	NA	NA	NA	NA
Juveniles	GB, GOME, southern NE continental shelf south to Delaware Bay and the following estuaries: Sheepscot R., Casco Bay, Mass Bay to Cape Cod Bay	20 - 50		Bottom habitats with substrate of sand or sand and mud	M	M	M	L	L
Adults	GB, GOME, southern NE continental shelf south to Delaware Bay and the following estuaries: Sheepscot R., Casco Bay, Mass Bay to Cape Cod Bay	20 - 50		Bottom habitats with substrate of sand or sand and mud	M	M	M	L	L
Spawning Adults	GB, GOME, southern NE continental shelf south to Delaware Bay and the following estuaries: Mass Bay to Cape Cod Bay	10-125		Bottom habitats with substrate of sand or sand and mud	M	M	M	L	L

Rationale: Yellowtail Flounder (*Limanda ferruginea*) are found from the Gulf of St. Lawrence south to the Chesapeake Bay (Klein-MacPhee 2002a, Johnson et al. 1999). They are most abundant on the western half of Georges Bank, western Gulf of Maine, east of Cape Cod, and off southern New England (Johnson et al. 1999). Their usual depth range is from 10 - 100 m (Klein MacPhee 2002a). Juveniles and adults are found in some New England estuaries while eggs and larvae are found more frequently in these habitats (NEFMC 1998). Yellowtail eggs and larvae are pelagic, so EFH vulnerability is not applicable.

Yellowtail flounder feed mainly on benthic macrofauna, primarily amphipods and polychaetes (Johnson et al. 1999). Adults eat mostly crustaceans while juveniles focus on polychaetes. Both life stages are found on substrates of sand or sand and mud. Vulnerability of juvenile and adult EFH to the three types of mobile gear was rated as moderate because of the potential affect of these gears on infaunal yellowtail prey.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0- No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 116. Red Crab EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	southern flank of GB and south the Cape Hatteras, NC	200-400		attached to the underside of the female crab until hatched - see spawning adults	NA	NA	NA	NA	NA
Larvae	southern flank of GB and south the Cape Hatteras, NC	200-1800	Jan - Jun	Water column from surface to seafloor	NA	NA	NA	NA	NA
Juveniles	southern flank of GB and south the Cape Hatteras, NC	700-1800		Bottom habitats of continental slope with a substrate of silts, clays, and all silt-clay-sand composites	L	0	0	L	L
Adults	southern flank of GB and south the Cape Hatteras, NC	200-1300		Bottom habitats of continental slope with a substrate of silts, clays, and all silt-clay-sand composites	L	0	0	L	L
Spawning Adults	southern flank of GB and south the Cape Hatteras, NC	200-1300		Bottom habitats of continental slope with a substrate of silts, clays, and all silt-clay-sand composites	L	0	0	L	L

Rationale: Red Crab *(Chaeceon (Geryon) quinquedens)* are found on the outer continental shelf and slope of the western Atlantic from Nova Scotia into the Gulf of Mexico (Steimle et al. 2001). They are found on the bottom, chiefly between water depths of 200 and 1800. EFH depth range for juveniles is from 700 to 1800 m, and for adults EFH ranges from 200-1300 m. They are found on substrates of silt and clay to hard sediments.

Red crab are opportunistic benthic feeders/scavengers, with a diet of epifauna and other opportunistically available items (Steimle et al. 2001). Post-larval juveniles feed on a wide variety of infaunal and epifaunal benthic invertebrates. Small crabs eat sponges, hydroids, gastropods and other organisms. Larger crabs eat similar small benthic fauna and larger prey including demersal and mid-water fishes.

The only fishery using mobile bottom gear which operates in red crab EFH is the monkfish trawl fishery (NEFMC 2002). The vulnerability of adult and juvenile red crab EFH was characterized as low because of their opportunistic feeding ability. Vulnerability to scallop dredges and clam dredges was rated as none since those gear do not operate in red crab EFH. Since red crab eggs are brooded on the abdomen of females, the two EFH designations are identical. Larval red crab are pelagic and EFH vulnerability is not applicable.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 117. Atlantic Mackerel EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	Continental Shelf from Maine through Cape Hatteras, NC also includes estuaries from Great Bay to Cape Cod Bay; Buzzards Bay to Long Island Sound; Gardiners Bay and Great South Bay	0 - 15		Pelagic waters	NA	NA	NA	NA	NA
Larvae	Continental Shelf from GOME through Cape Hatteras, NC also includes estuaries from Great Bay to Cape Cod Bay; Narragansett Bay to Long Island Sound; Gardiners Bay and Great South Bay	10-130		Pelagic waters	NA	NA	NA	NA	NA
Juveniles	Continental Shelf from GOME through Cape Hatteras, NC also includes estuaries from Passamaquoddy Bay; Penobscot Bay to Saco Bay; Great Bay; Mass Bay to Cape Cod Bay; Narragansett Bay, Long Island Bay; Gardiners Bay to Hudson R./ Raritan Bay	0 - 320		Pelagic waters	NA	NA	NA	NA	NA
Adults	Continental Shelf from GOME through Cape Hatteras, NC also includes estuaries from Passamaquoddy Bay to Saco Bay; Mass Bay to Long Island Bay; Gardiners Bay to Hudson R./ Raritan Bay	0 - 380		Pelagic waters	NA	NA	NA	NA	NA

Rationale: All life stages of Atlantic Mackerel ***(Scomber scombrus)*** are pelagic, so their EFH is not vulnerable to bottom tending fishing gear, and vulnerability was categorized as ?not applicable.?

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT- Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 118. Black Sea Bass EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	Continental Shelf and estuaries from southern NE to North Carolina, also includes Buzzards Bay	0 - 200	May to October	Water column of coastal Mid-Atlantic Bight and Buzzards Bay	NA	NA	NA	NA	NA
Larvae	Pelagic waters over Continental Shelf from GOME to Cape Hatteras, NC, also includes Buzzards Bay	(<100)	(May - Nov, peak Jun - Jul)	Habitats for transforming (to juveniles) larvae are near coastal areas and into marine parts of estuaries between Virginia and NY. When larvae become demersal, found on structured inshore habitat such as sponge beds.	H	H	H	L	L
Juveniles	Demersal waters over Continental Shelf from GOME to Cape Hatteras, NC, also includes estuaries from Buzzards Bay to Long Island Sound; Gardiners Bay, Barnegat Bay to Chesapeake Bay; Tangier/ Pocomoke Sound and James River	(1 - 38)	Found in coastal areas (Apr - Dec , peak Jun - Nov) between VA and MA, but winter offshore from NJ and south; Estuaries in summer and spring	Rough bottom, shellfish and eelgrass beds, man-made structures in sandy-shelly areas, offshore clam beds and shell patches may be used during wintering	H	H	H	L	L
Adults	Demersal waters over Continental Shelf from GOME to Cape Hatteras, NC, also includes estuaries: Buzzards Bay, Narragansett Bay, Gardiners Bay, Great South Bay, Barnegat Bay to Chesapeake Bay; Tangier/ Pocomoke Sound and James River	(20-50)	Wintering adults (Nov. to April) offshore, south of NY to NC Inshore, estuaries from May to October	Structured habitats (natural & man-made) sand and shell substrates preferred	H	H	H	L	L

Rationale: Black sea bass *(Centropristis striata)* are found in coastal waters of the northwest Atlantic, from Cape Cod south to Cape Canaveral (Klein-MacPhee 2002e). Occasionally they stray as far north as the Bay of Fundy. Juveniles are common in high salinity estuaries. Adults and juveniles are found estuaries from Massachusetts south to the James River, VA (Stone et al. 1994).

Black sea bass larvae are pelagic, but then become demersal and occupy structured inshore habitat such as sponge beds, eelgrass beds, shellfish beds, shell patches, and other rough bottoms (Steimle et al. 1999a) and offshore shell patches including clam beds (Able and Fahay 1998). The availability of structure limits successful postlarval and/or juvenile recruitment (Steimle et al. 1999a). Juveniles are diurnal visual predators that feed on benthic invertebrates and small fish. Adults are also structure oriented, and thought to use structure as shelter during day- time, but may stray off it to hunt at night.

Each of these life stages is associated with structure that may be vulnerable to fishing gear impacts, so vulnerability was rated as high for all mobile gear. It is important to note that structured habitats comprised of wrecks or other artificial reefs prone to damage mobile gear may be avoided by these fishermen. This is true of high relief natural areas as well. Black sea bass eggs are pelagic, so vulnerability to EFH is not applicable. Although larvae are pelagic, they do become demersal as they transition into juveniles. Therefore, larvae were rated the same as juveniles to recognize this demersal stage.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 119. Bluefish EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	North of Cape Hatteras, found over Continental Shelf from Montauk Point, NY south to Cape Hatteras, South of Cape Hatteras, found over Continental Shelf through Key West, Florida	Mid-shelf depths	April to August	Pelagic waters	NA	NA	NA	NA	NA
Larvae	North of Cape Hatteras, found over Continental Shelf from Montauk Point, NY south to Cape Hatteras, South of Cape Hatteras, found over Continental Shelf through Key West, Florida, the slope sea and Gulf Stream between latitudes 29N and 40N; includes the following estuaries: Narragansett Bay	>15	April to September	Pelagic waters	NA	NA	NA	NA	NA
Juveniles	North of Cape Hatteras, found over Continental Shelf fro m Nantucket Island, MA south to Cape Hatteras, South of Cape Hatteras, found over Continental Shelf through Key West, Florida, the slope sea and Gulf Stream between latitudes 29N and 40N also includes estuaries between Penobscot Bay to Great Bay; Mass Bay to James R.; Albemarle Sound to St. Johns River, FL		North Atlantic estuaries from June to October Mid-Atlantic estuaries from May to October South Atlantic estuaries from March to December	Pelagic waters	NA	NA	NA	NA	NA
Adults	North of Cape Hatteras, found over Continental Shelf from Cape Cod Bay, MA south to Cape Hatteras, South of Cape Hatteras, found over Continental Shelf through Key West, Florida also includes estuaries between Penobscot Bay to Great Bay; Mass Bay to James R.; Albemarle Sound to Pamilco/ Pungo R., Bougue Sound, Cape Fear R., St. Helena Sound, Broad R., St. Johns R., & Indian R.		North Atlantic estuaries from June to October Mid-Atlantic estuaries from April to October South Atlantic estuaries from May to January	Pelagic waters	NA	NA	NA	NA	NA

Rationale: All life stages of Bluefish *(Pomatomus saltatrix)* are pelagic, so their EFH is not vulnerable to bottom tending fishing gear, and vulnerability was categorized as ?not applicable.?

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT- Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 120. Butterfish EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	Over Continental shelf from GOME through Cape Hatteras, NC, also in estuaries from Mass Bay to Long Island Sound; Gardiners Bay, Great South Bay, and Chesapeake Bay	0-1829	(spring and summer)	Pelagic waters	NA	NA	NA	NA	NA
Larvae	Over Continental shelf from GOME through Cape Hatteras, NC, also in estuaries from Boston Harbor, Waquoit Bay to Long Island Sound; Gardiners Bay to Hudson R./ Raritan Bay; Delaware Bay and Chesapeake Bay	10-1829	(summer and fall)	Pelagic waters	NA	NA	NA	NA	NA
Juveniles	Over Continental shelf from GOME through Cape Hatteras, NC also in estuaries from Mass Bay, Cape Cod Bay to Delaware Inland Bays; Chesapeake Bay, York R. and James R.	10-365 (most <120)	(winter - shelf spring to fall - estuaries)	Pelagic waters (larger individuals found over sandy and muddy substrates)	NA	NA	NA	NA	NA
Adults	Over Continental shelf from GOME through Cape Hatteras, NC, also in estuaries from Mass Bay, Cape Cod Bay to Hudson R./ Raritan Bay; Delaware Bay and Inland Bays; York R. and James R.	10-365 (most <120)	(winter - shelf summer to fall - estuaries)	Pelagic waters (schools form over sandy, sandy-silt and muddy substrates)	NA	NA	NA	NA	NA

Rationale: All lifestages of Butterfish *(Peprilus triacanthus)* are pelagic, so their EFH is not vulnerable to bottom tending fishing gear, and vulnerability was categorized as ?not applicable.?

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0- No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 121. Illex Squid EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Juveniles	Over Continental shelf from GOME through Cape Hatteras, NC	0 - 182	(carried northward by Gulf Stream)	Pelagic waters	NA	NA	NA	NA	NA
Adults	Over Continental shelf from GOME through Cape Hatteras, NC	0 -182	(late fall - offshore, spawn Dec- Mar)	Pelagic waters	NA	NA	NA	NA	NA

Rationale: All stages of Ilex Squid *(Illex illecebrosus)* are pelagic, so their EFH is not vulnerable to bottom tending fishing gear, and vulnerability was categorized as ?not applicable.?

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT- Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 122. Loligo Squid EFH - Vulnerability to Effects of Benthic Fishing Gear.

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs* **	Over Continental shelf from GOME through Cape Hatteras, NC	(<50)	(May - spawned, hatch in Jul)	(Demersal egg masses are commonly found on sandy/mud bottom, usually attached to rocks/boulders, pilings or algae such as fucus, ulva, laminaria, porphyra)	H	H	H	L	L
Juveniles	Over Continental shelf from GOME through Cape Hatteras, NC	0 - 213	spring - fall - inshore winter - offshore	Pelagic waters	NA	NA	NA	NA	NA
Adults	Over Continental shelf from GOME through Cape Hatteras, NC	0 - 305	(Mar - Oct - inshore; winter - offshore)	Pelagic waters	NA	NA	NA	NA	NA

Rationale: Loligo or longfin squid *(Loligo pealeii)* is a pelagic schooling species. It is distributed in the continental shelf and slope waters from Newfoundland to the Gulf of Venezuela (Cargnelli et al. 1999a). Most life stages of loligo squid are pelagic; however, encapsulated eggs are laid in masses, called ?mops? which are attached to structure such as rocks and algae on substrates of sand, mud, or hard bottom (Cargnelli et al. 1999a). ***As of this writing, EFH is not designated for Loligo eggs, however it will be designated in the near future. Once loligo egg EFH is designated its EFH will be rated as highly vulnerable to otter trawls and scallop dredges, particularly biogenic structure used as attachment sites

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT- Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 123. Ocean Quahog EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Juveniles	Eastern edge of GB and GOME throughout the Atlantic EEZ	8-245		Throughout substrate to a depth of 3ft within federal waters, occurs progressively further offshore between Cape Cod and Cape Hatteras	L	L	L	L	L
Adults	Eastern edge of GB and GOME throughout the Atlantic EEZ	8 -245	(spawn May-Dec with several peaks)	Throughout substrate to a depth of 3ft within federal waters, occurs progressively further offshore between Cape Cod and Cape Hatteras	L	L	L	L	L

Rationale: Ocean Quahog *(Arctica islandica)* juveniles are found in offshore sandy substrate, and may survive in muddy intertidal areas (Cargnelli et al. 1999b). Adults are found in similar offshore habitats, just below the surface of the sediment, usually in medium to fine-grained sand. Although fis hing gear may harvest these clams, the effect of the gear on the habitat is not expected to change the habitat?s functional value for clams. EFH vulnerability was rated as low for all mobile gears. Ocean quahog eggs and larvae are pelagic therefore EFH vulnerability is not applicable.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0- No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 124. Atlantic Surfclam EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	**SD**	**CD**	**PT**	**NL**
Juveniles	Eastern edge of GB and the GOME throughout Atlantic EEZ	0 -60 , low density beyond 38		Throughout substrate to a depth of three feet within federal waters. (Burrow in med. To coarse sand and gravel substrates. Also found in silty to fine sand, not in mud)	L	L	L	L	L
Adults	Eastern edge of GB and the GOME throughout Atlantic EEZ	0 -60 , low density beyond 38	(spawn-summer to fall at 19 -30 ^{o}C)	Throughout substrate to a depth of three feet within federal waters	L	L	L	L	L

Rationale: Atlantic Surfclams *(Spisula solidissima)* are found in sandy continental shelf habitats from the southern Gulf of St. Lawrence to Cape Hatteras, North Carolina (Cargnelli et al. 1999c). They burrow into substrates from fine to coarse sandy gravel and are not found in mud. Although fishing gear may harvest these clams, the effect of the gear on the habitat is not expected to change the habitat?s functional value for clams. EFH vulnerability was rated as low for all mobile gears. Surfclam eggs and larvae are pelagic therefore EFH vulnerability is not applicable.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT- Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 125. Scup EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	Southern NE to coastal Virginia includes the following estuaries: Waquoit Bay to Long Island Sound; Gardiners Bay, Hudson R./ Raritan Bay	(<30)	May - August	Pelagic waters in estuaries	NA	NA	NA	NA	NA
Larvae	Southern NE to coastal Virginia includes the following estuaries: Waquoit Bay to Long Island Sound; Gardiners Bay, Hudson R./ Raritan Bay	(<20)	May - September	Pelagic waters in estuaries	NA	NA	NA	NA	NA
Juveniles	Continental Shelf from GOME to Cape Hatteras, NC includes the following estuaries: Mass Bay, Cape Cod Bay to Long Island Sound; Gardiners Bay to Delaware Inland Bays; & Chesapeake Bay	(0 - 38)	Spring and summer in estuaries and bays	Demersal waters north of Cape Hatteras and Inshore on various sands, mud, mussel, and eelgrass bed type substrates	M	M	M	L	L
Adults	Continental Shelf from GOME to Cape Hatteras, NC includes the following estuaries: Cape Cod Bay to Long Island Sound; Gardiners Bay to Hudson R./ Raritan Bay; Delaware Bay & Inland Bays; & Chesapeake Bay	(2 - 185)	Wintering adults (November - April) are usually offshore, south of NY to NC	demersal waters north of Cape Hatteras and Inshore estuaries (various substrate types)	L	L	L	L	L

Rationale: Scup *(Stenotomus chrysops)* is a temperate species that occurs primarily from Massachusetts to South Carolina, although it has been reported as far north as the Bay of Fundy and Sable Island Bank, Canada (Steimle et al. 1999). Scup are primarily benthic feeders that use a variety of habitat types. Juveniles forage on epibenthic amphipods, other small crustaceans, polychaetes, mollusks, fish eggs, and larvae. They occur over a variety of substrates, and are most abundant in areas without structure. Limited observations of scup have shown periodic use of seafloor depressions for cover (Auster et al. 1991, 1995).

Adults are found on soft bottoms or near structures. During the summer they are closer inshore and found on a wider range of habitats. In the winter they congregate offshore in areas that are expected to serve as a thermal refuge (Klein-MacPhee 2002f), particularly deeper waters of the outer continental shelf and around canyon heads. Smaller adults feed on echinoderms, annelids, and small crustaceans. Larger scup consume more squids and fishes. Since juvenile scup are primarily benthic feeders, their EFH was rated as moderately vulnerable to impacts from mobile bottom gear. EFH for adults was rated as low since there is less of a reliance on benthic prey items.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 126. Spiny Dogfish EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Juveniles	GOME through Cape Hatteras, NC across the Continental Shelf; Continental Shelf waters South of Cape Hatteras, NC through Florida; also includes estuaries from Passamaquaddy Bay to Saco Bay; Mass Bay & Cape Cod Bay	10-390		Continental Shelf waters and estuaries	L	L	L	L	L
Adults	GOME through Cape Hatteras, NC across the Continental Shelf; Continental Shelf waters South of Cape Hatteras, NC through Florida; also includes estuaries from Passamaquaddy Bay to Saco Bay; Mass Bay & Cape Cod Bay	10-450		Continental Shelf waters and estuaries	L	L	L	L	L

Rationale: Spiny Dogfish *(Squalus acanthias)* is a coastal shark with a circumboreal distribution and is one of the most abundant sharks in the western North Atlantic (McMillan and Morse 1999). Female dogfish are viviparous, so EFH designations were reserved for juveniles and adults. Smaller dogfish have been reported to feed on more crustaceans, with an increase in piscivory in larger individuals (Burgess 2002). Fish, mainly schooling pelagics, constitute 50% of their diet. The voracious and opportunistic feeding behavior was emphasized by McMillan and Morse (1999). Since neither of these life stages appears to be closely tied to benthic organisms, the vulnerability of their EFH to mobile gears was rated as low.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 127. Summer Flounder EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	Over Continental Shelf from GOME to Cape Hatteras, NC; South of Cape Hatteras to Florida	30-70 fall; 110 winter; 9-30 spring	October to May	Pelagic waters , heaviest concentrations within 9 miles of shore off NJ and NY	NA	NA	NA	NA	NA
Larvae	Over Continental Shelf from GOME to Cape Hatteras, NC; South of Cape Hatteras to Florida; also includes estuaries from Waquoit Bay to Narragansett Bay; Hudson River/ Raritan Bay; Barnegat Bay, Chesapeake Bay, Rappahannock R., York R., James R., Albemarle Sound, Pamlico Sound, Neuse R. to Indian R.	10-70	mid-Atlantic Bight from Sept. to Feb.; Southern part from Nov. to May at depths 9-30m	Pelagic waters, larvae most abundant 19 - 83 km from shore; Southern areas 12 - 52 miles from shore	NA	NA	NA	NA	NA
Juveniles	Over Continental Shelf from GOME to Cape Hatteras, NC; South of Cape Hatteras to Florida; also includes estuaries from Waquoit Bay to James R.; Albemarle Sound to Indian R.	(0.5-5) in estuary		Demersal waters, muddy substrate but prefer mostly sand; found in the lower estuaries in flats, channels, salt marsh creeks, and eelgrass beds	M** L	L	L	0	0
Adults	Over Continental Shelf from GOME to Cape Hatteras, NC; South of Cape Hatteras to Florida; also includes estuaries from Buzzards Bay, Narragansett Bay, Conn. R. to James R.; Albemarle Sound to Broad R.; St. Johns R., & Indian R.	(0 - 25)	Inhabit shallow coastal and estuarine waters during warmer months and move offshore on outer Continental Shelf at depths of 150m in colder months	Demersal waters and estuaries	M** L	L	L	0	0

Rationale: Summer Flounder *(Paralichthys dentatus)* occur in the shallow estuarine waters and outer continental shelf from Nova Scotia to Florida with the center of its range located in the Middle Atlantic Bight (Packer et al. 1999). Juvenile summer flounder are opportunistic feeders, and their diet includes mysids, fish, and some crustaceans (Packer et al. 1999). There are gradual ontogenetic changes in the diet of summer flounder, with fish becoming more important as a food source as individuals get larger. Adults are also opportunistic feeders, with fish and crustaceans making up a significant portion of their diet.

Eelgrass and macroalgae has been designated as a habitat area of particular concern (HAPC) for adult and juvenile summer flounder. Stephan et al. (2000) determined that otter trawls could result in below ground impacts to SAV, which, of all the impacts to SAV possible from fishing gear, was ranked as the impact of greatest concern. This determination was caveated by an acknowledgment that factors relevant to use and the type of SAV species impacted, must be considered for a more precise evaluation of this gear type. * *Based on potential impacts to SAVs, the vulnerability of the summer flounder HAPC to otter trawls is rated as moderate. Vulnerability to scallop or clam dredges was considered low since these gears are not typically used in estuaries where SAV are found.

Since adults and juveniles are both opportunistic feeders, their EFH vulnerability (aside from the HAPC) was rated as low for all bottom tending gear. Summer flounder eggs and larvae are pelagic so EFH vulnerability is not applicable.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year;
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 128. Tilefish EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	US Canadian Boundary to VA/NC boundary (shelf break; GB to Cape Hatteras)	76-365	(Serial spawning March - November; peaks April - October)	Water column	NA	NA	NA	NA	NA
Larvae	US Canadian Boundary to VA/NC boundary Outer continental shelf; (GB to Cape Hatteras)	76-365	(Feb - Oct; peaks July - Oct)	Water column	NA	NA	NA	NA	NA
Juveniles	US Canadian Boundary to VA/NC boundary (shelf break, submarine canyon walls and flanks; GB to Cape Hatteras)	76-365	(All year; may leave GB in winter)	Rough bottom, small burrows, and sheltered areas. (Substrate - rocky, stiff clay, human debris)	H	L	0	L	L
Adults	US Canadian Boundary to VA/NC boundary (shelf break, submarine canyon walls and flanks; GB to Cape Hatteras)	76-365	(All year; may leave GB in winter)	Rough bottom, small burrows, and sheltered areas. (Substrate - rocky exposed ledges, stiff clay)	H	L	0	L	L

Tilefish *(Lopholatilus chamaeleontieps)* are restricted to the Continental shelf break south of the Gulf of Maine (Steimle et al. 1999a). They occupy a number of habitats, including scour basins around rocks or other rough bottom areas that form burrow-like cavities, and pueblo habitats in clay substrate. The dominant habitat type is a vertical burrow in a substrate of semi-hard silt/clay, 2 - 3 m deep and 4 - 5 m in diameter with a funnel shape. These burrows are excavated by tilefish, and then secondary burrows are created by other organisms, including lobsters, conger eels, and galatheid crabs. Tilefish are visual daytime feeders on galatheid crabs, mollusks, shrimps, polychaetes and occasionally fish. Mollusks and echinoderms are more important to smaller tilefish. Little is known about juveniles of the species.

A report to the Mid-Atlantic Fishery Management Council (Able and Muzeni 2002) from a video study in areas of tilefish habitat identified trawl tracks through these areas, causing a resuspension of bottom sediments. The report noted that these sediments may silt burrows in and/or cause physiological stress to tilefish that are present. No obvious structural impacts to the habitat were identified. However, due to the tilefish's reliance on structured shelter and the need for further study, the vulnerability of tilefish EFH to otter trawls was ranked as high. Clam dredges operate in waters (shallow, sandy) typically uninhabited by tilefish and tilefish EFH vulnerability was rated as none. Scallop vessel monitoring data indicate that scallopers operate in areas overlapping Tilefish EFH, therefore, EFH vulnerability to scallop dredges was ranked as low since the overlap is not extensive. Tilefish eggs and larvae are pelagic therefore EFH vulnerability is not applicable.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT- Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 129. Barndoor Skate EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Juveniles	eastern GOME, GB, SNE, MAB to Hudson Canyon	0-750 mostly <150		Bottom habitats with mud, gravel, and sand substrates	M	M	L	L	L
Adults	eastern GOME, GB, SNE, MAB to Hudson Canyon	0-750 mostly <150		Bottom habitats with mud, gravel, and sand substrates	M	M	L	L	L

Rationale: Barndoor Skate *(Dipturus laevis)* occur from Newfoundland south to Cape Hatteras, but are most abundant on Georges Bank and in the Gulf of Maine. They are found over sediments from soft mud to sand and gravel. (Packer et al. In press (a)). Barndoor skate feed on invertebrates and fish usually associated with the bottom, including polychaetes, gastropods, bivalves, squid and fish. Smaller individuals focus on polychaetes, copepods and amphipods while larger individuals capture larger and more active prey (McEachran 2002, Packer et al. In press (a)). A single fertilized egg is encapsulated in a leathery capsule known as a ?mermaids purse.? The young hatch in late spring or early summer and are thought to be about 180-190 mm in length, although very little information is available on this life stage (Packer et al. In press).

Juvenile EFH was considered to be moderately vulnerable to otter trawls and scallop dredges because of the closer association of juveniles to a benthic invertebrate diet. Adult EFH vulnerability to otter trawls and scallop dredges was rated as moderate due primarily to their reproductive habits. EFH vulnerability to clam dredges was rates as low for juveniles and adults because this gear is not extensively used in EFH.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT- Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 130. Clearnose Skate EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Juveniles	GOME, along shelf to Cape Hatteras, NC; includes the estuaries from Hudson River/Raritain Bay south to the Chesapeake Bay mainstem	0 - 500 mostly <111		Bottom habitats with substrate of soft bottom along continental shelf and rocky or gravelly bottom	M	M	M	L	L
Adults	GOME, along shelf to Cape Hatteras, NC; includes the estuaries from Hudson River/Raritain Bay south to the Chesapeake Bay mainstem	0 - 500 mostly <111		Bottom habitats with substrate of soft bottom along continental shelf and rocky or gravelly bottom	M	M	M	L	L

Rationale: Clearnose Skate *(Raja eglanteria)* occur in the Gulf of Maine, but are most abundant from Cape Hatteras north to Delaware Bay. They are found over soft bottoms of mud and sand, and also occur on rocky or gravelly bottoms. They have been captured from shore out to waters 330m deep, and are most abundant at depths less than 111 m. (Packer et al. In press(b)). Adults and juveniles feed on polychaetes, amphipods, decapod crustaceans, mollusks, and fish. Like barndoor skates, crabs and benthic invertebrates are more important for smaller, younger individuals, and importance of fish in diet increases with age (McEachran 2002; Packer et al. In press(b)). A single fertilized egg is encapsulated in a leathery case. Eggs are deposited in the spring or summer and hatch 3 months later.

Juvenile EFH was considered to be moderately vulnerable to otter trawls, scallop dredges and clam dredges because of the closer association of juveniles to a benthic invertebrate diet. Adult EFH vulnerability to otter trawls, scallop dredges and clam dredges was rated as moderate due primarily to their reproductive habits.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT- Pots and Traps; NL - Gill Nets and Longlines. NA -

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL

not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 131. Little Skate EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Eggs	GB through MAB to Cape Hatteras, NC; includes the estuaries from Buzzards Bay south to the Chesapeake Bay mainstem	<27		Bottom habitats with sandy substrate	L	L	L	L	L
Juveniles	GB through MAB to Cape Hatteras, NC; includes the estuaries from Buzzards Bay south to the Chesapeake Bay mainstem	0-137 mostly 73-91		Bottom habitats with sandy or gravelly substrate or mud	M	M	M	L	L
Adults	GB through MAB to Cape Hatteras, NC; includes the estuaries from Buzzards Bay south to the Chesapeake Bay mainstem	0-137 mostly 73-91		Bottom habitats with sandy or gravelly substrate or mud	M	M	M	L	L

Rationale: Little Skate *(Leucoraja erinacea)* range from Nova Scotia to Cape Hatteras, and are most abundant on Georges Bank and in coastal waters south to the mouth of Chesapeake Bay. They have been found at depths up to 500 m, but are most common at depths less than 111 m. In southern New England, juveniles and adults have been associated with microhabitat features including biogenic depressions and flat sand during the day (Auster et al. 1991, 1995). They are generally found on sandy or gravelly bottoms, but also occur on mud. They co-occur with winter skate, and are more active at night, although they appear to feed throughout the day and night. The most important prey are amphipods and decapod crustaceans, followed by polychaetes. Prey items of minor importance include bivalves, isopods, and fish. Similar to barndoor and clearnose, the use of fish as a food source increases with increasing size. Smaller skates eat more amphipods, and larger skate consume more decapod crustaceans (Packer et al. In press (c)).

A single fertilized egg is encapsulated in a leathery case which is deposited on sandy substrate. The cases have sticky filaments that adhere to bottom substrates. In one study, eggs deposited in the late spring and early summer require five to six months to hatch. Other studies have shown incubation to exceed one year. When the young hatch, they are considered juveniles and are fully developed, measuring from 93-102 mm in total length (Packer et al. In press (c)).

Vulnerability of juvenile EFH to mobile bottom gear was characterized as moderate because of the species dependence on benthic organisms in its diet. Vulnerability of adult EFH to mobile bottom gear was characterized as moderate due to its reproductive habits. Little skate is the only skate species in which EFH has been designated for eggs. Although bottom tending mobile gear may have adverse effects upon the eggs themselves, this type of impact was not considered to be a habitat impact. Since the bottom substrate appears to provide an attachment point for the eggs the EFH vulnerability to mobile gear was rated as low instead of none.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT- Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 132. Rosette Skate EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Juveniles	Nantucket shoals and southern edge of GB to Cape Hatteras, NC	33-530 mostly 74-274		Bottom habitats with soft substrate, including sand/mud bottoms, mud with echinoid and ophiuroid fragments, and shell and pteropod ooze	M	M	M	L	L
Adults	Nantucket shoals and southern edge of GB to Cape Hatteras, NC	33-530 mostly 74-274		Bottom habitats with soft substrate, including sand/mud bottoms, mud with echinoid and ophiuroid fragments, and shell and pteropod ooze	M	M	M	L	L

Rationale: Rosette Skate *(Leucoraja garmani virginica)* are a deeper water species that occur along the outer shelf and continental slope from Nantucket Shoals to the Dry Tortugas, Florida. North of Cape Hatteras, it is most abundant in the southern section of the Chesapeake Bight. It occurs on soft bottoms, including sand and mud, at depths from 33-530 m, and is most common between 74 and 274 m. Juveniles tend to be found between 100 - 140 m. Major prey items include polychaetes, copepods, cumaceans, amphipods, *Crangon*, crabs, squid, octopods, and small fishes. A single fertilized egg is encapsulated in a leathery case. Egg cases are found in mature females most frequently in the summer (Packer et al. In press (d)).

Information on rosette skate is very limited. Because of the limited information available and the apparent dependence of the juveniles of this species on benthic organisms in its diet, and the reproductive habits of the adults EFH vulnerability to mobile bottom gear was characterized as moderate.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT- Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 133. Smooth Skate EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Juveniles	Offshore banks of GOME	31-874 mostly 110-457		Bottom habitats with a substrate of soft mud (silt and clay), sand, broken shells, gravel and pebbles	M	M	0	L	L
Adults	Offshore banks of GOME	31-874 mostly 110-457		Bottom habitats with a substrate of soft mud (silt and clay), sand, broken shells, gravel and pebbles	H	H	0	L	L

Rationale: Smooth skate *(Malacoraja senta)* center of abundance is the Gulf of Maine. It occurs along the Atlantic coast from the Gulf of St. Lawrence south to South Carolina, at depths between 31-874 m. It is most abundant between 110-457 m. Analysis of NEFSC trawl survey data found juvenile skate most abundant between depths of 100-300 m during the time period from 1963-69. Smooth skate are found mostly over soft mud and clay of the Gulf of Maine?s deepwater basins, but also over the Gulf?s off shore banks with substrates of sand, shell, and/or gravel (Packer et al. In press (e)).

The diet of smooth skate is generally limited to epifaunal crustaceans, with decapod shrimp and euphausids as the most common prey, followed by amphipods and mysids. The diet shifts from amphipods and mysids to decapods as smooth skate grow (Packer et al. In press (e)). The diet of smooth skate is more restricted than other skate species (McEachran 2002). Egg cases, which contain a single fertilized egg, may have been recovered at depths of 150-300 m in the St. Lawrence River estuary in summer (Packer et al. In press (e)).

The vulnerability of juvenile smooth skate EFH to otter trawls and scallop dredges was characterized as moderate because of the dietary habits of this species. The vulnerability of adult EFH was rated as high for otter trawls and scallop dredges because benthic diet as well as the reproductive habits of the species. Vulnerability to clam dredges was considered to be none for juveniles and adults since this gear is not used in the Gulf of Maine.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 134. Thorny Skate EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Juveniles	GOME and GB	18-2000 mostly 111-366		Bottom habitats with a substrate of sand gravel, broken shell, pebbles, and soft mud	M	M	0	L	L
Adults	GOME and GB	18-2000 mostly 111-366		Bottom habitats with a substrate of sand gravel, broken shell, pebbles, and soft mud	M	M	0	L	L

Rationale: Thorny Skate ***(Amblyraja radiata)*** ranges from Greenland south to South Carolina. In the region, it is most commonly seen in the Gulf of Maine and on the Northeast Peak and northern Great South Channel of Georges Bank. It is one of the most common skates in the Gulf of Maine, and occurs over a wide variety of bottom substrates, from sand, gravel, and broken shell to mud. It is found at depths ranging from 18 - 1200 m, and is reported most common between 50-350 m. A single fertilized egg is encapsulated in an egg case. Females with fully formed egg cases were captured year round, though the percentage of mature females with egg cases is higher in the summer. (Packer et al. In press (f)).

The primary prey of thorny skates includes polychaetes and decapods, followed by amphipods and euphausids. Fish and mysids are also consumed in lesser quantities. According to a survey from Nova Scotia to Cape Hatteras, thorny skate prey varies with skate size. Skates less than 40 cm total length fed mostly on amphipods, skates greater than 40 cm fed on polychaetes and decapods, and fishes were a major dietary component for skates greater than 70 cm. In general, with increasing skate size mysids decreased in the diet while fishes increased (Packer et al. In press (f)).

Since juvenile thorny skate appear to be more reliant on benthic invertebrates, vulnerability of EFH to otter trawls and scallop dredges for this life stage was characterized as moderate. For adults, EFH vulnerability to otter trawls and scallop dredges was characterized as moderate because of its reproductive habits. EFH vulnerability to clam dredges was rated as none for juveniles and adults since there is no overlap between thorny skate EFH and areas in which clam dredges are used.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

Table 135. Winter Skate EFH - Vulnerability to Effects of Benthic Fishing Gear

Life Stage	Geographic Area of EFH	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability*				
					OT	SD	CD	PT	NL
Juveniles	Cape Cod Bay, GB, SNE shelf through MAB to North Carolina; includes the estuaries from Buzzards Bay south to the Chesapeake Bay mainstem	0-371 mostly <111		Bottom habitats with substrate of sand and gravel or mud	M	M	M	L	L
Adults	Cape Cod Bay, GB, SNE shelf through MAB to North Carolina; includes the estuaries from Buzzards Bay south to the Chesapeake Bay mainstem	0-371 mostly <111		Bottom habitats with substrate of sand and gravel or mud	M	M	M	L	L

Rationale: Winter Skate *(Leucoraja ocellata)* are found from Newfoundland south to Cape Hatteras. It is most abundant on Georges Bank and in coastal waters south to the mouth of the Hudson River. They are found over substrates of sand, gravel, and mud, in depths from shore out to 371 m, and are most common in less than 111 m of water. A single fertilized egg is encapsulated in a leather case and deposited on the bottom during summer in the northern portion of the range. Deposition has been reported to extend through January off southern New England. Young are fully developed at hatching.

Polychaetes and amphipods are the most important prey items, followed by decapods, isopods, bivalves, and fish. In general, crustaceans make up over 50% of the diet for skate less than 61 cm, and fish and bivalves are a major component of the diet for skates greater than 79 cm. Crustaceans declined in importance with increasing skate size while polychaetes increased, until skates reached 81 cm.

Since juvenile winter skate appear to be more reliant on benthic invertebrates, vulnerability of EFH to mobile gear for this life stage was characterized as moderate. For adults, EFH vulnerability to mobile gear was characterized as moderate because of its reproductive habits.

Definitions: GOME - Gulf of Maine; GB - Georges Bank; NE - New England; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year:
OT - Otter Trawls; SD - New Bedford Scallop Dredge; CD - Hydraulic Clam Dredge; PT - Pots and Traps; NL - Gill Nets and Longlines. NA - not applicable;
0 - No vulnerability; L - Low vulnerability; M - moderate vulnerability; H - high vulnerability; EFH - essential fish habitat; * derived from matrix analysis – see Determination of Adverse Impacts Section of Amendment 13 document.

7.2.6.2.5.1 Methodology for Vulnerability Matrix Analysis

A matrix (Table 137) was developed for each benthic life stage for each species to determine the vulnerability of its EFH to effects from bottom tending mobile gear. Six criteria were qualitatively evaluated for each life stage based upon existing information. Each evaluation consisted of a score based upon a predefined threshold. The first three criteria were related to habitat function and included shelter, food and reproduction. Scores for these criteria were determined as follows:

7.2.6.2.5.1.1 Shelter

(Scored from 0-2) If the lifestage has no dependence upon bottom habitat to provide shelter then a 0 was selected. Almost every lifestage evaluated has some dependence upon the bottom for shelter so 0 was seldom used with the exception of a few egg lifestages. If the lifestage has some dependence upon unstructured or non-complex habitat for shelter it was scored a 1. For example, flatfishes that rely primarily on cryptic coloration for predator avoidance or small scale sand waves for refuge were scored a 1. If the lifestage has a strong reliance on complex habitats for shelter it was scored a 2. For example, species such as juvenile cod and haddock that are heavily reliant on structure or complex habitat for predator avoidance were scored a 2.

7.2.6.2.5.1.2 Food

(Scored from 0-2) If the lifestage has no dependence on benthic prey it was scored a 0. For example, eggs were always scored a 0 as were lifestages that fed exclusively in the plankton. If the lifestage utilizes benthic prey for part of its diet but not exclusively a benthic feeder it was scored a 1. For example, species feeding opportunistically on crabs as well as squid or fish were scored a 1. If the lifestage feeds exclusively on benthic organisms and cannot change its mode of feeding it was scored a 2.

7.2.6.2.5.1.3 Reproduction

(Scored from 0-1) If the species has no dependence upon bottom habitats for spawning or its lifestage was not a reproductive stage it was scored a 0. For example, species that spawn in the water column were scored a 0 as well as juveniles of all species. If the species has some dependence upon bottom habitats for spawning it was scored a 1. For example, species that spawn on or over the bottom were scored a 1. This criteria was the most difficult to assess since there is limited knowledge on spawning behaviors for many species.

7.2.6.2.5.1.4 Habitat Sensitivity

(Scored from 0-2) This criterion no longer evaluates the function of the habitat for the species but looks at its overall sensitivity to disturbances in a relative fashion. The habitat needed by the species was based primarily upon its EFH designation. If a habitat was not considered sensitive to disturbance it was scored a 0. However, a score of 0 was not used for any benthic habitat type. If the habitat was considered to have a low sensitivity it was scored a 1. For example, habitats that are typically characterized as high energy environments without structural complexity or have rapid recovery rates they were scored a 1 (e.g. high energy sand environments). If the habitat type was considered highly sensitive it was scored a 2. For example, habitats that are characterized as structurally complex (such as habitats supporting epibenthic communities, boulder pile fields, etc.) or have very slow recovery rates (such as low energy deepwater environments) were scored a 2. These scores were based upon the existing conceptual models that show a direct relationship between structural complexity of the habitat and recovery time with increasing vulnerability.

7.2.6.2.5.1.5 Habitat Rank

The habitat rank was determined quantitatively as the sum of the previous scores (shelter + food + reproduction + habitat sensitivity). Another way to characterize the habitat rank is the relative vulnerability of the habitat to non-natural physical disturbance. The rank could range from 0-7, with 7 being the most vulnerable.

7.2.6.2.5.1.6 Gear Distribution

(Scored from 0-2) This criterion factors in the use of a particular gear type (otter trawl, scallop dredge, hydraulic clam dredge) in EFH for a particular lifestage. If the gear is not used in the described EFH it was scored a 0. If the gear operates in only a small portion of the described EFH it was scored a 1. If the gear operates in more than a small amount of the described EFH it was scored a 2. Distribution was determined as the qualitative overlap of EFH on the Vessel Trip Report location data which has been described in previous sections of this report.

7.2.6.2.5.1.7 Gear Rank (Vulnerability of EFH to Particular Gear)

The gear rank provides the vulnerability of EFH to a particular gear type and was calculated as the product of the Habitat Rank x Gear Distribution. Based upon natural breaks in the rankings frequency distribution the following interpretations of the ranking have be made: **0 = no vulnerability** to the gear. This could only be attained if the gear was not used in the habitat (gear distribution = 0). **1 - 6 = low vulnerability** to the gear. This generally occurred where the gear has minimal overlap with EFH (gear distribution = 1) and Habitat Rank was less than 7. Additionally, low vulnerability could be in habitats with high gear overlap (gear distribution = 2) but where Habitat Rank was low (3 or less). **7 - 9 = moderate vulnerability** to the gear. This typically occurred where gear overlap with EFH was high (gear distribution = 2) and habitat rank was 4 or, overlap with EFH was low (gear distribution = 1) and Habitat Rank was 7. **10 - 14 = high vulnerability** to the gear. This occurred only if the gear overlap with EFH was high (gear distribution = 2) and the habitat rank was 5 or more.

GEAR RANK (Vulnerability of EFH to particular gear) = (Habitat Rank) x (Gear Distribution)

Table 136. Summary of the criteria used to identify the EFH vulnerability determinations.

CRITERIA	RANK	KEY
Shelter	0-2	0 = no dependence 1 = lower dependence, not reliant on complex structure 2 = strong dependence, reliant on complex structure
Food	0-2	0 = no dependence on benthic prey 1 = includes benthic prey 2 = relies exclusively on benthic prey
Reproduction	0-1	0 = no dependence (e.g. spawns in water column or life stage not reproductive) 1 = dependence (e.g. spawns on or over bottom)
Habitat Sensitivity	0-2	0 = not sensitive 1 = low sensitivity (i.e. no habitat structure/complexity issues, rapid recovery rates, e.g. high energy sand habitats 2 = highly sensitive (e.g. habitat structural/complexity issues, slow recovery rates, i.e. deep water/low energy habitats)
Habitat Rank	**= Shelter + Food +Reproduction + Habitat Sensitivity**	
Gear Distribution	0-2	0 = gear not utilized in this habitat 1 = gear operates in a small portion of this habitat 2 = gear operates in much of this habitat
Gear Rank	**= Habitat Rank X Gear Distribution**	

Summary:
GEAR RANK is the vulnerability of the EFH to the gear type. In terms of the EFH Vulnerability Section, Gear Rank is the following: 0 = none, 1-6 = Low vulnerability, 7-9 = Moderate vulnerability, 10-14 = High vulnerability.

Table 137. EFH Vulnerability Matrix Analysis

Species	Shelter	Food	Reproduction	Habitat Sensitivity	Habitat Rank	Otter Trawl Distribution	Scallop Dredge Distribution	Otter Trawl Rank	Scallop Dredge Rank	Vulnerability to Otter Trawling	Vulnerability to Scallop Dredging
American Plaice (A)	1	2	1	1	5	2	2	10	10	High	High
American Plaice (J)	1	2	0	1	4	2	2	8	8	Mod	Mod
Atlantic Cod (A)	1	1	0	2	4	2	2	8	8	Mod	Mod
Atlantic Cod (J)	2	1	0	2	5	2	2	10	10	High	High
Atlantic Halibut (A)	1	1	1	1	4	2	2	8	8	Mod	Mod
Atlantic Halibut (J)	1	2	0	1	4	2	2	8	8	Mod	Mod
Atlantic Herring (E)	0	0	1	1	2	2	2	4	4	Low	Low
Atlantic Herring (SA)	0	0	1	1	2	2	2	4	4	Low	Low
Atlantic Scallops (A)	1	0	1	1	3	2	2	6	6	Low	Low
Atlantic Scallops (J)	2	0	0	1	3	2	2	6	6	Low	Low
Barndoor Skate (A)	1	1	1	1	4	2	2	8	8	Mod	Mod
Barndoor Skate (J)	1	2	0	1	4	2	2	8	8	Mod	Mod
Black Sea Bass (A)	2	1	0	2	5	2	2	10	10	High	High
Black Sea Bass (J)	2	1	0	2	5	2	2	10	10	High	High
Clearnose Skate (A)	1	1	1	1	4	2	2	8	8	Mod	Mod
Clearnose Skate (J)	1	2	0	1	4	2	2	8	8	Mod	Mod
Haddock (A)	1	2	0	2	5	2	2	10	10	High	High
Haddock (J)	2	2	0	2	6	2	2	12	12	High	High
Little Skate (A)	1	1	1	1	4	2	2	8	8	Mod	Mod
Little Skate (E)	0	0	1	1	2	2	2	4	4	Low	Low
Little Skate (J)	1	2	0	1	4	2	2	8	8	Mod	Mod
Monkfish (A)	1	1	0	1	3	2	2	6	6	Low	Low
Monkfish (J)	1	1	0	1	3	2	2	6	6	Low	Low
Ocean Pout (A)	2	2	1	2	7	2	2	14	14	High	High
Ocean Pout (E)	2	0	1	2	5	2	2	10	10	High	High
Ocean Pout (J)	2	2	0	2	6	2	2	12	12	High	High
Ocean Quahog (A)	1	0	1	1	3	2	2	6	6	Low	Low
Ocean Quahog (J)	1	0	0	1	2	2	2	4	4	Low	Low
Offshore Hake (A)	1	1	0	1	3	2	1	6	3	Low	Low
Offshore Hake (J)	1	1	0	1	3	2	1	6	3	Low	Low
Pollock (A)	1	1	1	1	4	2	2	8	8	Mod	Mod
Pollock (J)	1	1	0	1	3	2	2	6	6	Low	Low
Red Crab (A)	1	1	1	2	5	1	0	5	0	Low	None

Species	Shelter	Food	Reproduction	Habitat Sensitivity	Habitat Rank	Otter Trawl Distribution	Scallop Dredge Distribution	Otter Trawl Rank	Scallop Dredge Rank	Vulnerability to Otter Trawling	Vulnerability to Scallop Dredging
Red Crab (J)	1	1	0	2	4	1	0	4	0	Low	None
Red Hake (A)	1	2	0	1	4	2	2	8	8	Mod	Mod
Red Hake (J)	2	2	0	2	6	2	2	12	12	High	High
Redfish (A)	1	1	0	2	4	2	2	8	8	Mod	Mod
Redfish (J)	2	1	0	2	5	2	2	10	10	High	High
Rosette Skate (A)	1	1	1	1	4	2	2	8	8	Mod	Mod
Rosette Skate (J)	1	2	0	1	4	2	2	8	8	Mod	Mod
Scup (A)	1	1	0	1	3	2	2	6	6	Low	Low
Scup (J)	1	2	0	1	4	2	2	8	8	Mod	Mod
Silver Hake (A)	1	1	0	1	3	2	2	6	6	Low	Low
Silver Hake (J)	1	1	0	2	4	2	2	8	8	Mod	Mod
Smooth Skate (A)	1	2	1	1	5	2	2	10	10	High	High
Smooth Skate (J)	1	2	0	1	4	2	2	8	8	Mod	Mod
Spiny Dogfish (A)	1	1	0	1	3	2	2	6	6	Low	Low
Spiny Dogfish (J)	1	1	0	1	3	2	2	6	6	Low	Low
Summer Flound. (A)	1	1	0	1	3	2	2	6	6	Low	Low
Summer Flound. (J)	1	1	0	1	3	2	2	6	6	Low	Low
Surfclam (A)	1	0	1	1	3	2	2	6	6	Low	Low
Surfclam (J)	1	0	0	1	2	2	2	4	4	Low	Low
Thorny Skate (A)	1	1	1	1	4	2	2	8	8	Mod	Mod
Thorny Skate (J)	1	2	0	1	4	2	2	8	8	Mod	Mod
Tilefish (A)	2	2	0	1	5	2	1	10	5	High	Low
Tilefish (J)	2	2	0	1	5	2	1	10	5	High	Low
White Hake (A)	1	1	0	1	3	2	2	6	6	Low	Low
White Hake (J)	1	2	0	1	4	2	2	8	8	Mod	Mod
Windowpane Flndr (A)	1	0	0	1	2	2	2	4	4	Low	Low
Windowpane Flndr (J)	1	1	0	1	3	2	2	6	6	Low	Low
Winter Flounder (A)	1	1	1	1	4	2	2	8	8	Mod	Mod
Winter Flounder (E)	0	0	1	1	2	2	2	4	4	Low	Low
Winter Flounder (J)	1	1	0	1	3	2	2	6	6	Low	Low
Winter Skate (J)	1	2	0	1	4	2	2	8	8	Mod	Mod
Winter Skate(A)	1	1	1	1	4	2	2	8	8	Mod	Mod
Witch Flounder (A)	1	2	0	1	4	2	1	8	4	Mod	Low
Witch Flounder (J)	1	2	0	1	4	2	1	8	4	Mod	Low
Yellowtail Flound (A)	1	2	0	1	4	2	2	8	8	Mod	Mod
Yellowtail Flound (J)	1	2	0	1	4	2	2	8	8	Mod	Mod

7.2.6.3 Adverse Impacts Determination from Fishing Regulated Under the Atlantic Sea Scallop FMP

The EFH Final Rule (50 CFR Part 600) provides guidance to the Regional Fishery Management Councils for identifying fishing activities that adversely impact essential fish habitat (EFH). In addition to the EFH Final Rule, guidance provided by the Habitat Conservation Division (HCD) headquarters office of the NMFS in the form of a memo dated October 2002 was followed in the preparation of this section of Amendment 13. This evaluation should primarily include the impacts of activities associated with the fishery that is the subject of the management action, as well as other federally-managed and state-managed fishing activities. Based on the guidance provided by the EFH Final Rule and the HCD office, this determination focuses on the effects of fishing activities in the Atlantic Sea Scallop fishery on EFH. It also includes information on the effects of other federally-managed fishing activities on scallop EFH, and identifies gears used in state-managed fisheries that could affect scallop EFH. Most of the information needed to complete this determination is provided in more detail in Section 7.2.6.2.

The EFH Final Rule also stipulates "each FMP must minimize to the extent practicable the adverse effects of fishing on EFH that is designated under other federal FMPs". Federally-managed species that could be affected by the Atlantic Sea Scallop fishery are listed in

Table 138. These species and life stages were ranked according to the vulnerability of their EFH to the effects of mobile, bottom-tending gear (see Section 7.2.6.2.5).

For this determination, fishing activities are interpreted to mean fishing gears, since there is not enough information available to support a more detailed determination based on different fishing practices used with each gear type. Adverse impacts associated with each gear type are assessed for specific habitat types that make up scallop EFH. Only benthic habitats are considered, since the gears used to catch scallops are bottom-tending gears. Habitat type is based on type of substrate, and, to some extent, depth and degree of exposure to natural disturbance. These simplifications were made in order to allow maximum use of the information available and to provide an evaluation that encompasses as broad a range of the relevant fisheries and affected habitats as possible.

EFH for those ranked as moderately or highly vulnerable were included in this adverse impacts evaluation. For the purposes of this action, EFH vulnerability that is ranked as low is considered to have a potential adverse effect to EFH that is minimal and temporary in nature. Therefore, the Council will eliminate from further consideration any EFH that has a low vulnerability to scallop dredges or otter trawls. Refer to Table 137 for a detailed look at the vulnerability rankings based on shelter, food, reproduction, habitat sensitivity, habitat rank, gear distribution and gear rank. Background on how vulnerability was determined in this exercise is useful for understanding how EFH could be adversely affected as a result of fishing with different gear types. Vulnerability was divided into four broad categories, including: none (0); low (L); moderate (M); and high (H), based upon a matrix analysis of habitat function, habitat sensitivity and gear use. Several criteria were qualitatively evaluated for each life stage based upon existing information. Each evaluation consisted of a score based upon a predefined threshold. The criteria used and the key describing what each ranking stands for is described in Table 137.

Table 138. Summary species and life stage's EFH adversely impacted by otter trawling and scallop dredging (gears that adversely impact EFH used in the Scallop fishery).

Species	Lifestage	Vulnerability to Otter Trawling	Vulnerability to Scallop Dredging	Depth in meters (EFH Designation)	Substrate (EFH Designation)
American Plaice	A	High	High	45-150	sand or gravel
American Plaice	J	Mod	Mod	45-175	sand or gravel
Atlantic Cod	A	Mod	Mod	25-75	cobble or gravel
Atlantic Cod	J	High	High	10-150	rocks, pebble, gravel
Atlantic Halibut	A	Mod	Mod	20-60	sand, gravel, clay
Atlantic Halibut	J	Mod	Mod	100-700	sand, gravel, clay
Barndoor Skate	A	Mod	Mod	0-750, mostly <150	mud, gravel, and sand
Barndoor Skate	J	Mod	Mod	0-750, mostly <150	mud, gravel, and sand
Black Sea Bass	A	High	High	20-50	structures, sand and shell
Black Sea Bass	J	High	High	1-38	rough bottom, shell and eelgrass beds, structures and offshore clam beds in winter
Clearnose Skate	A	Mod	Mod	0-500, mostly <111	soft bottom along shelf and rocky or gravelly bottom
Clearnose Skate	J	Mod	Mod	0-500, mostly <111	soft bottom along shelf and rocky or gravelly bottom
Haddock	A	High	High	35-100	pebble gravel
Haddock	J	High	High	40-150	broken ground, pebbles, smooth hard sand, smooth areas between rocky patches
Little Skate	A	Mod	Mod	0-137, mostly 73-91	sand or gravel or mud
Little Skate	J	Mod	Mod	0-137, mostly 73-91	sand or gravel or mud
Ocean Pout	A	High	High	<110	soft sediments
Ocean Pout	J	High	High	<80	smooth bottom near rocks or algae
Ocean Pout	L	High	High	<50	close to hard bottom nesting areas
Ocean Pout	E	High	High	<50	hard bottom, sheltered holes
Pollock	A	Mod	Mod	15-365	hard bottom, artificial reefs
Red Hake	A	Mod	Mod	10-130	sand and mud
Red Hake	J	High	High	<100	shell and live scallops
Redfish	A	Mod	Mod	50-350	silt, mud, or hard bottom
Redfish	J	High	High	25-400	silt, mud, or hard bottom
Rosette Skate	A	Mod	Mod	33-530, mostly 74-274	soft substrates including sand/mud and mud
Rosette Skate	J	Mod	Mod	33-530, mostly 74-274	soft substrates including sand/mud

Species	Lifestage	Vulnerability to Otter Trawling	Vulnerability to Scallop Dredging	Depth in meters (EFH Designation)	Substrate (EFH Designation)
					and mud
Scup	J	Mod	Mod	0-38	inshore sand, mud, mussel and eelgrass beds
Silver Hake	J	Mod	Mod	20-270	all substrate types
Smooth Skate	A	High	High	31-874, mostly 110-457	soft mud, sand, broken shells, gravel and pebbles
Smooth Skate	J	Mod	Mod	31-874, mostly 110-457	soft mud, sand, broken shells, gravel and pebbles
Thorny Skate	A	Mod	Mod	18-2000, mostly 111-366	sand gravel, broken shell, pebble, and soft mud
Thorny Skate	J	Mod	Mod	18-2000, mostly 111-366	sand gravel, broken shell, pebble, and soft mud
Tilefish	A	High	Low	76-365	rough, sheltered bottom
Tilefish	J	High	Low	76-365	rough, sheltered bottom
White Hake	J	Mod	Mod	5-225	pelagic during pelagic stage and mud or fine sand during demersal stage
Winter Flounder	A	Mod	Mod	1-100	estuaries with mud, gravel, or sand
Winter Skate	A	Mod	Mod	0-371, mostly <111	sand, gravel, or mud
Winter Skate	J	Mod	Mod	0-371, mostly <111	sand, gravel, or mud
Witch Flounder	A	Mod	Low	25-300	fine-grained sediment
Witch Flounder	J	Mod	Low	50-450	fine-grained sediment
Yellowtail Flounder	A	Mod	Mod	20-50	sand and mud
Yellowtail Flounder	J	Mod	Mod	20-50	sand and mud

7.2.6.3.1 EFH Designation

Depth range and substrates that are included in the EFH designations for those species that have been determined to be adversely impacted indicate that, as a group, they occupy a wide range of depths and bottom types (See Table 138).

7.2.6.3.2 Gear Descriptions

Commercial fishing gear types that contact the bottom and are defined for data-reporting purposes are listed in Table 3 in Appendix VI. Some of them are federally-regulated and others that are only used in state waters are not. Federally-regulated gears that contact the bottom can be divided into two types, mobile and stationary (or fixed) gears. Mobile, bottom-tending gears fall into two major groups, trawls and dredges. Types of trawls used in the Northeast region include otter trawls for fish, scallops, and shrimp, and Scottish and Danish seines. Federally-managed dredges include scallop and clam dredges. Bottom-tending fixed gears include sink and stake gill nets, long lines, pots and traps used to catch lobsters, crabs, and fish, and floating traps. Descriptions of these gears, and other gears used in the Northeast Region, are provided in Appendix VI of this document. The descriptions for trawls and dredges include some information on individual components that contact the bottom and some details about fishing practices (types of bottom fished, towing speeds, etc.). Bottom otter trawls are described as a single category, with some information on differences in gear design and configuration for trawls used to target particular resources (fish, scallops, or shrimp) or habitat types (smooth vs. rocky bottom). Of all the bottom-tending gears that have the potential to adversely affect benthic EFH in the NE region, bottom otter trawls are the most diverse group.

7.2.6.3.3 Distribution of Fishing Activity

The five primary gears types are used federally-managed fisheries in the Northeast Region are bottom otter trawls, bottom gill nets, longlines, hydraulic clam dredges and scallop dredges. Information on the spatial distribution of fishing activity for these five gear types during 1995-2001 is provided in Section 7.2.6.2.3. The geographic distributions of the ten minute squares (TMS) of latitude and longitude by the gears used in the scallop fishery that have been demonstrated to adversely effect EFH are as follows:

Bottom trawling in federal waters in the Northeast region during 1995-2001 accounted for 150% more days absent from port as scallop dredging and 23 times more days absent than days spent fishing with clam dredges. Significant areas were closed to bottom trawlers on GB and in SNE (Map 35). Bottom trawling, more than any other fishing activity, was conducted to a greater extent in deeper water in the GOM, north of GB, and along the shelf break in SNE and the Mid-Atlantic (MA) region. A continuous area of high trawling activity occurred from the central GOM west to the coast, then through the southwestern GOM, down the west side of the Great South Channel and east across the top of Closed Area I on GB. Trawling was also reported west and south of Closed Area II on eastern GB, on the southern portion of GB, throughout most of SNE in inner, mid, and outer shelf waters, along the shelf break in the MA, and in North Carolina coastal waters. There was a large open access area with no, or minimal, trawling in the middle and inner portions of the MA shelf from the New York Bight south to the North Carolina border. Trawling activity was fairly evenly distributed among the four sub-regions of the Northeast shelf (see map of sub-regions, Map 35).

Scallop dredging in federal waters in the Northeast region during 1995-2001 accounted for less than half as many days absent as bottom trawling, but nearly ten times more time at sea than was spent dredging with hydraulic clam dredges. Scallop dredging during 1995-2001 was reported in TMS along the eastern Maine coast, in the extreme southwestern “corner” of the GOM north of Cape Cod, along the western side of the Great South Channel, along the northern edge of GB and on its southeastern flank, and in a very large continuous area reaching from the eastern end of Long Island south across the shelf that included outer shelf waters as far south as the North Carolina border (Map 40). Large expanses of bottom area in the outer GOM, in the central part of GB, in SNE, and in inner shelf waters of the MA did not support any notable amount of scallop dredging. Unlike bottom trawling, scallop dredging was almost completely confined to depths shallower than 50 fathoms. Analysis of VTR data by sub-region showed that about half of the reported scallop dredging days at sea were in the MA sub-region, about 30% in the GB sub-region (the same proportion as for trawls), 10% in SNE, and 5% or less in the GOM.

7.2.6.3.4 Summary of Adverse Impacts

7.2.6.3.4.1 Gears That Could Adversely Impact Scallop EFH

None of the five gear types that are either used to harvest the Atlantic Sea Scallops that is managed under the NEFMC Atlantic Sea Scallop FMP, or which are capable of catching scallops (i.e., as by-catch), or which are used in other federally-managed fisheries adversely affect benthic EFH for the Atlantic Sea Scallops.

7.2.6.3.4.2 Gears Used in the Scallop Fishery Adversely Effect EFH

Bottom otter trawls and scallop dredges have been determined to adversely effect EFH for a variety of species and life stages (See Table 138). This conclusion is based on the Gear Effects Evaluation in Section 7.2.6.2 and is substantiated by two recent reports.

The first of these (NREFHSC 2002) is the report of a workshop held in October 2001 that examined the habitat effects of gears used in the Northeast region on three substrate types (gravel, sand, and mud). A panel of experts concluded that otter trawls and scallop dredges were the two highest priority gears in terms of impacts, with minimal impacts for clam dredges, nets and lines, and pots and traps.

The second report (Morgan and Chuenpagdee 2003) evaluated the effects of ten different commercial fishing gears on marine ecosystems in U.S. waters[59]. The report concluded that bottom trawls and dredges have very high habitat impacts, bottom gillnets and pots and traps have low to medium impacts, and bottom longlines have low impacts. Individual types of trawls and dredges were not evaluated. The impacts of bottom gill nets, traps, and longlines were limited to warm or shallow-water environments with rooted aquatic vegetation or “live bottom” environments (e.g., coral reefs). According to the report, dredging reduces habitat complexity, leading to long term effects including decreased species richness and biomass and increased presence of weedy species. Dredging damages organisms, reduces biomass and smothers submerged aquatic vegetation (SAV) and algae. On sand, mud, and silt bottoms, dredging smooths bedforms, resuspends sediments reducing the number of species living there as a result of burial or smothering, and reduces nutrients and microbial activity. Dredging of gravel, hard-bottom, and living habitats reduces species living in the interstices of the gravel and rocks, species attached to the seafloor, and habitat complexity. Dredging causes severe habitat damage in areas that are sensitive to mobile bottom gear disturbance, particularly in areas of hard bottom and gravel.

Section 7.2.6.2.4 of this document describes the general effects of trawls and dredges on benthic marine habitats, as reported in three recent reports (ICES 2000, Johnson (2002), and NRC (2002). The report by Morgan and Chuenpagdee was not available when this summary was written, however, it generally confirms the findings of the other three reports. All four of these reports are international or national in scope and include information on the effects of types of trawls and dredges not used in the Northeast region of the U.S. (e.g., beam trawls and toothed scallop dredges) and affected habitats not found in the NE region (e.g, coral reefs and maerl beds). The conclusions reached are, nevertheless, pertinent to an evaluation of potential adverse impacts of the types of trawls and dredges used in this region.

The NRC (2002) report also identified three major effects of trawling and dredging, the first two of which are also mentioned in the ICES (2001) report:

1. Reduced habitat complexity;
2. Discernible changes in benthic communities (caused by repeated trawling and dredging);
3. Reduced productivity of benthic habitats.

[59] It also relied on input from a larger group of experts and used more scientifically-based methods for collecting and analyzing the information.

The four effects of trawling identified in the ICES (2001) report are listed in order of decreasing permanence. Given the MSA definition of "adverse" as "more than minimal and not temporary," the first effect is clearly adverse. The second effect may be permanent and the other two are not likely to be permanent. However, they are still considered as potential adverse impacts since they are effects that could persist in certain habitats that are exposed to more or less continual, or frequently repeated, trawling activity. Furthermore, given the similarity in the habitat effects of dredges and trawls noted in the NRC (2002) and Morgan and Chuenpagdee (2003) reports, all of these potential adverse effects are considered to apply equally well to both gear types.

Looking at the effects of bottom trawls, scallop dredges, and hydraulic clam dredges in the NE region, there is more specific information to evaluate. According to the October 2001 workshop report (NREFHSC 2002), otter trawls had greater overall impacts than scallop dredges, but affected physical and biological structure equally. Effects on biological structure scored higher than effects on physical structure for both gears. In addition, trawls were judged to have some effects on major physical features.

Additional information is provided in this report on the recovery times for each type of impact for all three gears in mud, sand, and gravel habitats ("gravel" includes other hard-bottom habitats). This information makes it possible to rank these three substrates in terms of their vulnerability to the effects of bottom trawling and dredging, bearing in mind that other factors such as frequency of disturbance from fishing and from natural events are also important. Otter trawls and scallop dredges were assigned higher impact scores in gravel, mud ranked second for trawls (and sand third), and sand ranked second for scallop dredges (this gear is not used in mud habitats). Clam dredges had low impacts compared to scallop dredges and trawls and are only used in sand.

Effects of trawls on major physical features in mud (deep-water clay-bottom habitats) and gravel bottom were described as permanent, and impacts to biological and physical structure were given recovery times of months to years in mud and gravel. Impacts of trawling on physical structure in sand were of shorter duration (days to months) given the exposure of most continental shelf sand habitats to strong bottom currents and/or frequent storms.

For scallop dredges in gravel, recovery from impacts to biological structure was estimated to take several years and, for impacts to physical structure, months to years. In sand, biological structure was estimated to recover within months to years and physical structure within days to months. Clam dredges are only used in sandy habitats where impacts to biological structure were estimated to last for months to years (depending on species composition) and impacts to physical structure, days to months.

Results of a comprehensive review of available gear effect publications that were relevant to the NE region of the U.S. are summarized in 7.2.6.2.4.6. Positive and negative effects of otter trawls, scallop dredges, and hydraulic clam dredges from 32 of these publications are listed by substrate type in Table 139 - Table 142 along with recovery times (when known). Without more information on recovery times, it is difficult to be certain which of the negative effects listed in these tables last for, say, more than a month or two. In fact, it is difficult to conclude in some cases (e.g., furrows produced by trawl doors) whether the habitat effect is positive, negative, or just neutral. Despite these shortcomings in the information, the scientific literature for the NE region does provide some detailed results that confirm the previous determinations of potential adverse impacts of trawls and dredges that were based on the ICES (2001), NRC (2002), and Morgan and Chuenpagdee (2003) reports.

Table 139. Effects and Recovery Times of Bottom Otter Trawls on Mud Substrate in the Northeast Region as Noted By Authors of Eight Gear Effect Studies.

Physical Effects	**Recovery**
Doors produce furrows/berms	2-18 months
Repeated tows increase bottom roughness	
Re-suspension/dispersal of fine sediments	
Rollers compress sediments	
Smoothing of surface features	
Biological Effects	
Reduced infaunal abundance	Within 3 ½ months (1 of 2 studies)
Reduced number of infaunal species	Within 3 ½ months
Reduced abundance of polychaete/bivalve species	Within 3 ½ months (1 of 2 studies)
Increased food value of sediments	
Increased chlorophyll production of surface sediments	
Removal/damage of epifauna	
Reduced abundance of brittlestars	
Increased number of infaunal species	
Increased abundance of polychaetes	
Decreased abundance of bivalves	
Altered community structure	18 months

Table 140. Effects and Recovery Times of Bottom Otter Trawls on Sand Substrate in the Northeast Region as Noted By Authors of Twelve Gear Effect Studies.

Physical Effects	**Recovery**
Doors produce furrows/berms	Few days – a year
Smoothing of surface features	Within a year
Re-suspension/dispersal of fine sediments	No lasting effects
Biological Effects	
Mortality of large sedentary and/or immobile epifaunal species	
Reduced density of attached macrobenthos	
Removal/damage of epifauna	
Reduced abundance of polychaetes	
Reduced abundance/biomass of epibenthic organisms	
Reduced biomass/average size of many epibenthic species	
Epifauna (sponges/anemones) less abundant in closed areas	

Table 141. Effects and Recovery Times of Bottom Otter Trawls on Gravel and Rock Substrate in the Northeast Region as Noted By Authors of Three Gear Effect Studies.

Physical Effects	**Recovery**
Displaced boulders	
Removal of mud covering boulders and rocks	
Groundgear leave furrows	
Biological Effects	
Reduced abundance of attached organisms (sponges, anemones, soft corals)	
Damaged sponges, soft corals, brittle stars	12 months

Table 142. Effects and Recovery Times of Chain Sweep Scallop Dredges on Sand Substrate in the Northeast Region as Noted By Authors of Three Gear Effect Studies.

Physical Effects	**Recovery**
Disturbed physical/biogenic structures	
Loss of fine surficial sediments	More than 6 months
Reduced food quality of sediments	Within 6 months
Biological Effects	
Reduction in total number of infaunal individuals	Within 6 months
Reduced abundance of some species (polychaetes/amphipods)	
Decreased densities of two megafaunal species	

Given the evidence that there are potential adverse impacts of trawls on hard-bottom, sand, and mud habitats, of scallop dredges on hard-bottom and sand habitats in the NE region, the next step is to relate the intensity of fishing activity with each of these gear types to the distribution of these three substrates in the region. This comparison is over-simplified because it does not take into account other factors such as depth and the degree of natural disturbance, the quality of the sediment distribution is limited, and fishing activity is quantified by ten minute squares (TMS) of latitude and longitude. However, it generally indicates where within the region the adverse impacts of these three gears are concentrated.

The analysis in Section 7.2.6.2.3 indicates that the ten-minute-squares (TMS) that account for most of the bottom trawling in the region overlay a high percentage (>40%) of five different sediment types (Figure 43), even though most of the TMS are associated with sand since sand is the primary sediment type in the region. The results show that dredging is more closely related to sand (and less to the other sediment types) than trawling, but scallop dredges are used over a larger area than clam dredges and in a higher percentage of sand, gravelly sand, and gravel bottom areas. Bottom trawling during 1995-2001 was almost equally divided between the Gulf of Maine, Georges Bank, southern New England, and the Mid-Atlantic sub-regions, whereas scallop and clam dredging was more concentrated in the Mid-Atlantic (Figure 44). A significant amount of scallop dredging also took place on Georges Bank, likewise for clam dredging in southern New England. The frequency of scallop dredge activity increased relative to the amount of each sediment type present, with sediment grain size on Georges Bank and in the Mid-Atlantic. The same was true for clam dredges in the Mid-Atlantic and in southern New England.

7.2.6.3.4.3 Baseline Scallop Fishing Effort In Comparison To EFH Designations

When the EFH designations of the species with vulnerable EFH are combined, almost all the ten-minute squares within the Northwest Atlantic Analysis Area contain EFH for at least one species. According to Table 143, about 47% of the entire NAAA contains EFH for 6 or more juvenile species with vulnerable EFH, as well as about 43% for adult species with vulnerable EFH. Almost 48% of all scallop fishing time occurs over areas with 6 or more juvenile EFH designations that are deemed vulnerable to bottom tending gear, and about 35% of the area fished is over EFH designations for 6 or more adult species with vulnerable EFH. The percent of area that overlaps with both juvenile and adult EFH designations for "intense" scallop fishing is lower than the percent of overlap for all scallop fishing. For example, about 38% of "intense" scallop fishing effort is over areas with 6 or more EFH designations for juvenile species with vulnerable EFH, while about 48% of all scallop fishing is over areas with 6 or more EFH designations for juvenile species with vulnerable EFH. Although "intense" scallop fishing effort occurs frequently over areas with 6 or more EFH designations (38% for juveniles, 27% for adults), the percent of effort for both life stages is significantly less than the percent of scallop effort over areas with 6 or more EFH designations for species with vulnerable EFH and it appears that intense scallop fishing effort favors areas with lower EFH ranks for both juvenile and adult stages as compared to the entire NAAA. Scallop fishing time in rotational management areas for 1998-2000 is distributed very similarly to the areas with "all scallop fishing", in terms of percent of effort in areas with vulnerable EFH. The percent of area for scallop fishing time in rotation management areas over EFH for 6 or more juvenile species with vulnerable EFH is 47%, and 34% overlap for adult species.

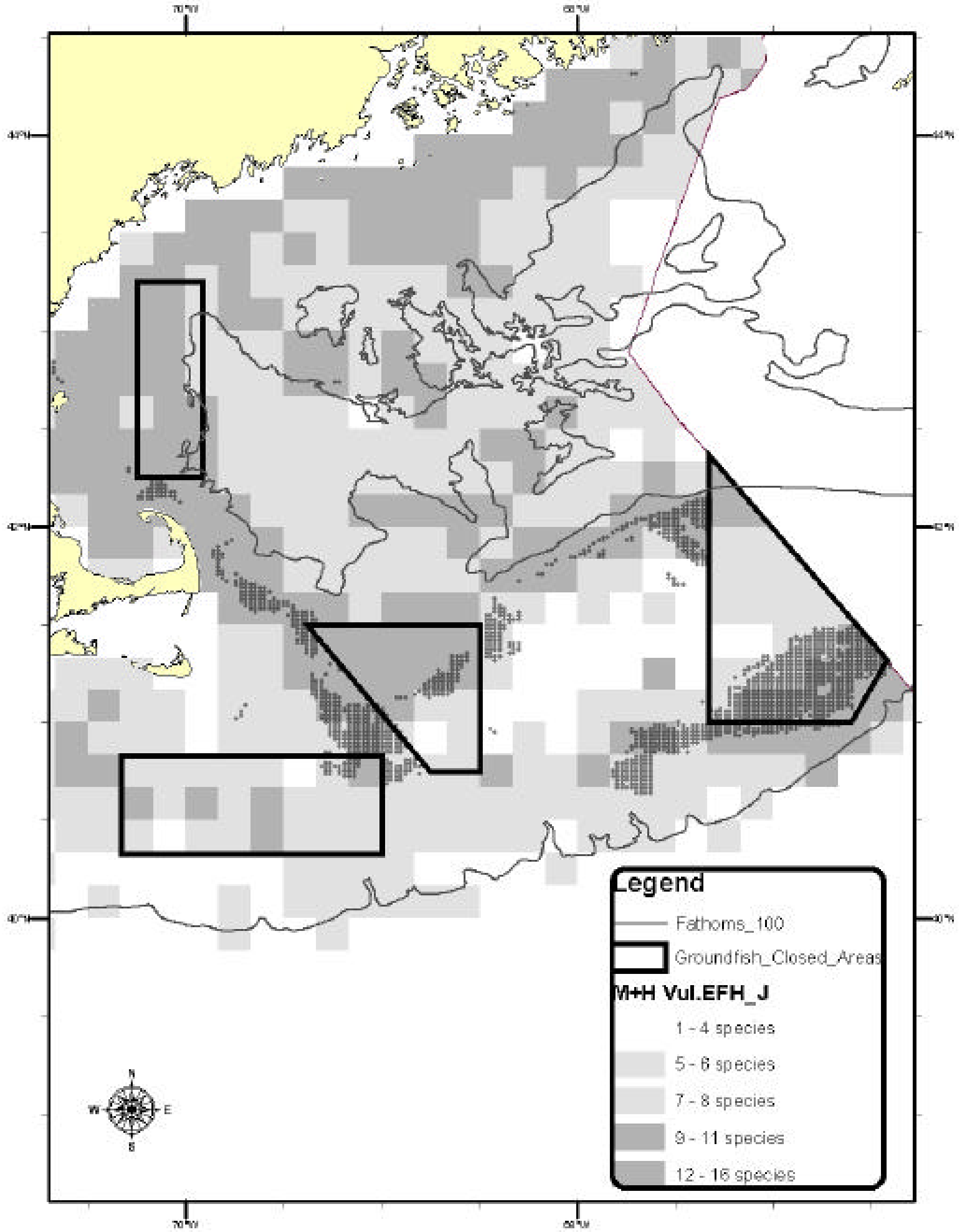
For FY2004 (with or without access to Georges Bank), the percent of area for scallop effort that overlaps with 6 or more juvenile species with vulnerable EFH increases compared to the historical scallop fishing effort within RMAs (1998-2000 baseline). On the other hand, the percent of area for scallop effort over adult EFH designations (6 or more) is less than the baseline average for effort in RMAs. The only projection estimate that has less effort over areas with 6 or more EFH designations, as compared to the baseline amount of effort in RMAs, is the 2005-2007 estimates with access to Georges Bank. The long-term averages with Georges Bank access are higher than the baseline in terms of percent of area that overlaps with 6 or more EFH designations for both adults and juveniles. According to the analysis, effort under a rotational area management strategy has a bias toward areas having more than 6 EFH designations for species with vulnerable EFH, since the percent of projected effort over these areas increases with all projections, except for the 2005-2007 with access to Georges Bank..

Table 143. Comparison of percent of area in NAAA and percent of effort for historic baselines and rotation management area projections

Note: It was realized later that the EFH values for juvenile whiting was inadvertently left out of this analysis. The values in this table would not change significantly with or without whiting EFH values because the EFH distribution of juvenile EFH is very widespread

	Percent of area or fishing area swept meeting EFH designation criterion	
	Juvenile	Adult
	6 or more species	6 or more species
EFH Designation area (Total NAAA)	47.0%	42.6%
Historic baselines		
All scallop fishing time	47.6%	34.9%
Scallop fishing time in square nautical mile blocks with 50+hours of annual fishing time (“intense” scallop fishing)	37.8%	27.3%
Scallop fishing time in rotation management areas (1998 - 2000 Baseline; 2002 = 6,773 nm^2; 2003 = 7,485 nm^2)	47.0%	33.9%
Rotation management area projections		
2004 without Georges Bank access (5,395 nm^2)	52.9%	28.0%
2004 with Georges Bank access (3,892 nm^2)	52.8%	31.4%
2005 - 2007 with Georges Bank access (5,070 nm^2)	42.8%	22.6%
Long-term averages with Georges Bank access (10,119 nm^2)	57.0%	36.6%

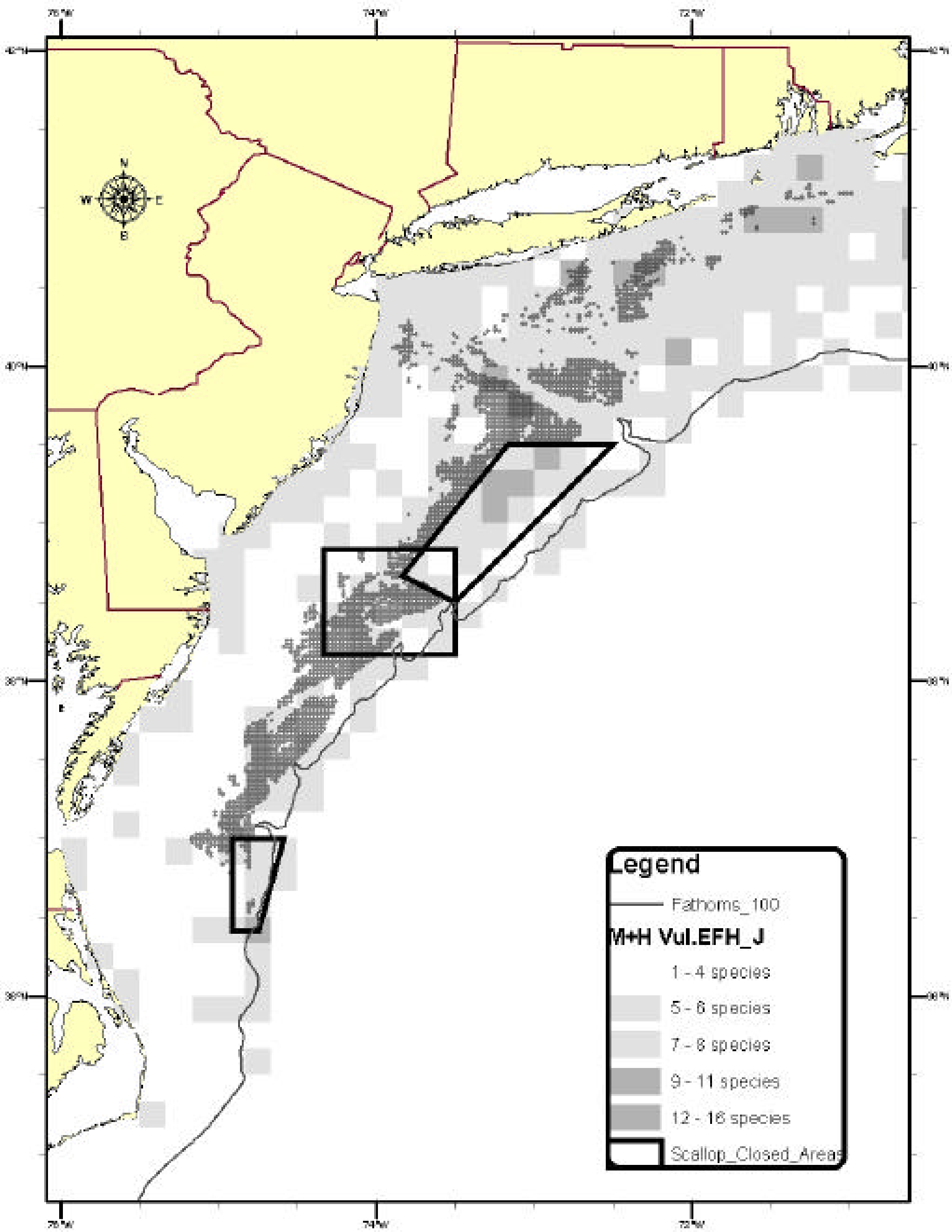
Map 41 and Map 42 describe the overlap of intense scallop effort and EFH designations for species with juvenile EFH vulnerable to bottom tending gear. Intense scallop effort is defined as one nautical mile blocks with over 50 hours of scallop fishing time (average per year) based on 1998-2000 VMS data. Areas of intense scallop effort in the Gulf of Maine region overlap with areas that are designated for greater than nine (9), particularly in the Great South Channel and the southeastern portion of Georges Bank (See Map 41). It is noteworthy that the amount of scallop fishing effort in the southeastern portion of Georges Bank may have been more intense than normal in 1998-2000 due to the access programs that allowed scallop vessels in the closed areas during this time period. Further, the Great South Channel may have been more intensively fished than normal because of other closures in the Gulf of Maine displacing effort into that area. Nevertheless, there are areas in the Gulf of Maine region where intense scallop effort overlaps with areas of high juvenile EFH value. Conversely, in the Mid-Atlantic, scallop effort occurred primarily over areas that are designated for a fewer number of species with vulnerable juvenile EFH (**Map 42**). There are only small areas of intense effort that overlap with ten-minute squares that are designated for over 9 species.



Map 41. Overlap of INTENSE scallop fishing effort in 1998-2000 with juvenile EFH designations for species with EFH that is vulnerable to bottom tending gear (Gulf of Maine region only).

Note: Dots represent 1 nmi2 squares with >50 hours of fishing effort per year.

EFH designations are broken down into 5 categories in the legend, but for display purposes the map only has three categories (1-4 species (white), 5-8 species (light gray), and 9-16 species (dark gray)).



Map 42. Overlap of INTENSE scallop effort in 1998-2000 with juvenile EFH designations for species with EFH vulnerable to bottom tending gear (Mid-Atlantic region only).
Note: Dots represent 1 nmi2 squares with >50 hours of fishing effort per year.
EFH designations are broken down into 5 categories in the legend, but for display purposes the map only has three categories (1-4 species (white), 5-8 species (light gray), and 9-16 species (dark gray)).

The following conclusions can therefore be reached:

1. Potentially adverse habitat impacts from bottom trawling occur throughout most of the NE region on a variety of substrates;

2. High levels of fishing activity with scallop dredges occur primarily in the Mid-Atlantic region and secondarily on Georges Bank, according to the vessel trip report data from 1995 – 2001. Intense dredge activity from the same data show that the highest intensity of scallop fishing is in the Great South Channel and portions of the Mid-Atlantic region from Long Island to VA (Map 36). The VMS data from 1998 confirms this assessment (Map 41 and Map 42), and also shows high scallop fishing intensity in the southern part of Closed Area II because the period included the area access program during the 1999 and 2000 fishing years which was intended to have high levels of effort to reduce impacts in open areas where smaller scallops existed.

3. Potentially adverse habitat impacts from scallop dredging may occur in areas where scallop effort overlaps with areas where EFH has been designated for species with vulnerable EFH. According to the analysis within this document, scallop fishing effort is distributed in the same proportion as juvenile and adult EFH designations, but areas with more intense scallop fishing effort tend to be over areas with less EFH designations for species with vulnerable EFH.

Based on these conclusions, bottom trawls are determined to have the largest adverse impact to benthic habitats in the NE region because they are used on more days at sea than dredges, and therefore affect a larger area of bottom, and because they affect a variety of substrates over a large area. It must be noted, however, that there is a large variety of bottom otter trawls that are designed to be used in specific bottom conditions to catch certain species, and that some of them affect benthic habitats more so than others. This conclusion therefore refers to bottom otter trawls in a generic sense. Scallop dredges (specifically, New Bedford style chain sweep dredges) rank second.

7.2.6.3.4.4 Cumulative Impacts of Bottom Trawls and Scallop Dredges

Because the potential adverse impacts of trawls and dredges are so similar bottom otter trawls and scallop dredges can be considered as a group and their cumulative effects as a function of the fishing activity of the two gears added together. In state waters, which are designated as EFH for one or more species in the multi-species assemblage, the cumulative effects of mobile, bottom-tending gear would also include adverse impacts from other types of dredges listed in Appendix VI. The combined effect of otter trawls and scallop dredges was ranked considerably higher in gravel (and other hard-bottom habitats) than in sand (ranked second) and mud (ranked third)). Impacts on biological structure were considered to be more severe than impacts on physical structure, with removal of major physical features ranking third). A fourth effect, changes in benthic prey, was not adequately evaluated because there was not enough information available. Combined impacts to gravel and sand habitat were primarily to biological structure, with gravel ranking higher than sand. Impacts on physical structure were judged to be the same in gravel and sand. Impacts in mud ranked low, with removal of major physical structures scoring higher than impacts to physical and biological structure.

7.2.6.3.4.5 Species/Life Stages With Vulnerable EFH

A final step in the process of assessing the potential adverse impacts that was taken for this amendment is the determination of which of the 39 federally-managed species in the Northeast region have EFH which is vulnerable to the adverse impacts of otter trawls and scallop dredges (Table 138). This evaluation was conducted by examining known life history information for each benthic life stage of these species that describes how habitat features such as three-dimensional structure and prey populations are affected by fishing activities for each gear type. Twenty-three species were determined to have EFH for at least one life stage that was moderately or highly vulnerable to the adverse effects of mobile, bottom-tending gear. Species and life stages that are not listed are adult and juvenile offshore hake, juvenile pollock, adult silver hake and white hake, juvenile winter flounder, adult and juvenile scallops and adult and juvenile windowpane. Assessments of habitat management measures that are intended to minimize the adverse impacts of fishing in this amendment/EIS should focus on the species and life stages.

The Council concurs with the EFH vulnerability determinations and has determined the following:

Notes:E = eggs lifestage, L = larvae lifestage, J = juvenile lifestage, and A = adult lifestage

Otter Trawls

The use of Otter Trawls may have an adverse effect on the following species (and life stages) EFH as designated in Amendment 11 to the Northeast Multispecies FMP (1998):

American plaice (Juvenile (J), Adult (A)), Atlantic cod (J, A), Atlantic halibut (J, A), haddock (J, A), ocean pout (E, L, J, A), red hake (J, A), redfish (J, A), white hake (J), silver hake (J), winter flounder (A), witch flounder (J, A), yellowtail flounder (J, A), red crab (J, A), black sea bass (J, A), scup (J), tilefish (J, A), barndoor skate* (J, A), clearnose skate* (J, A), little skate* (J, A), rosette skate* (J, A), smooth skate* (J, A), thorny skate* (J, A), and winter skate* (J, A).

Scallop Dredge (New Bedford style)

The use of New Bedford style Scallop Dredges may have an adverse effect on the following species (and life stages) EFH as designated in Amendment 11 to the Northeast Multispecies FMP (1998):

American plaice (J, A), Atlantic cod (J, A), Atlantic halibut (J, A), haddock (J, A), ocean pout (E, L, J, A), red hake (J, A), redfish (J, A), white hake (J), silver hake (J), winter flounder (J, A), yellowtail flounder (J, A), black sea bass , (J, A), scup (J), barndoor skate* (J, A), clearnose skate* (J, A), little skate* (J, A), rosette skate* (J, A), smooth skate* (J, A), thorny skate* (J, A), and winter skate* (J, A).

Gear types other than otter trawls and scallop dredges, in the context of the Atlantic Sea Scallop fishery, were not found to have adverse effects the Essential Fish Habitat as currently designated in this region.

7.2.6.4 Non-Magnuson-Stevens Act Fishing Activities that may Adversely Affect EFH

There are a number of fishing activities that may adversely affect EFH that are not necessarily managed under the Magnuson-Stevens Act. For example, state fisheries, some recreational fisheries, subsistence fishing, and even research projects. When these activities are added together, they may have the potential to cumulatively impact habitat. It is difficult to keep track of every non-Magnuson fishing activity, and measure all of these activities occurring along the coast, but the EFH Regional Steering Committee has gathered information about the various fishing gears used in the Northeastern United States and their potential effects on EFH. Table 144 describes the fishing gears used in estuaries and bays, coastal waters, and offshore waters of the EEZ from Maine to North Carolina. Notice the variety of gears used in state waters for non-Magnuson related fishing activities, and whether these gears come in contact with the bottom or not. An update of non-Magnuson-Stevens Act fishing activities that may adversely affect EFH will be completed in the next Habitat Omnibus Amendment.

Table 144. Fishing gears used in estuaries and bays, coastal waters, and offshore waters of the EEZ, from Maine to North Carolina.
Includes all gear responsible for 1% or greater of any state's total landings and all gear that harvested any amount of federally managed species. Based upon 1999 NMFS landings data and 2000 ASMFC Gear Report.
(Shaded areas represent gears that are federally managed and contact the bottom)

GEAR	Estuary or Bay	Coastal 0-3 Miles	Offshore 3-200 Miles	Contacts Bottom	Federally Regulated
Bag Nets	X	X	X		X
Beam Trawls	X	X	X	X	X
By Hand	X	X			X
Cast Nets	X	X	X		
Clam Kicking	X			X	
Diving Outfits	X	X	X		
Dredge Clam	X	X	X	X	X
Dredge Conch	X			X	
Dredge Crab	X	X		X	
Dredge Mussel	X	X		X	
Dredge Oyster, Common	X			X	
Dredge Scallop, Bay	X			X	
Dredge Scallop, Sea		X	X	X	X
Dredge Urchin, Sea		X	X	X	
Floating Traps (Shallow)	X	X		X	X
Fyke And Hoop Nets, Fish	X	X		X	
Gill Nets, Drift, Other			X		X
Gill Nets, Drift, Runaround			X		X
Gill Nets, Sink/Anchor, Other	X	X	X	X	X
Gill Nets, Stake	X	X	X	X	X
Haul Seines, Beach	X	X		X	
Haul Seines, Long	X	X		X	
Haul Seines, Long(Danish)		X	X	X	X

Hoes	X			X	
Lines Hand, Other	X	X	X		X
Lines Long Set With Hooks		X	X	X	X
Lines Long, Reef Fish		X	X	X	X
Lines Long, Shark		X	X		X
Lines Troll, Other		X	X		X
Lines Trot With Baits		X	X		X
Otter Trawl Bottom, Crab	X	X	X	X	
Otter Trawl Bottom, Fish	X	X	X	X	X
Otter Trawl Bottom, Scallop		X	X	X	X
Otter Trawl Bottom, Shrimp	X	X	X	X	X
Otter Trawl Midwater		X	X		X
Pots And Traps, Conch	X	X		X	
Pots and Traps, Crab, Blue Peeler	X	X		X	
Pots And Traps, Crab, Blue	X	X		X	
Pots And Traps, Crab, Other	X	X	X	X	X
Pots And Traps, Eel	X	X		X	
Pots and Traps, Lobster Inshore	X	X		X	
Pots and Traps, Lobster Offshore			X	X	X
Pots and Traps, Fish	X	X	X	X	X
Pound Nets, Crab	X	X		X	
Pound Nets, Fish	X	X		X	
Purse Seines, Herring		X	X		X
Purse Seines, Menhaden		X	X		
Purse Seines, Tuna		X	X		X
Rakes	X			X	
Reel, Electric or Hydraulic		X	X		X
Rod and Reel	X	X	X		X
Scottish Seine		X	X	X	X
Scrapes	X			X	
Spears	X	X	X		
Stop Seines	X			X	
Tongs and Grabs, Oyster	X			X	
Tongs Patent, Clam Other	X			X	
Tongs Patent, Oyster	X			X	
Trawl Midwater, Paired		X	X		X
Weirs	X			X	

7.2.6.5 Non-fishing Related Activities that may Adversely Affect EFH

The Omnibus Habitat Amendment (1998), Amendment 9 to the Scallop FMP, identified numerous potential non-fishing threats to essential fish habitat. The chemical, biological, and physical threats to riverine, inshore, and offshore habitats are extensively discussed in Section 5.2 of the Omnibus document. Overall, the major threats to marine and aquatic habitats are a result of increasing human population and coastal development, which is contributing to an increase of human generated pollutants. These pollutants are being discharged directly into riverine and inshore habitats by way of both *point* and *non-point* sources of pollution. Point sources of pollution include industrial discharge, power plants, sewage treatment plants, disposal of dredged materials, energy and mineral exploration, marine transportation, coastal and port development, and erosion. Non-point sources include run-off, wildlife feces, industrial shipping, recreational boating, septic systems, and contaminated groundwater and sediments. Table 145 summarizes the Non-Fishing Related Threats to EFH. Refer to Amendment 9 to the Scallop FMP (1998) for a more complete discussion of these potential threats. These and other non-fishing related activities that may adversely affect EFH will be updated in the next Habitat Omnibus Amendment.

Table 145. Non-Fishing Related Threats to EFH and Activities and Sources Contributing the Threats (*Source: Habitat Omnibus Am. (1998))*

	Chemical												**Biological**			**Physical**																		
																				erosion control						*diversion*			*mining*					
ACTIVITIES & SOURCES ("2°" ≡ secondary source)	oil	heavy metals	nutrients	pesticides	herbicides / fungicide	acid	chlorine	thermal	metabolic / food	suspended particles	radioactive wastes	greenhouse gases	exotic / reared	nuisance / toxic algae	pathogens	channel dredge	dredge and fill	marina/dock	vessel activity	bulkheads	seawalls	jetties	groins	tidal restriction	dam	water withdrawal	irrigation	deforestation	gravel / mineral	oil / gas mining	peat mining	debris	artificial reefs	dredged material
non-point sources																																		
municipal run-off	X	X	X	X	X	X			X	X	X			X	X																	X		
agricultural run-off	X	X	X	X	X	X			X	X				X	X																			
atmospheric deposition		X	X	X	X	X				X	X	X																						
wildlife feces			X						X					X	X																			
septic systems			X				X		X					X	X																			
industrial shipping	X	X	X							X			X	X	X	X		X	X										X	X	X	X		X
recreational boating	X	X	X							X			X	X		X		X	X													X		X
contaminated		X	X	X	X	X	X				X			X																				
contaminated sediments	X	X	X	X							X			X																				X
nuisance / toxic algae (2°)			X						X						X																			
point sources																																		
industrial discharge		X	X			X	X	X	X	X	X			X																				
power plants	X	X					X	X			X														X									
sewage treatment plants			X			X	X		X					X	X																			
ocean disposal of	X	X	X	X						X				X																				
aquariums			X										X		X																			
biotechnology labs													X		X																			
silviculture			X						X	X				X														X						
water diversion			X	X	X					X				X	X									X	X	X	X							
decaying shoreline																		X	X													X		
energy and mineral	X		X							X				X															X	X	X			X
marine transportation	X	X								X						X		X	X															X
coastal development			X	X	X											X	X	X	X	X	X	X	X	X	X	X	X	X						X
port / harbor development																X	X	X	X	X	X	X	X	X	X			X				X		X
erosion control										X										X	X	X	X	X	X									

7.2.6.6 Conservation and Enhancement

The Magnuson-Stevens Fishery Conservation and Management Act requires all fishery management plans (FMPs) to identify actions to promote the conservation and management of fishery resources. Prior to the concept of essential fish habitat (EFH), conservation primarily involved management measures to reduce overfishing and rebuild overfished stocks. The Habitat Omnibus Amendment (1998) strengthened the role of the New England Fishery Management Council to further conserve and enhance EFH and related fishery resources. Section 6.0 of the EFH Amendment describes options to avoid, minimize, or compensate for the adverse effects of activities identified as non-fishing threats to essential fish habitat.

The conservation and enhancement options promoted by the Council include, as directed in the Interim Final Rule: the enhancement of rivers, streams, and coastal areas; improving water quality and quantity; watershed analysis and planning; and habitat creation. The Habitat Omnibus Amendment detailed recommendations to address fishing threats including chemical, biological, and physical threats. Furthermore, the state, non-profit, and other federal agencies that are working with the Council to develop programs to monitor and research habitat are highlighted in that document as well. This section will be updated in the next Habitat Omnibus Amendment.

7.2.6.7 Prey Species

Appendix A of the Habitat Omnibus Amendment (1998) describes the life history and habitat characteristics of all Council-managed species. The abundance of major prey items in the diet of these managed species are listed within the Appendix, which are based on the NEFSC bottom trawl survey data. This information is important to consider when analyzing prey species and essential fish habitat, however existing law does not require the Council to define prey species as EFH. Technical guidance from NOAA general counsel encouraged the Councils to identify the prey species for the species managed under the FMP and describe the habitat of those significant prey species to aid in the determination of adverse effects to their habitat. This information should be included in the “adverse effects” section of the EFH FMP, rather than the description and identification section. Therefore, the Habitat Omnibus Amendment is sufficient to date, and the EFH Source Documents should be referred to when evaluating adverse effects of EFH (Appendix A of EFH Amendment). The prey species of sea scallops and other managed species in the region will be updated in the next Habitat Omnibus Amendment.

7.2.6.8 Research and Information Needs

The regulatory text of the EFH Final Rule directs the Council to include in the EFH amendment recommendations, preferably in priority order, for research efforts that the Council and NMFS view as necessary for carrying out their EFH management mandate. The need for additional research is to make available sufficient information to support a higher level of description and identification of EFH. Additional research may also be necessary to identify and evaluate actual and potential adverse effects on EFH including, but not limited to, direct physical alteration, impaired habitat quality/functions, cumulative impacts from fishing, or indirect adverse effects such as sea level rise, global warming and climate shifts, and non-equipment related fishery impacts. The need for additional research on the effects of fishing equipment on EFH is also included. The research needed to quantify and mitigate adverse effects on EFH is identified in this amendment as well.

The Council hopes to coordinate with NMFS in identifying research priorities for EFH; therefore, the Council supports the recent work compiled by the Northeast Region EFH Steering Committee (2000). Table 146 is the result of what the EFH Steering Committee discussed related to habitat research needs. Five major research categories were identified: habitat characterization needs, gear impacts, specific habitat studies, data collection needs, and anthropogenic impacts. Research priority is given when appropriate, and potential funding sources are identified as well. The Habitat Technical Team recognizes that all research priorities are important, but the cost and length of a project are critical factors in determining its overall priority and practicality. The length of recovery for a specific habitat type may be a realistic goal for short-term research, but until a determination is made on how fish are linked to these habitats, management will not benefit from these projects. The Council's Habitat Technical Team identified high-resolution mapping of the ocean floor as the research need with the highest benefit to EFH research, but it also carries the highest price tag. Furthermore, it is important for the Council to assist the research community to identify what habitat research is currently taking place, so future research can be directed to complete these projects into one integrated EFH dataset for the Northwest Atlantic.

Table 146. Essential Fish Habitat Research Needs (Identified by the EFH Steering Committee)

Research Category	Research Need	Priority	Potential Funding Source	Council/ ASMFC Interest
Habitat Characterization Needs	Provide high resolution benthic/sediment mapping of mid-Atlantic and New England areas	HIGH	Examples - NOAA (Habitat Characterization Initiative), NMFS, Sea Grant, Councils	All
	# Identify and describe biogenic structure and biological communities associated with different physical habitat types	HIGH		All
	# Develop mechanism for fishing industry-supported, high resolution sediment mapping in the Gulf of Maine and Georges Bank. Use Canadian sea scallop industry mapping effort as an example to establish process for similar mapping efforts in U.S. waters	HIGH	NE Cooperative Research Funds	NEFMC
	Identify nursery and overwintering habitats for black sea bass	HIGH	MAFMC-TAC	MAFMC ASMFC
	Identify nursery and overwintering habitats for scup	Med.	MAFMC-TAC	MAFMC ASMFC
	Identify Loligo squid spawning areas	Med.	MAFMC-TAC	MAFMC
	Identify dogfish pupping areas	Med.	MAFMC-TAC	All
	Identify Atlantic herring spawning areas	Med.		NEFMC ASMFC
	Identify spring spawning bluefish areas in South Atlantic Bight	Low		MAFMC ASMFC
	Refine identification of summer flounder nursery habitat	Low		MAFMC ASMFC

Research Category	Research Need	Priority	Potential Funding Source	Council/ ASMFC Interest
Gear Impacts	Assess effects of specific mobile bottom gear types along a gradient of effort, on specific habitat types	HIGH	NOAA, MAFMC, NEFMC	All
	# Effects on tilefish burrows	HIGH		MAFMC
	# Effects on Loligo egg mops	HIGH		MAFMC
	# Effects on soft muddy bottom communities	HIGH		NEFMC
	# Identify and compare/contrast impacts to a variety of habitat types (mud, sand, gravel, cobble, rock, boulder) associated with the various fishing gear types used in New England and Mid-Atlantic fisheries	HIGH		All
	# Explore options for the development of new otter trawl, scallop and clam dredge, and other fishing gear designs that have less contact and impact on the benthos than current fishing gear designs	Med.		All
	Effects on ecosystems as compared to other anthropogenic impacts and natural perturbations	HIGH	Cooperative Research Funding	NEFMC MAFMC
	# Identify and establish baseline sites throughout the New England and Mid-Atlantic regions where fishing effort has been minimal	HIGH		All
	Determine recovery rates for various habitat types	HIGH		All
	Identify fishing grounds and SAV distributions to locate where the two overlap and identify the changes in beds over time	Med.		MAFMC ASMFC
	Effects of dredging for surf clams and ocean quahogs	Med.		NEFMC MAFMC
	Effects of ghost fishing gear	Low		MAFMC ASMFC
Specific Habitat Studies	Determine the functional value of various habitat types	HIGH		All
	# Distribution and value of relic shoal habitat along the mid-Atlantic coast	HIGH		MAFMC
	# Investigate the conditions and benthos that contribute to groundfish settlement and recruitment. Identify the areas where this happens with some regularity	HIGH		NEFMC MAFMC
	# Relationship between SAV and environmental quality of fish habitat and relative importance of SAV to other habitat types	Med.		All
	# Role of artificial fish habitats, both intentional and accidental, in the health of fishery species	Med.		All
	# Importance of "open sand bottoms" in shallow areas for various fish	Low		MAFMC ASMFC
	# Tagging/in situ observations to estimate habitat home range of species at critical life stages	Low		All
Data Collection Needs	Develop a reporting system and/or expand vessel tracking system to collect high resolution data on the distribution of fishing effort	HIGH	NMFS	All
Anthropogenic Impacts (non-fishing)	Effects on fish communities due to alterations to mud flat habitats	Med.		All
	Identify impediments to anadromous and catadromous fish passage on rivers and assess their impacts	Med.		All
	Effects of power plants on fish populations due to habitat change, entrainment and impingement	Low		All

7.2.6.9 Identification of HAPCs

This review will take place during the next Habitat Omnibus Amendment scheduled to be completed in 2004. The process for considering new HAPC proposals is outlined in the Council's Habitat Annual Review and Report of 2000. This process will be followed during the next Omnibus Amendment.

7.2.6.10 Review and Revision of EFH Components of FMP's

The Council is in the process of initiating a Omnibus EFH Amendment to all the FMPs under the Council's jurisdiction. This next Amendment will review and revise the EFH components of all the Council's FMPs. The EFH Final Rule requires this review and revision at least once every five (5) years. Since the Council implemented the first EFH Omnibus Amendment in 1998, the initiation of the second Omnibus Amendment in 2003 will satisfy the requirements of the SFA.

7.2.7 Protected Species

The following Sections contain a complete list of species that are protected either by the Endangered Species Act of 1973 (ESA) or the Marine Mammal Protection Act of 1972 (MMPA), and may be found within the scallop fishery management unit (Northeast Region) as described under the existing FMP and proposed Amendment 10. The Sections are presented in order of their potential impact from scallop fishing activities.

The potential impacts to protected species that may result from the management alternatives and measures being considered under this FMP are described in Section 8.3.1. The sections below will focus on the status of the various species listed below that are found in the scallop management unit and may be affected by the fishing operations occurring under the existing Scallop FMP and proposed Amendment 10. Additional background information on the range-wide status of these species can be found in a number of published documents, including sea turtle status reviews (NMFS and USFWS 1995, Marine Turtle Working Group - TEWG, 1998, 2000) and biological reports (USFWS 1997), recovery plans for the Kemp's Ridley sea turtle (USFWS and NMFS 1992), Atlantic green sea turtle (NMFS and USFWS 1998a), leatherback sea turtle (NMFS and USFWS 1992), and loggerhead sea turtle (NMFS and USFWS 1998b); and the 2000 and Draft 2001 Marine Mammal Stock Assessment Reports (Waring et al. 2000, 2001).

The Council has reviewed the current information available on the distribution and habitat needs of the endangered, threatened, and otherwise protected species listed in the Sections below in relation to the action being considered in the existing Scallop FMP and proposed Amendment 10. The Council has concluded that scallop fishing operations, as managed by the existing FMP and proposed Amendment 10, are not expected to affect the bulk of these species, thus restricting the protected species impact assessment to the endangered green, leatherback, and Kemp's Ridley, and the threatened loggerhead sea turtles; and the candidate species barndoor skate.

7.2.7.1 Protected Species Inhabiting the Scallop Management Unit

Cetaceans

Northern right whale (*Eubalaena glacialis*)	Endangered
Humpback whale (*Megaptera novaeangliae*)	Endangered
Fin whale (*Balaenoptera physalus*)	Endangered
Blue whale (*Balaenoptera musculus*)	Endangered
Sei whale (*Balaenoptera borealis*)	Endangered
Sperm whale (*Physeter macrocephalus*)	Endangered
Minke whale (*Balaenoptera acutorostrata*)	Protected
Harbor porpoise (*Phocoena phocoena*)	Protected
Risso's dolphin (*Grampus griseus*)	Protected
Pilot whale (*Globicephala* spp.)	Protected
White-sided dolphin (*Lagenorhynchus acutus*)	Protected
Common dolphin (*Delphinus delphis*)	Protected
Spotted and striped dolphins (*Stenella* spp.)	Protected
Bottlenose dolphin (*Tursiops truncatus*)	Protected

Seals

Harbor seal (*Phoca vitulina*)	Protected

Gray seal (*Halichoerus grypus*)	Protected
Harp seal (*Phoca groenlandica*)	Protected

Sea Turtles

Leatherback sea turtle (*Dermochelys coriacea*)	Endangered
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered
Green sea turtle (*Chelonia mydas*)	Endangered
Hawksbill sea turtle (*Eretmochelys imbricata*)	Endangered
Loggerhead sea turtle (*Caretta caretta*)	Threatened

Fish

Shortnose sturgeon (*Acipenser brevirostrum*)	Endangered
Atlantic salmon (*Salmo salar*)	Endangered
Barndoor Skate (*Dipturis laevis)*	Candidate Species

Birds

Roseate tern (*Sterna dougallii dougallii*)	Endangered
Piping plover (*Charadrius melodus*)	Endangered

Critical Habitat Designations

Right whale	Cape Cod Bay Great South Channel

7.2.7.2 Protected Species not Affected by the Scallop Plan

Right Whale

The northern right whale has the highest risk of extinction of all large whales; with the western North Atlantic subpopulation only estimated to number approximately 300 animals. Scarcity of right whales is the result of an 800-year history of whaling that continued into the 1960s (Klumov 1962). By the time the species was internationally protected in 1935 there may have been fewer than 100 North Atlantic right whales in the western North Atlantic (Hain 1975; Reeves et al. 1992; Kenney et al. 1995).

Right whales appear to prefer shallow coastal waters, but their distribution is also strongly correlated to zooplankton prey distribution (Winn et al. 1986). In the western North Atlantic, they are found west of the Gulf Stream and are most commonly associated with cooler waters (<21º C).

NMFS designated three right whale critical habitat areas on June 3, 1994 (59 FR 28793) to help protect important right whale foraging and calving areas within the U.S. These areas are: Cape Cod Bay; the Great South Channel (both off Massachusetts); and the waters adjacent to the southern Georgia and northern Florida coast. In 1993, Canada's Department of Fisheries declared two conservation areas for right whales; one in the Grand Manan Basin in the lower Bay of Fundy, and a second in Roseway Basin between Browns and Baccaro Banks (Canadian Recovery Plan for the North Atlantic Right Whale 2000).

Right whales feed on zooplankton through the water column, and in shallow waters may feed near the bottom. In the Gulf of Maine they have been observed feeding primarily on copepods, by skimming at or below the water's surface with open mouths (NMFS 1991; Kenney et al. 1986; Murison and Gaskin 1989; and Mayo and Marx 1990). Research suggests that right whales must locate and exploit extremely dense patches of zooplankton to feed efficiently (Waring et al. 2000). New England waters include important foraging habitat for right whales and at least some portion of the right whale population is present in these waters throughout most months of the year. They are most abundant in Cape Cod Bay between February and April (Hamilton and Mayo 1990; Schevill et al. 1986; Watkins and Schevill 1982) and in the Great South Channel in May and June (Kenney et al. 1986; Payne et al. 1990) where they have been observed feeding predominantly on copepods, largely of the genera *Calanus* and *Pseudocalanus* (Waring et al. 2000). Right whales also frequent Stellwagen Bank and Jeffrey's Ledge, as well as Canadian waters including the Bay of Fundy and Browns and Baccaro Banks, in the spring and summer months. Mid-Atlantic waters are used as a migratory pathway from the spring and summer feeding/nursery areas to the winter calving grounds off the coast of Georgia and Florida.

The major known sources of anthropogenic mortality and injury of right whales clearly are ship strikes and entanglement in commercial fishing gear. Right whales are known to become entangled in fixed gear. However, no right whales have ever been observed or reported taken in the mobile dredge and bottom trawl gear used to catch scallops. The apparent preference of right whale prey resources to mid-water or surface zones further makes it unlikely that the scallop fishery will affect the species.There are several cetaceans protected under the Marine Mammal Protection Act of 1972 (MMPA) that are found within the management unit of the Scallop FMP (Northeast Region waters), namely the minke whale, Risso's dolphin, pilot whale, Atlantic white-sided dolphin, common dolphin, spotted and striped dolphins, and the coastal form of Atlantic bottlenose dolphin. These species are common along the continental shelf from the Gulf of Maine to Cape Hatteras, and generally forage for small schooling fish species, zooplankton, or squid that are found either near the surface or in the mid-water levels.

Although these species may occasionally become entangled or otherwise entrapped in bottom tending fixed gear or in mid-water trawls, it is unlikely that the bottom-tending dredge and trawl gear used by the scallop fishery will affect these species.

Humpback Whale

Humpback whales calve and mate in the West Indies and migrate to feeding areas in the northwestern Atlantic during the summer months. Most of the humpbacks that forage in the Gulf of Maine visit Stellwagen Bank and the waters of Massachusetts and Cape Cod Bays. Sightings are most frequent from mid-March through November between 41º N and 43º N, from the Great South Channel north along the outside of Cape Cod to Stellwagen Bank and Jeffreys Ledge (CeTAP 1982), and peak in May and August. However, small numbers of individuals may be present in this area year-round. They feed on a number of species of small schooling fishes, particularly sand lance and Atlantic herring, by filtering large amounts of water through their baleen to capture prey (Wynne and Schwartz 1999).

Humpback whales use the Mid-Atlantic as a migratory pathway. However, observations of juvenile humpbacks since 1989 in the Mid-Atlantic have been increasing during the winter months, peaking January through March (Swingle et al. 1993). The whales using this Mid-Atlantic area were found to be residents of the Gulf of Maine and Atlantic Canada (Gulf of St. Lawrence and Newfoundland) feeding groups, suggesting a mixing of different feeding stocks in the Mid-Atlantic region. New information has become available on the status and trends of the humpback whale population in the North Atlantic that indicates the population is increasing (Barlow and Clapham 1997).

The major known sources of anthropogenic mortality and injury of humpback whales include entanglement in commercial fishing gear and ship strikes. Humpback whale entanglements in fixed gear are well documented. However, no humpback whales have ever been observed or reported taken in the mobile dredge and bottom trawl gear used to catch scallops. The apparent preference of humpback whale prey resources to mid-water or surface zones make it further unlikely to be affected by the scallop fishery.

Fin Whale

In the North Atlantic today, fin whales are widespread and occur from the Gulf of Mexico and Mediterranean Sea northward to the edges of the arctic pack ice (NMFS 1998a). Most migrate seasonally from relatively high-latitude Arctic feeding areas in the summer to relatively low-latitude breeding and calving areas in the winter (Perry et al. 1999).

The overall distribution of fin whales may be based on prey availability. This species preys opportunistically on both zooplankton and fish (Watkins et al. 1984). The predominant prey of fin whales varies greatly in different geographical areas depending on what is locally available. In the western North Atlantic fin whales feed on a variety of small schooling fish (i.e., herring, capelin, sand lance) as well as squid and planktonic crustaceans (Wynne and Schwartz 1999). As with humpback whales, fin whales feed by filtering large volumes of water for their prey through their baleen plates. Photo identification studies in western North Atlantic feeding areas, particularly in Massachusetts Bay, have shown a high rate of annual return by fin whales, both within years and between years (Seipt et al. 1990).

As discussed above, fin whales were the focus of commercial whaling, primarily in the 20th century. The IWC did not begin to manage commercial whaling of fin whales in the North Atlantic until 1976, and the species was not given total protection until 1987, with the exception of a subsistence-whaling hunt for Greenland. In total, there have been 239 reported kills of fin whales from the North Atlantic from 1988 to 1995.

As was the case for the right and humpback whales, fin whale populations were heavily affected by commercial whaling. The remaining major known sources of anthropogenic mortality and injury of fin whales include ship strikes and entanglement in commercial fishing gear. However, no fin whales have ever been observed or reported taken in the mobile dredge and bottom trawl gear used to catch scallops. The apparent preference of fin whale prey resources to mid-water or surface zones make it further unlikely to be affected by the scallop fishery.

Blue Whale

Like the fin whale, blue whales occur worldwide and are believed to follow a similar migration pattern from northern summering grounds to more southern wintering areas (Perry et al. 1999). Blue whales are only occasional visitors to east coast U.S. waters. They are more commonly found in Canadian waters, particularly the Gulf of St. Lawrence where they are present for most of the year, and in other areas of the North Atlantic. It is assumed that blue whale distribution is governed largely by food requirements (NMFS 1998b). In the Gulf of St. Lawrence, blue whales appear to predominantly feed on several copepod species (NMFS 1998b).

Blue whales were intensively hunted in all of the world's oceans from the turn of the century to the mid-1960's when development of steam-powered vessels and deck-mounted harpoon guns in the late 19th century made it possible to exploit them on an industrial scale (NMFS 1998b). Although entanglements in fishing gear and ship strikes may be the major sources of mortality and injury of blue whales, confirmed deaths or serious injuries are few. As with the other baleen whales discussed above, the apparent preference of blue whale prey resources to mid-water or surface zones make it unlikely to be affected by gear used in the scallop fishery.

Sei Whale

Sei whales are a widespread species in the world's temperate, subpolar and subtropical and even tropical marine waters, favoring deep water, over the continental slope or in basins situated between banks. In the western North Atlantic, the whales travel along the eastern Canadian coast in autumn on their way to and from the Gulf of Maine and Georges Bank where they occur in winter and spring. Within the Northeast Region, the sei whale is most common on Georges Bank and into the Gulf of Maine/Bay of Fundy region during spring and summer. Individuals may range as far south as North Carolina.

Although sei whales may prey upon small schooling fish and squid in the Northeast Region, available information suggests that zooplankton is the primary prey of this species. There are occasional influxes of sei whales further into Gulf of Maine waters, presumably in conjunction with years of high copepod abundance inshore. Sei whales are occasionally seen feeding in association with right whales in the southern Gulf of Maine and in the Bay of Fundy, although there is no evidence of interspecific competition for food resources.

Sei whales became the target of modern commercial whalers primarily in the late 19th and early 20th century after stocks of other whales, including right, humpback, fin and blues, had already been depleted. Few instances of injury or mortality of sei whales due to entanglement or vessel strikes have been recorded in U.S. waters. Entanglement is not known to impact this species in the U.S. Atlantic, possibly because sei whales typically inhabit waters further offshore than most commercial fishing operations, or perhaps entanglements do occur but are less likely to be observed. As with the other baleen whales discussed above, the apparent preference of sei whale prey resources to mid-water or surface zones make it unlikely to be affected by gear used in the scallop fishery.

Sperm Whale

Sperm whales range from Greenland to the Gulf of Mexico and the Caribbean in the western North Atlantic.

The IWC estimates that nearly a quarter-million sperm whales were killed worldwide in whaling activities between 1800 and 1900 (IWC 1971). With the advent of modern whaling the larger rorqual whales were targeted. However as their numbers decreased, whaling pressure again focused on smaller rorquals and sperm whales. From 1910 to 1982 there were nearly 700,000 sperm whales killed worldwide from whaling activities (Clarke 1954). Some sperm whales were also taken off the U.S. Mid-Atlantic coast (Reeves and Mitchell 1988; Perry et al. 1999), and in the northern Gulf of Mexico (Perry et al. 1999). Recorded North Atlantic sperm whale catch numbers for Canada and Norway from 1904 to 1972 total 1,995. All killing of sperm whales was banned by the IWC in 1988.

Sperm whales generally occur in waters greater than 180 meters in depth with a preference for continental margins, seamounts, and areas of upwelling, where food is abundant (Leatherwood and Reeves 1983). Waring et al. (1993) suggest sperm whale distribution is closely correlated with the Gulf Stream edge with a migration to higher latitudes during summer months where they are concentrated east and northeast of Cape Hatteras. Distribution extends further northward to areas north of Georges Bank and the Northeast Channel region in summer and then south of New England in fall, back to the Mid-Atlantic Bight (Waring et al. 2000).

Few instances of injury or mortality of sperm whales due to human impacts have been recorded in U.S. waters. Because of their generally more offshore distribution and their benthic feeding habits, sperm whales are found at the fringe of the area fished by scallop vessels. In addition, they are unlikely to be affected by mobile gear used in the scallop fishery.

Minke Whale

Minke whales have a cosmopolitan distribution in polar, temperate, and tropical waters. The species is common and widely distributed along the U.S. continental shelf. They show a certain seasonal distribution with spring and summer peak numbers, falling off in the fall to very low winter numbers. Like all baleen whales, the minke whale generally occupies the continental shelf proper, feeding on small schooling fish or zooplankton in the upper or mid-water zones.

Although minke whales may occasionally become entangled or otherwise entrapped in fixed sink gillnet or lobster trap gear, it is unlikely that the mobile dredge and trawl gear used by the scallop fishery will affect these species.

Risso's Dolphin and Pilot Whale

The Risso's dolphin and pilot whale are two odontocetes with similar distribution and feeding patterns. Both species are distributed along the continental shelf edge of North America from Cape Hatteras to Georges Bank. Both species have been observed taken in the pelagic drift gillnet, pelagic longline, and mid-water trawl fisheries, but have never been reported in the dredge gear. Although their feeding habitat overlaps with the distribution of the scallop fishery, their pelagic prey species (squid and schooling fishes) would make it unlikely that they would encounter the bottom tending mobile gear used in the scallop fishery.

Atlantic White-Sided Dolphin

White-sided dolphins are found in the temperate and sub-polar waters of the North Atlantic, primarily on the continental shelf waters out to the 100-meter depth contour. The species is distributed from central western Greenland to North Carolina, with the Gulf of Maine stock commonly found from Hudson Canyon to Georges Bank and into the Gulf of Maine to the Bay of Fundy. White-sided dolphins have been observed taken in the multispecies sink gillnet, the pelagic drift gillnet, and several mid-water and bottom trawl fisheries. Although their feeding habitat overlaps with the distribution of the scallop fishery, their pelagic prey species (squid and schooling fishes) would make it unlikely that they would encounter the bottom tending mobile gear used in the scallop fishery.

Pelagic Delphinids (Common, Spotted, Striped, and Offshore Bottlenose Dolphins)

The pelagic delphinid complex is made up of small odontocete species that are broadly distributed along the continental shelf edge where depths range from 200 - 400 meters. They are commonly found in large schools feeding on schools of fish. The minimum population estimates for each species number in the tens of thousands found on or near the surface. They are known to be taken in pelagic and sink gillnets gear as well as mid-water trawl gear. Their pelagic prey species suggest they do not forage near the bottom, making it unlikely that they would encounter the bottom tending gear used in the scallop fishery.

Harbor Porpoise

Harbor porpoise are found primarily in the Gulf of Maine in the summer months. However, they migrate seasonally through regions where scallops are caught. For example, they move through the southern New England area where the scallop fishery occurs in the spring (March and April). Harbor porpoise also move through the Massachusetts Bay and Jeffrey's Ledge region in the spring (April and

May) and the fall (October November). They are not known to frequent the Georges Bank region where scallops are also found. They forage on small pelagic and benthic fish. They are not known to interact with slow moving bottom tending mobile gear such as scallop dredges and trawls. Therefore, vessels participating in the scallop fishery are not expected to have an impact on harbor porpoise.

Coastal Bottlenose Dolphins

The coastal form of the bottlenose dolphin occurs in the shallow, relatively warm waters along the U.S. Atlantic coast from New Jersey to Florida and the Gulf of Mexico. They rarely range beyond the 25-meter depth contour north of Cape Hatteras. They forage on small coastal fish, and rarely are found in the deeper cold-water regions where the scallop fishery occurs. Therefore, vessels participating in the scallop fishery are not expected to have an impact on the coastal form of bottlenose dolphin.

Harbor Seal

The harbor seal is found in all nearshore waters of the Atlantic Ocean above about 30 degrees latitude (Waring et al. 2001). In the western North Atlantic they are distributed from the eastern Canadian Artic and Greenland south to southern New England and New York, and occasionally the Carolinas (Boulva and McLaren 1979; Gilbert and Guldager 1998). It is believed that the harbor seals found along the U.S. and Canadian east coasts represent one population (Waring et al. 2001). Harbor seals are year-round inhabitants of the coastal waters of eastern Canada and Maine, and occur seasonally along the southern New England and New York coasts from September through late-May. However, breeding and pupping normally occur only in waters north of the New Hampshire/Maine border. Since passage of the MMPA in 1972, the number of seals found along the New England coast has increased nearly five-fold with the number of pups seen along the Maine coast increasing at an annual rate of 12.9 percent during the 1981-1997 period (Gilbert and Guldager 1998). The minimum population estimate for the harbor seal is 30,990 based on uncorrected total counts along the Maine coast in 1997 (Waring et al. 2001). They forage on small pelagic and benthic fish, and rarely are found in the deeper cold-water regions where the scallop fishery occurs. Therefore, vessels participating in the scallop fishery are not expected to have an impact on harbor seals.

Gray Seal

The gray seal is found on both sides of the North Atlantic, with the western North Atlantic population occurring from New England to Labrador. There are two breeding concentrations in eastern Canada; one at Sable Island and one that breeds on the pack ice in the Gulf of St Lawrence. There are several small breeding colonies on isolated islands along the coast of Maine and on outer Cape Cod and Nantucket Island in Massachusetts (Waring et al. 2001). The population estimates for the Sable Island and Gulf of St Lawrence breeding groups was 143,000 in 1993. The gray seal population in Massachusetts has increased from 2,010 in 1994 to 5,611 in 1999, although it is not clear how much of this increase may be due to animals emigrating from northern areas. Approximately 150 gray seals have been observed on isolated island off Maine. They forage on small pelagic and benthic fish, and rarely are found in the deeper cold-water regions where the scallop fishery occurs. Therefore, vessels participating in the scallop fishery are not expected to have an impact on gray seals.

Harp Seal

The harp seal occurs throughout much of the North Atlantic and Artic Oceans, and have been increasing off the East Coast of the United States from Maine to New Jersey. Harp seals are usually found off the U.S. from January to May when the western stock of harp seals is at their most southern point of migration (Waring et al. 2001). Harp seals congregate on the edge of the pack ice in February through April when breeding and pupping takes place. The harp seal is highly migratory, moving north and south with the edge of the pack ice. Non-breeding juveniles will migrate the farthest south in the winter, but the entire population moves north toward the Artic in the summer. They forage on small pelagic fish, and rarely are found in the deeper cold-water regions where the scallop fishery occurs. Therefore, vessels participating in the scallop fishery are not expected to have an impact on harp seals.

Hawksbill Sea Turtle

The hawksbill turtle is relatively uncommon in the waters of the Northeast Region. Hawksbills prefer coral reefs, such as those found in the Caribbean and Central America where they feed primarily on a wide variety of sponges and mollusks. There are accounts of small hawksbills stranded as far north as Cape Cod, Massachusetts. However, many of these strandings were observed after hurricanes or offshore storms. No takes of hawksbill sea turtles have been recorded in northeast or Mid-Atlantic fisheries where observers have been deployed in the scallop dredge and trawl fisheries.

Hawksbills may occur in the southern range of the scallop management unit (i.e., North Carolina and South Carolina), but their distribution is not known to overlap with those waters fished by vessels that may catch scallop. Therefore, it is unlikely that interactions between hawksbill sea turtles and scallop vessels will occur.

Shortnose Sturgeon

The shortnose sturgeon is a benthic fish that mainly occupies the deep channel sections of several Atlantic coast rivers. They can be found in most major river systems from the St. Johns River, Florida to the Saint John River in New Brunswick, Canada. There have been no documented cases of shortnose sturgeon taken in dredge gear used to catch scallops.

The scallop fishery in the Northeast Region does not extend to shallow water, or into the intertidal zone of major river systems where shortnose sturgeon are likely to be found. Therefore, there appears to be adequate separation between the two species making it highly unlikely that the scallop fisheries will affect shortnose sturgeon.

Atlantic Salmon

The wild populations of Atlantic salmon found in rivers and streams from the lower Kennebec River north to the U.S.-Canada border are considered to be endangered. These rivers include the Dennys, East Machias, Machias, Pleasant, Narraguagus, Ducktrap, and Sheepscot Rivers and Cove Brook. Atlantic salmon are an anadromous species with spawning and juvenile rearing occurring in freshwater rivers followed by migration to the marine environment. Juvenile salmon in New England rivers typically migrate to sea in May after a two to three year period of development in freshwater streams, and remain at sea for two winters before returning to their U.S. natal rivers to spawn from mid October through early November. While at sea, salmon generally undergo an extensive northward migration to waters off Canada and Greenland. Data from past commercial harvest indicate that post-smolts overwinter in the southern Labrador Sea and in the Bay of Fundy. The numbers of wild Atlantic salmon that return to these rivers are perilously small, with total run sizes of approximately 150 spawners occurring in 1999 (Baum 2000).

Capture of Atlantic salmon in U.S. commercial fisheries or by research/survey vessels have occurred. However, none have been documented after 1992. No scallop landings have been recorded for the areas adjacent to the Atlantic salmon rivers. In addition, the NMFS fishery research surveys have rarely found scallop in the nearshore regions of the Atlantic salmon rivers. Therefore, it is unlikely that operation of the scallop fisheries occurs in or near the rivers where concentrations of Atlantic salmon are most likely to be found. Furthermore, bottom-tending gear used in the scallop fishery is not likely to encounter salmon in the open water environment, making it is highly unlikely that the fisheries occurring under the existing Scallop FMP and proposed Amendment 10 will affect the endangered runs of Atlantic salmon in the Gulf of Maine.

Roseate Tern and Piping Plover

The roseate tern and piping plover inhabit coastal waters and nest on coastal beaches within the Northeast Region. The terns prey on small schooling fishes, and the plovers prey on shoreline invertebrates and other small fauna. Foraging activity for these species occurs either along the shoreline (plovers) or within the top several meters of the water column (terns). Bottom-tending dredge and trawl gear used in the scallop fishery pose no threat to these species or their forage species.

Right Whale Critical Habitat

Two right whale critical habitat areas (Great South Channel and Cape Cod Bay) have been designated within the scallop fishery management unit. However, the Great South Channel area is the only one where scallop fishing activity occurs. The potential effects of several fisheries operations on both prey availability and quality and nursery protection in the critical habitat have been evaluated in other FMP's (Multispecies, Lobster, Monkfish, and Spiny Dogfish). The concern has been that the operation of these fisheries could diminish the value of the habitat by altering trophic dynamics that could reduce the availability of right whale prey within the critical habitat areas. However, right whales feed primarily on copepods that live in the mid-water zone, making it highly unlikely that bottom-tending scallop gear will have any adverse effect on these small copepods.

7.2.7.3 Protected Species that May be Affected by the Scallop Plan

Loggerhead Sea Turtle

Loggerhead sea turtles occur throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans in a wide range of habitats. These include open ocean, continental shelves, bays, lagoons, and estuaries (NMFS and USFWS 1995). Loggerhead sea turtles are primarily benthic feeders, opportunistically foraging on crustaceans and mollusks (Wynne and Schwartz 1999). Under certain conditions they may also scavenge fish (NMFS and USFWS 1998b). Horseshoe crabs are known to be a favorite prey item in the Chesapeake Bay area (Lutcavage and Musick 1985).
Status and Trends of Loggerhead Sea Turtles

The loggerhead sea turtle was listed as threatened under the ESA on July 28, 1978. The species was considered to be a single population in the North Atlantic at the time of listing. However, further genetic analyses conducted at nesting sites indicate the existence of five distinct subpopulations ranging from North Carolina, south along the Florida east coast and around the keys into the Gulf of Mexico, to nesting sites in the Yucatan peninsula and Dry Tortugas (TEWG 2000 and NMFS SEFSC 2001). Natal homing to those nesting beaches is believed to provide the genetic barrier between these nesting aggregations, preventing recolonization from turtles from other nesting beaches.

The loggerhead sea turtle is the most abundant of the sea turtles listed as threatened or endangered in the U.S. waters. In the western North Atlantic, most loggerhead sea turtles nest from North Carolina to Florida and along the gulf coast of Florida. The total number of nests along the U.S. Atlantic and Gulf coasts between 1989 and 1998, ranged from 53,014 to 92,182 annually, with a mean of 73,751. Since a female often lays multiple nests in any one season, the average adult female population was estimated to be 44,780 (Murphy and Hopkins 1984).

However, the status of the northern loggerhead subpopulation is of particular concern. Based on the above, there are only an estimated 3,800 nesting females in the northern loggerhead subpopulation, and the status of this northern population based on number of loggerhead nests, has been classified declining or stable (TEWG 2000). Another factor that may add to the vulnerability of the northern subpopulation is that genetics data show that the northern subpopulation produces predominantly males (65%). In contrast, the much larger south Florida subpopulation produces predominantly females (80%) (NMFS SEFSC 2001).

The activity of the loggerhead is limited by temperature. Loggerheads commonly occur throughout the inner continental shelf from Florida through Cape Cod, Massachusetts. Loggerheads may also occur as far north as Nova Scotia when oceanographic and prey conditions are favorable. Surveys conducted offshore as well as sea turtle stranding data collected during November and December off North Carolina suggest that sea turtles emigrating from northern waters in fall and winter months may concentrate in nearshore and southerly areas influenced by warmer Gulf Stream waters (Epperly et al. 1995). This is supported by the collected work of Morreale and Standora (1998) who tracked 12 loggerheads and 3 Kemp’s ridleys by satellite. All of the turtles followed similar spatial and temporal corridors, migrating south from Long Island Sound, New York, during October through December. The turtles traveled within a narrow band along the continental shelf and became sedentary for one or two months south of Cape Hatteras.

Loggerhead sea turtles do not usually appear on the most northern summer foraging grounds in the Gulf of Maine until June, but are found in Virginia as early as April. They remain in the Mid-Atlantic and Northeast areas until as late as November and December in some cases, but the majority leave the Gulf of Maine by mid-September. Aerial surveys of loggerhead turtles north of Cape Hatteras indicate that they are most common in waters from 22 to 49 meters deep, although they range from the beach to waters beyond the continental shelf (Shoop and Kenney 1992).

All five loggerhead subpopulations are subject to natural phenomena that cause annual fluctuations in the number of young produced. For example, there is a significant overlap between hurricane seasons in the Caribbean Sea and northwest Atlantic Ocean (June to November), and the loggerhead sea turtle nesting season (March to November). Sand accretion and rainfall that result from these storms as well as wave action can appreciably reduce hatchling success. In 1992, Hurricane Andrew affected turtle nests over a 90-mile length of coastal Florida; all of the eggs were destroyed by storm surges on beaches that were closest to the eye of this hurricane (Milton et al. 1994). Other sources of natural mortality include cold stunning and biotoxin exposure.

General Human Impacts and Entanglements

The diversity of the sea turtles life history leaves them susceptible to many human impacts, including impacts on land, in the benthic environment, and in the pelagic environment. Anthropogenic factors that impact the success of nesting and hatching include: beach erosion, beach armoring and nourishment; artificial lighting; beach cleaning; increased human presence; recreational beach equipment; beach driving; coastal construction and fishing piers; exotic dune and beach vegetation; and poaching. An increased human presence at some nesting beaches or close to nesting beaches has led to secondary threats such as the introduction of exotic fire ants, and an increased presence of native species (e.g., raccoons, armadillos, and opossums) which raid and feed on turtle eggs.

Loggerhead sea turtles originating from the western Atlantic nesting aggregations are believed to lead a pelagic existence in the North Atlantic gyre for as long as 7-12 years before settling into benthic environments. Loggerhead sea turtles are impacted by a completely different set of threats from human activity once they migrate to the ocean. During that period, they are exposed to a series of long-line fisheries that include the U.S. Atlantic tuna and swordfish longline fisheries, an Azorean long-line fleet, a Spanish long-line fleet, and various fleets in the Mediterranean Sea (Aguilar et al. 1995, Bolten et al. 1994, Crouse 1999). Observer records indicate that an estimated 6,544 loggerheads were captured by the U.S. Atlantic tuna and swordfish longline fleet between 1992-1998, of which an estimated 43 were dead (Yeung 1999). For 1998, alone, an estimated 510 loggerheads (225-1250) were captured in the longline fishery. Aguilar et al. (1995) estimated that the Spanish swordfish longline fleet, which is only one of the many fleets operating in the region, captures more than 20,000 juvenile loggerheads annually (killing as many as 10,700).

Once loggerheads enter the benthic environment in waters off the coastal U.S., they are exposed to a suite of fisheries in federal and State waters including trawl, purse seine, hook and line, gillnet, pound net, longline, and trap fisheries. Loggerhead sea turtles are captured in fixed pound net gear in the Long Island Sound, in pound net gear and trawls in summer flounder and other finfish fisheries in the Mid-Atlantic and Chesapeake Bay, in gillnet fisheries in the Mid-Atlantic and elsewhere, and in monkfish, spiny dogfish, and northeast sink gillnet fisheries. Recent NMFS observer information has recorded 11 loggerhead sea turtles taken in the Scallop dredge fishery during June through October of 2001. In addition, preliminary observer data from the 2002 scallop fishery has identified 23 sea turtles taken in the Hudson Canyon Area Access Program. Evaluation of the 2002 takes is incomplete.

Sea Turtle Takes in Dredge Gear

NMFS observers have reported sea turtle takes in dredge gear prior to 2001. A sea turtle take was observed in each of four observed dredge trips occurring in the Mid-Atlantic area from 1996-1999. Of these, only three were attributed to dredge gear, as one was a severely decomposed unidentified turtle wrapped in gillnet gear. These three were all released alive, although one unidentified turtle did have a cracked carapace. The other two released turtles were identified as a green and a loggerhead, both estimated to be about 60 – 70cm in size. All but one of the takes occurred in September in the New York bight area. One occurred off the mouth of the Chesapeake Bay in July.

A significant number of scallop dredge trips (191) were observed from 1999-2000 in Closed Area I and II and in the Nantucket Light Ship area without any sea turtle takes being reported. This supports the sea turtle distributional data shown in **Map 51** that indicate low levels of sea turtles in those areas.

A total of eleven sea turtle takes were observed in 2001 where observer effort was focused on the Hudson Canyon closed area that had just been opened. Ten of these events occurred in that area from June through October. The eleventh event occurred off the Delmarva Peninsula in October. Although the species identification of each take has not been verified, the reported status of the turtles were reported as nine released alive, one dead, and one seriously injured (cracked carapace). In addition, observer data from the 2002 scallop fishery has identified 23 sea turtles taken in the Hudson Canyon Area Access Program. Two of these turtles were decomposed carcasses and thus were not attributed to the scallop dredge fishery. No turtles were observed or reported to have been captured in the Virginia Beach Scallop Closed Area during 2002.

As seen in 2001, the condition of these 23 sea turtles observed included uninjured animals, as well as alive/injured and dead turtles. In all, of the 40 sea turtles reported captured in scallop dredge gear from 1996 to 2002, 23 were reported alive with no injuries, 6 were reported injured (one subsequently died on deck), 6 were of unknown condition, and 5 were dead (including the two decomposed carcasses mentioned above).

In addition to fishery interactions, loggerhead sea turtles also face other man-made threats in the marine environment. These include oil and gas exploration and coastal development, as well as marine pollution, underwater explosions, and hopper dredging. Offshore artificial lighting, power plant entrainment and/or impingement, and entanglement in debris or ingestion of marine debris are also seen as possible threats. Boat collisions and poaching are two direct impacts that affect loggerheads.

Kemp's Ridley Sea Turtle

The Kemp's ridley is the most endangered of the world's sea turtle species. Of the world's seven extant species of sea turtles, the Kemp's ridley has declined to the lowest population level. Kemp's ridleys nest in daytime aggregations known as arribadas, primarily on a stretch of beach in Mexico called Rancho Nuevo. Most of the population of adult females nest in this single locality (Pritchard 1969). When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand 1963). By the early 1970s, the world population estimate of mature female Kemp's ridleys had been reduced to 2,500-5,000 individuals. The population declined further through the mid-1980s.

Status and Trends of Kemp's Ridley Sea Turtles

The TEWG (1998; 2000) indicated that the Kemp's ridley population appears to be in the early stage of exponential expansion. Nesting data, estimated number of adults, and percentage of first time nesters have all increased from lows experienced in the 1970's and 1980's. From 1985 to 1999, the number of nests observed at Rancho Nuevo and nearby beaches has increased at a mean rate of 11.3% per year, allowing cautious optimism that the population is on its way to recovery. For example, nesting data indicated that the number of adults declined from a population that produced 6,000 nests in 1966 to a population that produced 924 nests in 1978 and 702 nests in 1985 then increased to produce 1,940 nests in 1995. Estimates of adult abundance followed a similar trend from an estimate of 9,600 in 1966 to 1,050 in 1985 and 3,000 in 1995. The increased recruitment of new adults is illustrated in the proportion of neophyte, or first time nesters, which has increased from 6% to 28% from 1981 to 1989 and from 23% to 41% from 1990 to 1994.

Kemp's ridley nesting occurs from April through July each year. Little is known about mating but it is believed to occur before the nesting season in the vicinity of the nesting beach. Hatchlings emerge after 45-58 days. Once they leave the beach, neonates presumably enter the Gulf of Mexico where they feed on available sargassum and associated infauna or other epipelagic species (USFWS and NMFS 1992). Ogren (1988) suggests that the Gulf coast, from Port Aransas, Texas, through Cedar Key, Florida, represents the primary habitat for subadult ridleys in the northern Gulf of Mexico. However, at least some juveniles will travel northward as water temperatures warm to feed in productive coastal waters off Georgia through New England (USFWS and NMFS 1992).

Juvenile Kemp's ridleys use northeastern and Mid-Atlantic coastal waters of the U.S. Atlantic coastline as primary developmental habitat during summer months, with shallow coastal embayments serving as important foraging grounds. Ridleys found in Mid-Atlantic waters are primarily post-pelagic juveniles averaging 40 centimeters in carapace length, and weighing less than 20 kilograms (Terwilliger and Musick 1995). Next to loggerheads, they are the second most abundant sea turtle in Virginia and

Maryland waters, arriving in these areas during May and June (Keinath et al., 1987; Musick and Limpus, 1997). Studies have found that post-pelagic ridleys feed primarily on a variety of species of crabs. Mollusks, shrimp, and fish are consumed less frequently (Bjorndal, 1997).

With the onset of winter and the decline of water temperatures, ridley's migrate to more southerly waters from September to November (Keinath et al., 1987; Musick and Limpus, 1997). Turtles who do not head south soon enough face the risks of cold-stunning in northern waters. Cold stunning can be a significant natural cause of mortality for sea turtles in Cape Cod Bay and Long Island Sound. For example, in the winter of 1999/2000, there was a major cold-stunning event where 218 Kemp's ridleys, 54 loggerheads, and 5 green turtles were found on Cape Cod beaches. The severity of cold stun events depends on: the numbers of turtles utilizing Northeast waters in a given year; oceanographic conditions; and the occurrence of storm events in the late fall. Cold-stunned turtles have also been found on beaches in New York and New Jersey. Cold-stunning events can represent a significant cause of natural mortality, in spite of the fact that many cold-stun turtles can survive if found early enough.

General human impacts and entanglement

Like other turtle species, the severe decline in the Kemp's ridley population appears to have been heavily influenced by a combination of exploitation of eggs and impacts from fishery interactions. From the 1940's through the early 1960's, nests from Ranch Nuevo were heavily exploited (USFWS and NMFS 1992), but beach protection in 1966 helped to curtail this activity (USFWS and NMFS 1992). Currently, anthropogenic impacts to the Kemp's ridley population are similar to those discussed for other sea turtle species. Takes of Kemp's ridley turtles have been recorded by sea sampling coverage in the Northeast otter trawl fishery, pelagic longline fishery, and southeast shrimp and summer flounder bottom trawl fisheries. However, there have been no known takes of Kemp's ridley sea turtles in the scallop fishery.

Kemp's ridleys may also be affected by large-mesh gillnet fisheries. In the spring of 2000, a total of five Kemp's ridley carcasses were recovered from a North Carolina beach where 277 loggerhead carcasses were found. Cause of death for most of the turtles recovered was unknown, but the mass mortality event was suspected to have been from a large-mesh gillnet fishery operating offshore in the preceding weeks. It is possible that strandings of Kemp's ridley turtles in some years have increased at rates higher than the rate of increase in the Kemp's ridley population (TEWG 1998).

Green Sea Turtle

Green turtles are distributed circumglobally. In the western Atlantic they range from Massachusetts to Argentina, including the Gulf of Mexico and Caribbean, but are considered rare north of Cape Hatteras (Wynne and Schwartz, 1999). Most green turtle nesting in the continental United States occurs on the Atlantic Coast of Florida (Ehrhart 1979). Green turtles were traditionally highly prized for their flesh, fat, eggs, and shell, and directed fisheries in the United States and throughout the Caribbean are largely to blame for the decline of the species. In the Gulf of Mexico, green turtles were once abundant enough in the shallow bays and lagoons to support a commercial fishery. However, declines in the turtle fishery throughout the Gulf of Mexico were evident by 1902 (Doughty 1984).

In the continental United States, green turtle nesting occurs on the Atlantic coast of Florida (Ehrhart 1979). Occasional nesting has been documented along the Gulf coast of Florida, at southwest Florida beaches, as well as the beaches on the Florida panhandle (Meylan et al., 1995). The pattern of green turtle nesting shows biennial peaks in abundance, with a generally positive trend during the ten years of regular monitoring, perhaps due to increased protective legislation throughout the Caribbean (Meylan et al., 1995). Increased nesting has also been observed along the Atlantic Coast of Florida, on beaches where only loggerhead nesting was observed in the past (Pritchard 1997). Recent population estimates for the western Atlantic area are not available.

While nesting activity is obviously important in determining population distributions, the remaining portion of the green turtle's life is spent on the foraging and breeding grounds. Juvenile green sea turtles occupy pelagic habitats after leaving the nesting beach. Pelagic juveniles are assumed to be omnivorous, but with a strong tendency toward carnivory during early life stages. At approximately 20 to 25 cm carapace length, juveniles leave pelagic habitats and enter benthic foraging areas, shifting to a chiefly herbivorous diet (Bjorndal 1997). Green turtles appear to prefer marine grasses and algae in shallow bays, lagoons and reefs (Rebel 1974) but also consume jellyfish, salps, and sponges.

As is the case for loggerhead and Kemp's ridley sea turtles, green sea turtles use Mid-Atlantic and northern areas of the western Atlantic coast as important summer developmental habitat. Green turtles are found in estuarine and coastal waters as far north as Long Island Sound, Chesapeake Bay, and North Carolina sounds (Musick and Limpus 1997). Like loggerheads and Kemp's ridleys, green sea turtles that use northern waters during the summer must return to warmer waters when water temperatures drop, or face the risk of cold stunning. Cold stunning of green turtles may occur in southern areas as well (*i.e.*, Indian River, Florida), as these natural mortality events are dependent on water temperatures and not solely geographical location.

General human impacts and entanglement

Anthropogenic impacts to the green sea turtle population are similar to those discussed for other sea turtles species. As with the other species, fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches, while other activities like dredging, pollution, and habitat destruction account for an unknown level of other mortality. Sea sampling coverage in the pelagic driftnet, pelagic longline, scallop dredge, southeast shrimp trawl, and summer flounder bottom trawl fisheries has recorded takes of green turtles (See scallop dredge discussion in the previous loggerhead section).

Leatherback Sea Turtle

Recent information suggests that Western Atlantic populations of leatherback sea turtles declined from 18,800 nesting females in 1996 (Spotila *et al.* 1996) to 15,000 nesting females by 2000 (Spotila, pers. comm). While the mortality rate of adult, female leatherback turtles has increased over the past ten years, decreasing the potential number of nesting females, the number of leatherback sea turtle nests in Florida and the U.S. Caribbean has been increasing at about 10.3% and 7.5%, respectively, per year since the early 1980s. In the 1990's the number of nesting females in the Caribbean Islands was estimated at 1,437-1,780 leatherbacks per year (Spotila *et al.* 1996)

There is no information at this time to show that leatherback sea turtles have been caught in scallop gear. Nevertheless, in a Biological Opinion issued on February 24, 2003, NMFS has taken a precautionary approach based on information of leatherback captures in other trawl fisheries, including the *Loligo* squid bottom trawl fishery which captured and released alive a leatherback sea turtle off of New Jersey in 2001. While there is data to show that tow times for scallop trawls are typically within the submergence limits for leatherback sea turtles, NMFS continues to take a precautionary approach and assumes that any capture of a leatherback sea turtle in scallop trawl gear could result in death due to forced submergence.

Barndoor Skate - Candidate Species

Barndoor skate is considered a candidate species under the ESA as a result of two petitions to list the species as endangered or threatened that were received in March and April 1999. In June 1999, the agency declared the petitioned actions to be warranted and requested additional information on whether or not to list the species under the ESA. At the 30th Stock Assessment Workshop (SAW 30) held in November 1999, the Stock Assessment Research Committee (SARC) reviewed the status of the barndoor skate stock relative to the five listing criteria of the ESA. The SARC provided their report to the NMFS in the SAW 30 document (NEFSC 2000). NMFS published a decision on the petitions on September 27, 2002 (67FR61055-61061) that the petitioned actions are not warranted at this time. However, NMFS is leaving barndoor skate on the agency's list of candidate species due to remaining uncertainties regarding the status and population structure of the species.

The barndoor skate occurs from Newfoundland, the Gulf of St. Lawrence, off Nova Scotia, the Gulf of Maine, and the northern sections of the Mid-Atlantic Bight down to North Carolina. It is one of the largest skates in the Northwest Atlantic and is presumed to be a long-lived, slow growing species. They inhabit mud and sand/gravel bottoms along the continental shelf, generally at depths greater than 150 meters. They are believed to feed on benthic invertebrates and fishes (Bigelow and Schroeder 1953).

The abundance of barndoor skate declined continuously through the 1960's. Since 1990, their abundance has increased slightly on Georges Bank, the western Scotian shelf, and in Southern New England, although the current NEFSC autumn survey biomass index is less than 5% of the peak observed in 1963. The species was identified as an overfished species at the SAW 30 (NEFSC 2000). Skates are sensitive to overutilization generally because of their limited reproductive capacity due to the characteristic of many larger fish species in the northeast that are relatively slow growing, long-lived, and late maturing.

7.3 Physical Environment

7.3.1 Introduction

A description of the affected environment was prepared for the Environmental Assessment (EA) that accompanied Amendment 11 to the Northeast Multispecies Fishery Management Plan, Amendment 9 to the Atlantic Sea Scallop Fishery Management Plan, Amendment 1 to the Monkfish FMP, Amendment 1 to the Atlantic Salmon FMP and Sections of the Atlantic Herring FMP (NEFMC 1998a) (heretofore referred to as the "Omnibus EFH Amendment"). Since the implementation of the Omnibus EFH Amendment, several reports have been published which add to our understanding of the physical and biological environment of the Northeast U.S. region. This description has therefore been up-dated in order to provide more complete information on the biological and physical components of the environment that could be affected by the actions proposed or under consideration in this DEIS. Additional information that describes recent changes in the status of exploited fishery resources, particularly the scallop resource, has also been included.

7.3.2 Physical Characteristics of Regional Systems

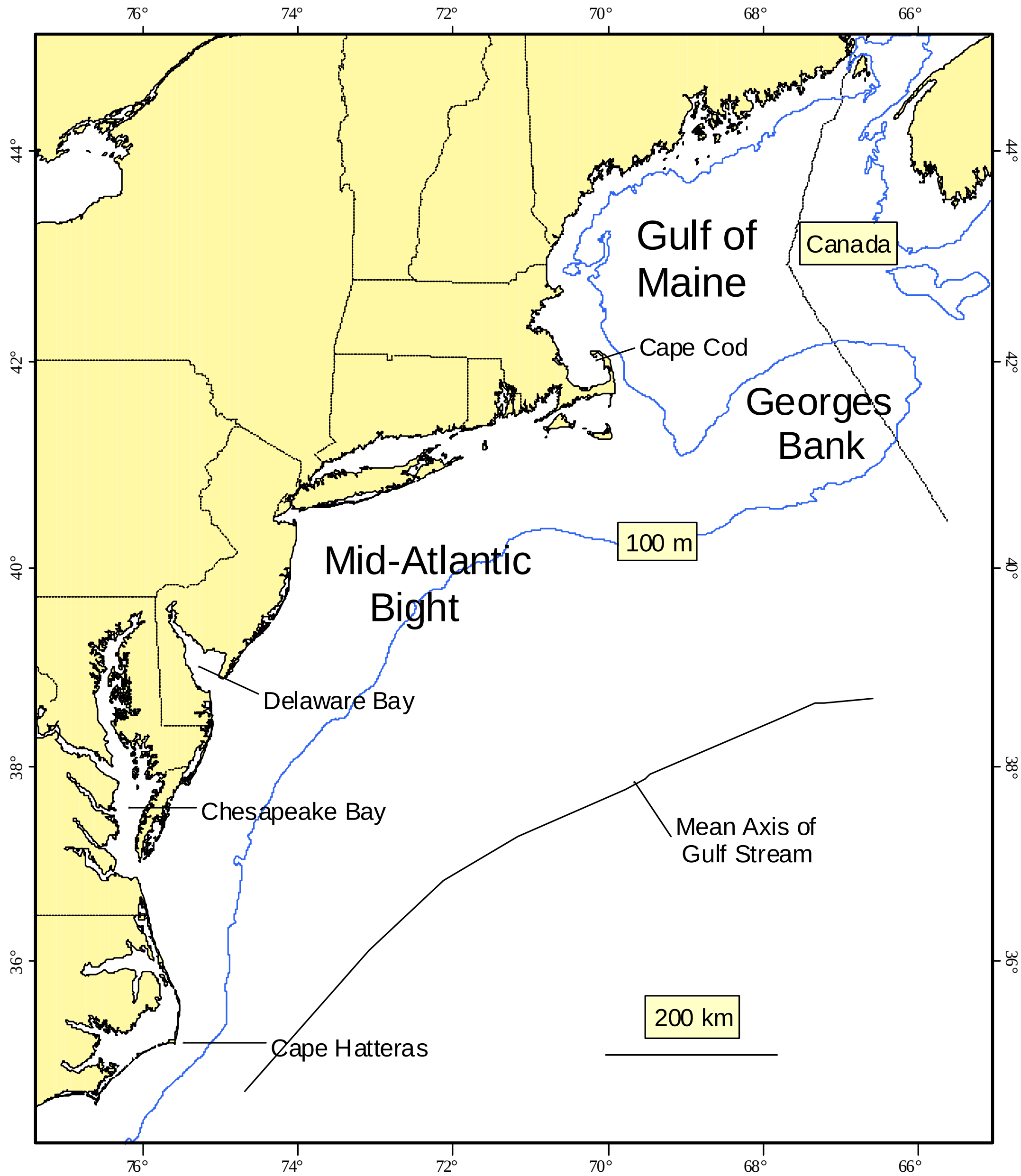
This section contains a description of the physical environment of the Scallop fishery, including oceanographic and physical habitat conditions in the Gulf of Maine, Georges Bank, Southern New England and the Mid-Atlantic regions. Some of the information presented in this section was originally included in the EA for the Omnibus EFH Amendment (NEFMC 1998a).

7.3.2.1 Introduction

The Northeast Shelf Ecosystem (Map 43) has been described as including the area from the Gulf of Maine south to North Carolina, extending from the coast seaward to the edge of the continental shelf, including the slope sea offshore to the Gulf Stream (Sherman *et al.* 1996). The continental slope of this region includes the area east of the shelf, out to a depth of 2000 m. A number of distinct sub-systems comprise the region, including the Gulf of Maine, Georges Bank, the Mid-Atlantic Bight, and the continental slope. Occasionally another subsystem, Southern New England, is described; however, we incorporated the distinctive features of this region into the descriptions of Georges Bank and the Mid-Atlantic Bight.

The Gulf of Maine is an enclosed coastal sea, characterized by relatively cold waters and deep basins, with a patchwork of various sediment types. Georges Bank is a relatively shallow coastal plateau that slopes gently from north to south and has steep submarine canyons on its eastern and southeastern edge. It is characterized by highly productive, well-mixed waters and strong currents. The Mid-Atlantic Bight is comprised of the sandy, relatively flat, gently sloping continental shelf from southern New England to Cape Hatteras, NC. The continental slope begins at the continental shelf break and continues eastward with increasing depth until it becomes the continental rise. It is fairly homogenous, with exceptions at the shelf break, some of the canyons, the Hudson Shelf Valley and in areas of glacially rafted hard bottom.

Pertinent aspects of the physical characteristics of each of these systems are described below. This review is based on several summary reviews (Abernathy 1989, Backus 1987, Beardsley *et al.* 1996, Brooks 1996, Cook 1988, Dorsey 1998, Kelley 1998, Wiebe et al. 1987, Mountain 1994, NEFMC 1998, Schmitz et al. 1987, Sherman *et al.* 1996, Steimle *et al*. 1999b, Stumpf and Biggs 1988, Townsend 1992, Tucholke 1987). Literature citations are not included for generally accepted concepts; however, new research and specific results of research findings are cited.



Map 43. U.S. Northeast shelf ecosystem.

7.3.2.2 Gulf of Maine

Although not obvious in appearance, the Gulf of Maine is actually an enclosed coastal sea, bounded on the east by Browns Bank, on the north by the Nova Scotian (Scotian) Shelf, on the west by the New England states and on the south by Cape Cod and Georges Bank (Map 43). The Gulf of Maine (GOM) was glacially derived, and is characterized by a system of deep basins, moraines and rocky protrusions with limited access to the open ocean. This geomorphology influences complex oceanographic processes which result in a rich biological community.

The Gulf of Maine is topographically unlike any other part of the continental border along the U.S. east coast. It contains 21 distinct basins separated by ridges, banks, and swells. The three largest basins are Wilkinson, Georges, and Jordan (Map 44). Depths in the basins exceed 250 m, with a maximum depth of 350 m in Georges Basin, just north of Georges Bank. The Northeast Channel between Georges Bank and Browns Bank, leads into Georges Basin, and is one of the primary avenues for exchange of water between the GOM and the North Atlantic Ocean.

High points within the gulf include irregular ridges, such as Cashes Ledge, which peaks at 9 m below the surface, as well as lower flat-topped banks and gentle swells. Some of these rises are remnants of the sedimentary shelf left after the glaciers removed most of it. Others are glacial moraines and a few, like Cashes Ledge, are out-croppings of bedrock. Very fine sediment particles created and eroded by the glaciers have collected in thick deposits over much of the Gulf of Maine, particularly in its deep basins (Map 44**)**. These mud deposits blanket and obscure the irregularities of the underlying bedrock, forming topographically smooth terrains. Some shallower basins are covered with mud as well, including some in coastal waters. In the rises between the basins, other materials are usually at the surface. Unsorted glacial till covers some morainal areas, as on Sewell Ridge to the north of Georges Basin and on Truxton Swell to the south of Jordan Basin. Sand predominates on some high areas and gravel, sometimes with boulders, predominates on others.

Coastal sediments exhibit a high degree of small-scale variability. Bedrock is the predominant substrate along the western edge of the Gulf of Maine north of Cape Cod in a narrow band out to a depth of about 60 m. Rocky areas become less common with increasing depth, but some rock outcrops poke through the mud covering the deeper sea floor. Mud is the second most common substrate on the inner continental shelf. Mud predominates in coastal valleys and basins that often border abruptly on rocky substrates. Many of these basins extend without interruption into deeper water. Gravel, often mixed with shell, is common adjacent to bedrock outcrops and in fractures in the rock. Large expanses of gravel are not common, but do occur near reworked glacial moraines and in areas where the seabed has been scoured by

Bottom currents. Gravel is most abundant at depths of 20-40 m, except in eastern Maine where a gravel-covered plain exists to depths of at least 100 m. Bottom currents are stronger in eastern Maine where the mean tidal range exceeds 5 m. Sandy areas are relatively rare along the inner shelf of the western Gulf of Maine, but are more common south of Casco Bay, especially offshore of sandy beaches.

An intense seasonal cycle of winter cooling and turnover, springtime freshwater runoff, and summer warming influences oceanographic and biologic processes in the Gulf of Maine. The Gulf has a general counterclockwise non-tidal surface current that flows around its coastal margin. It is primarily driven by fresh, cold Scotian Shelf water that enters over the Scotian Shelf and through the Northeast Channel, and freshwater river runoff, which is particularly important in the spring. Dense relatively warm and saline slope water entering through the bottom of the Northeast Channel from the continental slope also influences gyre formation. Counterclockwise gyres generally form in Jordan, Wilkinson, and

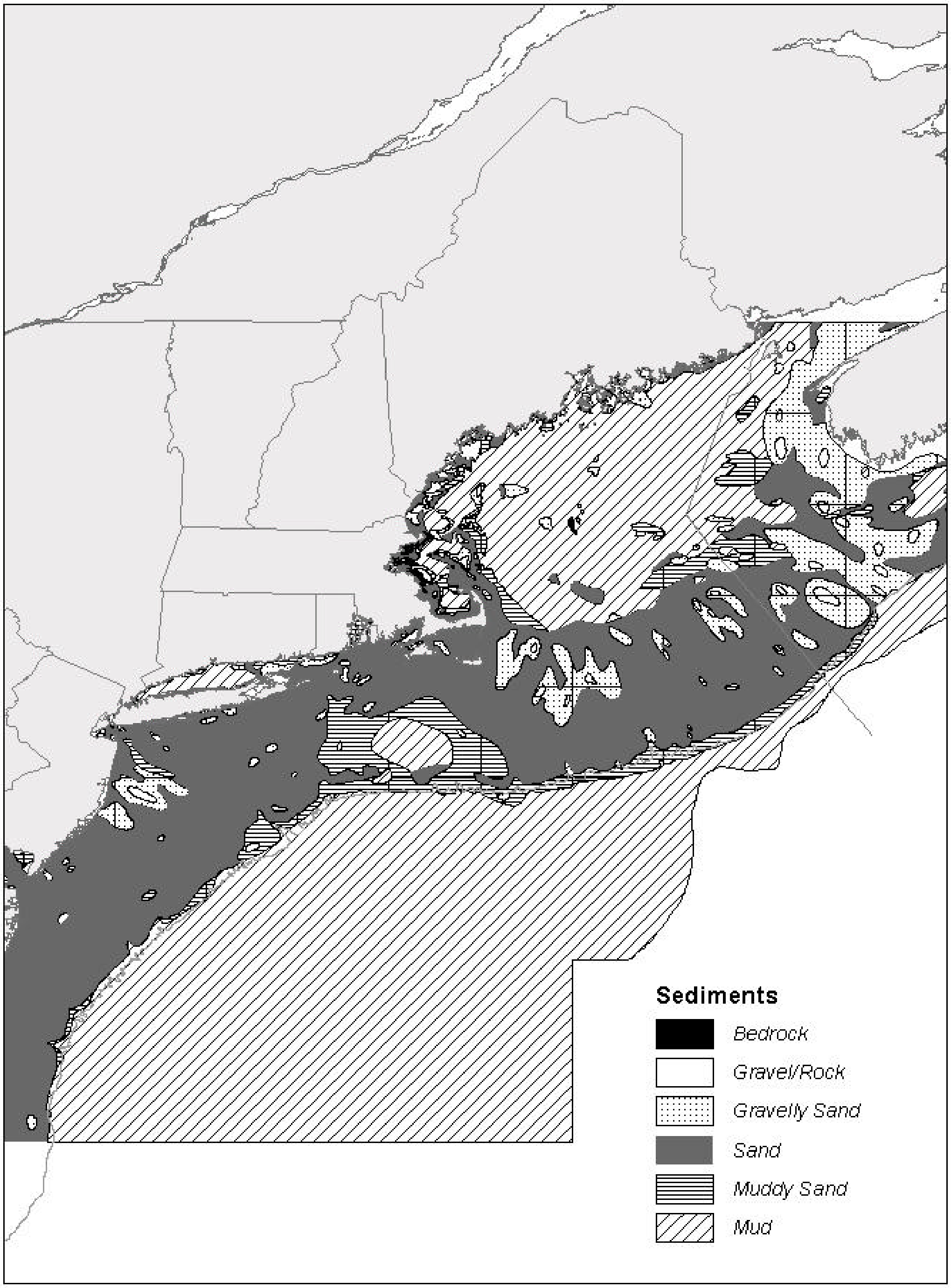
Georges Basins and the Northeast Channel as well. These surface gyres are more pronounced in spring and summer; with winter, they weaken and become more influenced by the wind.

Stratification of surface waters during spring and summer seals off a mid-depth layer of water that preserves winter salinity and temperatures. This cold layer of water is called "Maine intermediate water" (MIW) and is located between more saline Maine bottom water and the warmer, stratified Maine surface water. The stratified surface layer is most pronounced in the deep portions of the western GOM. Tidal mixing of shallow areas prevents thermal stratification and results in thermal fronts between the stratified areas and cooler mixed areas. Typically, mixed areas include Georges Bank, the southwest Scotian Shelf, eastern Maine coastal waters, and the narrow coastal band surrounding the remainder of the Gulf.

The Northeast Channel provides an exit for cold MIW and outgoing surface water while it allows warmer more saline slope water to move in along the bottom and spill into the deeper basins. The influx of water occurs in pulses, and appears to be seasonal, with lower flow in late winter and a maximum in early summer.

Gulf of Maine circulation and water properties can vary significantly from year to year. Notable episodic events include shelf-slope interactions such as the entrainment of shelf water by Gulf Stream rings (see *Gulf Stream and Associated Features*), and strong winds that can create currents as high as 1.1 meters/second over Georges Bank. Warm core Gulf Stream rings can also influence upwelling and nutrient exchange on the Scotian shelf, and affect the water masses entering the GOM. Annual and seasonal inflow variations also affect water circulation.

Internal waves are episodic and can greatly affect the biological properties of certain habitats. Internal waves can shift water layers vertically, so that habitats normally surrounded by cold MIW are temporarily bathed in warm, organic-rich surface water. On Cashes Ledge, it is thought that deeper nutrient rich water is driven into the photic zone, providing for increased productivity. Localized areas of upwelling interaction occur in numerous places throughout the Gulf.



Map 44. Map showing distribution of surficial sediments, Gulf of Maine, Georges Bank, and the Mid-Atlantic Bight (modified from original map by Poppe *et al.* 1989).

7.3.2.3 Georges Bank

Georges Bank is a shallow (3-150 m depth), elongate (161 km wide by 322 km long) extension of the continental shelf which was formed by the Wisconsinian glacial episode and is characterized by a steep slope on its northern edge and a broad, flat, gently sloping southern flank. The Great South Channel lies to the west. Natural processes continue to erode and rework the sediments on Georges Bank. It is anticipated that erosion and reworking of sediments will reduce the amount of sand available to the sand sheets, and cause an overall coarsening of the bottom sediments (Valentine *et al.* 1993).

Glacial retreat during the late Pleistocene deposited the bottom sediments currently observed on the eastern section of Georges Bank, and the sediments have been continuously reworked and redistributed by the action of rising sea level, and by tidal, storm and other currents. The strong, erosive currents affect the character of the biological community. Bottom topography on eastern Georges Bank is characterized by linear ridges in the western shoal areas; a relatively smooth, gently dipping sea floor on the deeper, easternmost part; a highly energetic peak in the north with sand ridges up to 30 m high and extensive gravel pavement, and steeper and smoother topography incised by submarine canyons on the southeastern margin (see *Continental Slope* for more on canyons). The nature of the seabed sediments varies widely, ranging from clay to gravel (Map 44). The gravel-sand mixture is usually a transition zone between coarse gravel and finer sediments.

The central region of the bank is shallow; shoals and troughs characterize the bottom, with sand dunes superimposed upon them. The two most prominent elevations on the ridge and trough area are Cultivator and Georges Shoals. This shoal and trough area is a region of strong currents, with average flood and ebb tidal currents greater than 4 km per hour, and as high as 7 km per hour. The dunes migrate at variable rates, and the ridges may move, also. In an area that lies between the central part and northeast peak, Almeida et al. (2000) identified high energy areas as between 35 – 65 m deep, where sand is transported on a daily basis by tidal currents; and a low energy area at depths > 65 m that is affected only by storm currents. The area west of the Great South Channel, known as Nantucket Shoals is similar in nature to the central region of the bank. Currents in these areas are strongest where water depth is shallower than 50 m. This type of traveling dune and swale morphology is also found in the mid-Atlantic bight, and further described in that section of the document.

The Great South Channel separates the main part of Georges Bank from Nantucket Shoals. Sediments in this region include gravel pavement and mounds, some scattered boulders, sand with storm generated ripples, scattered shell and mussel beds. Tidal and storm currents may range from moderate to strong, depending upon location and storm activity (Valentine, pers. comm.).

Oceanographic frontal systems occur between water masses from the Gulf of Maine and Georges Bank. These water masses differ in temperature, salinity, nutrient concentration, and planktonic communities, which influence productivity and may influence fish abundance and distribution. Currents on Georges Bank include a weak, persistent clockwise gyre around the bank, a strong semidiurnal tidal flow predominantly northwest and southeast, and very strong, intermittent storm-induced currents, which can all occur simultaneously. Tidal currents over the shallow top of Georges Bank can be very strong, and keep the waters over the bank well mixed vertically. This results in a tidal front that separates the cool waters of the well-mixed shallows of the central bank from the warmer, seasonally stratified shelf waters on the seaward and shoreward sides of the bank. The clockwise gyre is instrumental in distribution of the planktonic community, including larval fish. For example, Lough and Potter (1993) describe passive drift of Atlantic cod and haddock eggs and larvae in a southwest residual pattern around Georges Bank. Larval concentrations are found at varying depths along the southern edge between 60 – 100 m.

7.3.2.4 Mid Atlantic Bight

The Mid-Atlantic Bight includes the shelf and slope waters from Georges Bank south to Cape Hatteras, and east to the Gulf Stream (Map 45). Like the rest of the continental shelf, the topography of the Mid-Atlantic Bight was shaped largely by sea level fluctuations caused by past ice ages. The shelf's basic morphology and sediments derive from the retreat of the last ice sheet, and the subsequent rise in sea level. Since that time, currents and waves have modified this basic structure.

Shelf and slope waters of the Mid-Atlantic Bight have a slow southwestward flow that is occasionally interrupted by warm core rings or meanders from the Gulf Stream. On average, shelf water moves parallel to bathymetry isobars at speeds of 5-10 cm/second at the surface and 2 cm/second or less at the bottom. Storm events can cause much more energetic variations in flow. Tidal currents on the inner shelf have a higher flow rate of 20 cm/second that increases to 100 cm/second near inlets.

Slope water tends to be warmer than shelf water because of its proximity to the Gulf Stream, and also tends to be more saline. The abrupt gradient where these two water masses meet is called the shelf-slope front. This front is usually located at the edge of the shelf and touches bottom at about 75-100 m depth of water, and then slopes up to the east toward the surface. It reaches surface waters approximately 25-55 km further offshore. The position of the front is highly variable, and can be influenced by many physical factors. Vertical structure of temperature and salinity within the front can develop complex patterns because of the interleaving of shelf and slope waters – for example cold shelf waters can protrude offshore, or warmer slope water can intrude up onto the shelf.

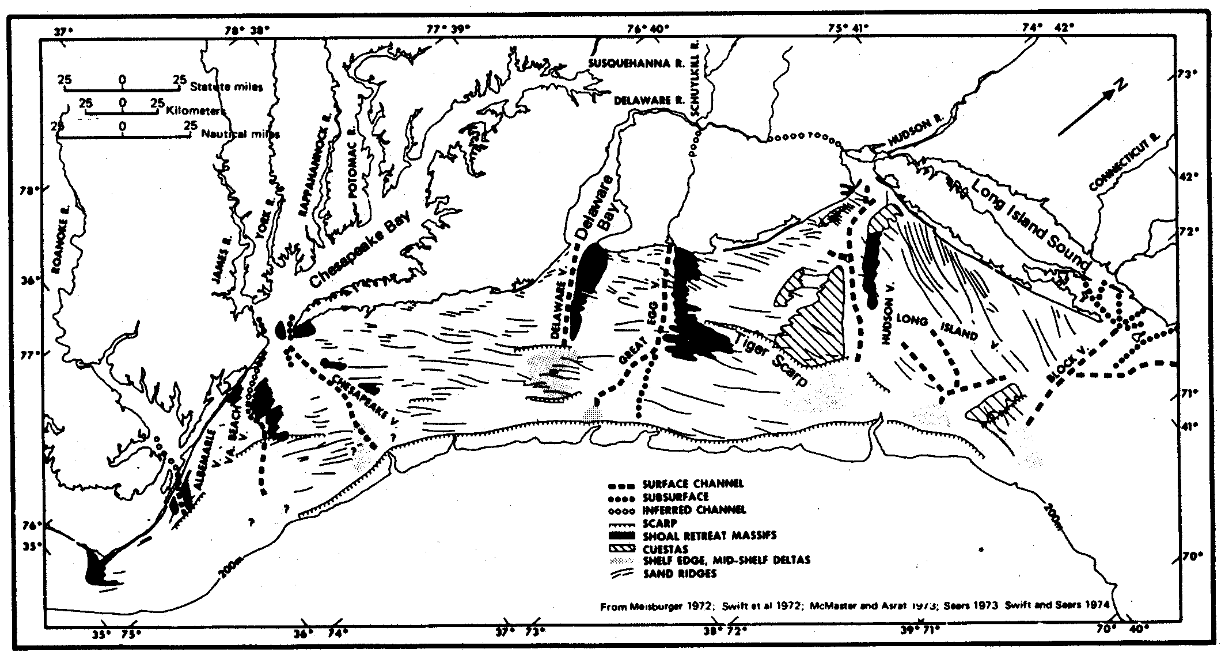
The seasonal effects of warming and cooling increase in shallower, near shore waters. Stratification of the water column occurs over the shelf and the top layer of slope water during the spring-summer and is usually established by early June. Fall mixing results in homogenous shelf and upper slope waters by October in most years. A permanent thermocline exists in slope waters from 200-600 m deep. Temperatures decrease at the rate of about 0.02º C per meter and remain relatively constant except for occasional incursions of Gulf stream eddies or meanders. Below 600 m, temperature declines, and usually averages about 2.2º C at 4000 m. A warm, mixed layer approximately 40 m thick resides above the permanent thermocline.

The "cold pool" is an annual phenomenon particularly important to the Mid-Atlantic Bight. It stretches from the Gulf of Maine along the outer edge of Georges Bank and then southwest to Cape Hatteras. It becomes identifiable with the onset of thermal stratification in the spring and lasts into early fall until normal seasonal mixing occurs. It usually exists along the bottom between the 40 m and 100 m isobaths and extends up into the water column for about 35 m, to the bottom of the seasonal thermocline. The cold pool usually represents about 30% of the volume of shelf water. Minimum temperatures for the cold pool occur in early spring and summer, and range from 1.1º C to 4.7º C.

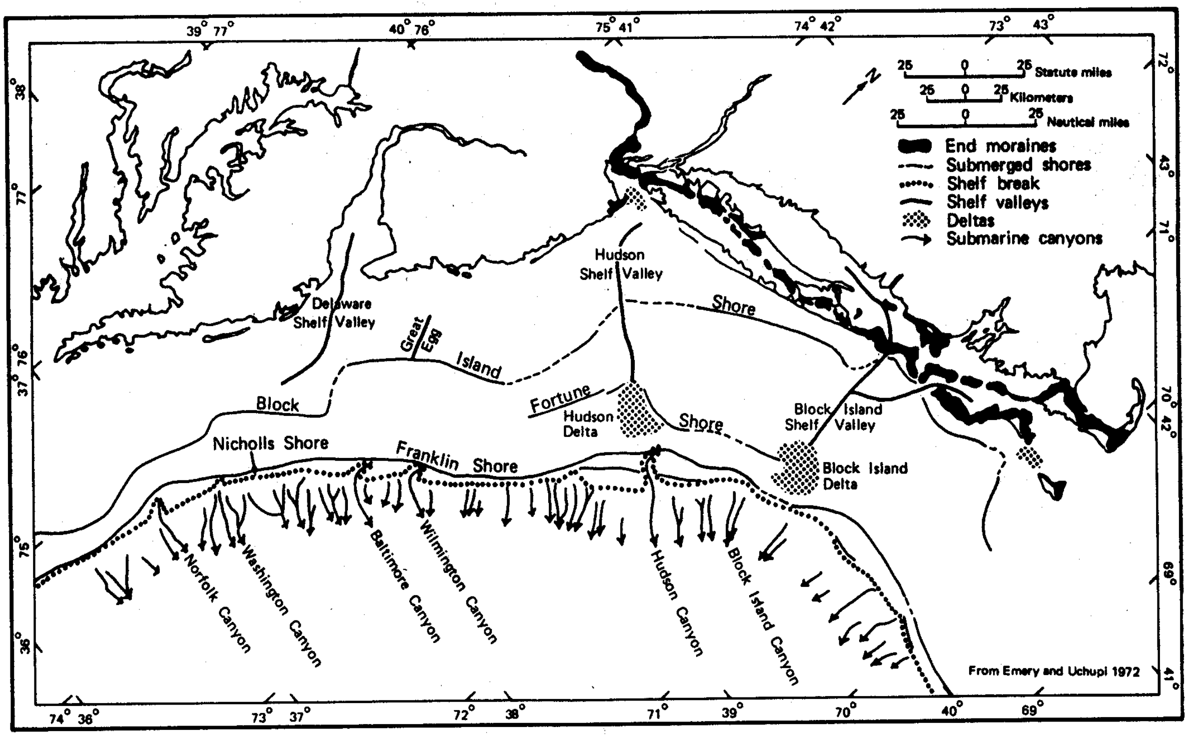
The shelf slopes gently from shore out to between 100 and 200 km offshore where it transforms to the slope (100 – 200 m water depth) at the shelf break. In both the Mid-Atlantic and on Georges Bank, numerous canyons incise the slope, and some cut up onto the shelf itself (see section on *Continental Slope*). The primary morphological features of the shelf include shelf valleys and channels, shoal massifs, scarps, and sand ridges and swales (Map 45, Map 46).

Most of these structures are relic except for some sand ridges and smaller sand-formed features. Shelf valleys and slope canyons were formed by rivers of melted glacier that deposited sediments on the outer shelf edge as they entered the ocean. Most valleys cut about 10 m into the shelf, with the exception of the Hudson Shelf Valley, which is about 35 m deep. The valleys were partially filled as the glacier melted and egressed across the shelf. The glacier also left behind a lengthy scarp near the shelf break from Chesapeake Bay north to the eastern end of Long Island. Shoal retreat massifs were produced by extensive deposition at a cape or estuary mouth. Massifs were also formed as estuaries retreated across the shelf.

The sediment type covering most of the shelf in the Mid-Atlantic Bight is sand, with some relatively small, localized areas of gravel and gravelly sand (Map 44). On the slope, muddy sand and mud predominate. Sediments are fairly uniformly distributed over the shelf in this region. A sheet of sand and gravel varying in thickness from 0 to 10 m covers most of the shelf. The mean bottom flow from the constant southwesterly current is not fast enough to move sand, so sediment transport must be episodic. Net sediment movement is in the same southwesterly direction as the current. The sands are mostly medium to coarse grains, with finer sand in the Hudson Shelf Valley and on the outer shelf. Mud is rare over most of the shelf, but is common in the Hudson Shelf Valley. Occasionally relic estuarine mud deposits are re-exposed in the swales between sand ridges. Fine sediment content increases rapidly at the shelf break, which is sometimes called the "mud line," and sediments are 70-100% fines on the slope.



Map 45. Mid-Atlantic Bight submarine morphology. Source: Stumpf and Biggs (1988).



Map 46. Major features of the Mid-Atlantic and Southern New England continental shelf. Source: Stumpf and Biggs (1988).

In addition to sand ridges that were formed by the glaciers, some sand ridges have been formed since the end of the last ice age. Their formation is not well understood; however, they appear to develop from the sediments that erode from the shore face. They maintain their shape, so it is assumed that they are in equilibrium with modern current and storm regimes. They are usually grouped, with heights of about 10 m, lengths of 10-50 km and spacing of 2 km. Ridges are usually oriented at a slight angle towards shore, running in length from northeast to southwest. The seaward face usually has the steepest slope. Sand ridges are often covered with smaller similar forms such as sand waves, megaripples, and ripples. Swales occur between sand ridges. Since ridges are higher than the adjacent swales, they are exposed to more energy from water currents, and experience more sediment mobility than swales. Ridges tend to contain less fine sand, silt and clay while relatively sheltered swales contain more of the finer particles. Swales have greater benthic macrofaunal density, species richness and biomass, due in part to the increased abundance of detrital food and the physically less rigorous conditions.

Sand waves are usually found in patches of 5-10 with heights of about 2 m, lengths of 50-100 m and 1-2 km between patches. Sand waves are primarily found on the inner shelf, and often observed on sides of sand ridges. They may remain intact over several seasons. Megaripples occur on sand waves or separately on the inner or central shelf. During the winter storm season, they may cover as much as 15% of the inner shelf. They tend to form in large patches and usually have lengths of 3-5 m with heights of 0.5-1 m. Megaripples tend to survive for less than a season. They can form during a storm and reshape the upper 50-100 cm of the sediments within a few hours. Ripples are also found everywhere on the shelf, and appear or disappear within hours or days, depending upon storms and currents. Ripples usually have lengths of about 1-150 cm and heights of a few centimeters.

The northern portion of the mid-Atlantic bight is sometimes referred to as southern New England. Someof the features of this area were described earlier (see *Georges Bank*); however, one other formation of this region that deserves note is the "mud patch" which is located just southwest of Nantucket Shoals and southeast of Long Island. Tidal currents in this area slow significantly, which allows silts and clays to settle out. The mud is mixed with sand, and is occasionally re-suspended by large storms. This habitat is an anomaly of the outer continental shelf.

Artificial reefs are another significant mid-Atlantic habitat, formed much more recently on the geologic time-scale than other regional habitat types. These localized areas of hard structure have been formed by shipwrecks, lost cargoes, disposed solid materials, shoreline jetties and groins, submerged pipelines, cables, and other materials (Steimle and Zetlin 2000). While some of materials have been deposited specifically for use as fish habitat, most have an alternative primary purpose; however, they have all become an integral part of the coastal and shelf ecosystem. It is expected that the increase in these materials has had an impact on living marine resources and fisheries, but these effects are not well known. In general, reefs are important for attachment sites, shelter, and food for many species, and fish predators such as tunas may be attracted by prey aggregations, or may be behaviorally attracted to the reef structure.

7.3.2.5 Continental Slope

The continental slope extends from the continental shelf break, at depths between 60 m and 200 m, eastward to a depth of 2000 m. The width of the slope varies from 10-50 km, with an average gradient of 3-6°; however, local gradients can be nearly vertical. The base of the slope is defined by a marked decrease in seafloor gradient where the continental rise begins.

The morphology of the present continental slope appears largely to be a result of sedimentary processes that occurred during the Pleistocene, including:

1) slope upbuilding and progradation by deltaic sedimentation principally during sea-level low-stands;
2) canyon-cutting by sediment mass movements during and following sea-level low-stands;
3) sediment slumping.

The slope is cut by at least 70 large canyons between Georges Bank and Cape Hatteras (Map 47) and numerous smaller canyons and gullies, many of which may feed into the larger canyon systems. The New England Seamount Chain including Bear, Mytilus, Balanus, etc. occurs on the slope southwest of Georges Bank. A smaller chain (Caryn, Knauss, etc.) occurs in the vicinity in deeper water.

A "mud line" occurs on the slope at a depth of 250 m – 300 m, below which fine silt and clay-size particles predominate (Map 47). Localized coarse sediments and rock outcrops are found in and near canyon walls, and occasional boulders occur on the slope as a result of glacial rafting. Sand pockets may also be formed as a result of downslope movements.

Gravity induced downslope movement is the dominant sedimentary process on the slope, and includes slumps, slides, debris flows, and turbidity currents, in order from thick cohesive movement to relatively non-viscous flow. Slumps are localized blocks of sediment that may involve short downslope movement. However, turbidity currents can transport sediments thousands of kilometers.

Submarine canyons are not spaced evenly along the slope, but tend to decrease in areas of increasing slope gradient. Canyons are typically "v"-shaped in cross section and often have steep walls and outcroppings of bedrock and clay. The canyons are continuous from the canyon heads to the base of the continental slope. Some canyons end at the base of the slope, but others continue as channels onto the continental rise. Larger and more deeply incised canyons are generally significantly older than smaller ones, and there is also evidence that some older canyons have experienced several episodes of filling and re-excavation. Many, if not all, submarine canyons may first form by mass-wasting processes on the continental slope, although there is evidence that some canyons formed as a result of fluvial drainage (i.e., Hudson Canyon).

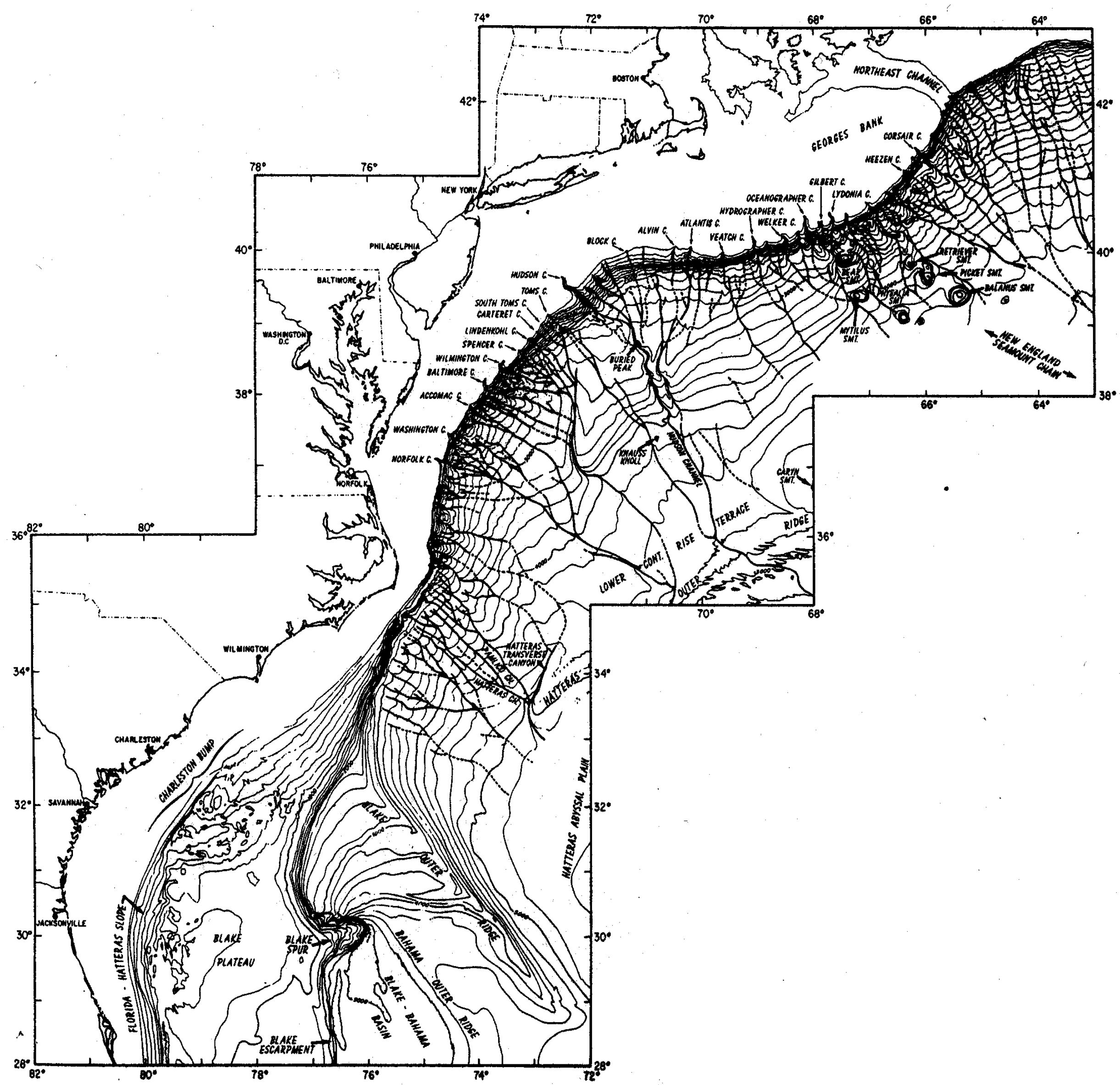
Canyons can alter the physical processes in the surrounding slope waters. Fluctuations in the velocities of the surface and internal tides can be large near the heads of the canyons, leading to enhanced mixing and sediment transport in the area. Shepard et al. (1979) concluded that the strong turbidity currents initiated in study canyons were responsible for enough sediment erosion and transport to maintain and modify those canyons. Since surface and internal tides are ubiquitous over the continental shelf and slope, it can be anticipated that these fluctuations are important for sedimentation processes in other canyons as well. In Lydonia Canyon, Butman et al. (1982) found that the dominant source of low-frequency current variability was related to passage of warm core Gulf Stream rings rather than the atmospheric events that predominate on the shelf.

The water masses of the Atlantic continental slope and rise are essentially the same as those of the North American Basin (defined in Wright and Worthington 1970). Worthington (1976) divided the water column of the slope into three vertical layers: deep water (colder than 4°C), the thermocline (4°-17°C), and warm water (warmer than 17°C). In the North American Basin the deep water accounts for two-thirds of all the water, the thermocline for about one quarter, and the warm water the remainder. In the slope water north of Cape Hatteras, the only warm water occurs in the Gulf Stream and seasonally influenced summer waters.

The principal cold-water mass in the region is the North Atlantic Deep Water. North Atlantic Deep Water is comprised of a mixture of five sources: Antarctic Bottom Water, Labrador Sea Water, Mediterranean Water, Denmark Strait Overflow Water, and Iceland-Scotland Overflow Water. The thermocline represents a fairly straightforward water mass compared with either the deep water or the surface water. Nearly 90% of all thermocline water comes from the water mass called the Western North Atlantic Water. This water mass is slightly less saline northeast of Cape Hatteras due to the influx of southward flowing Labrador Coastal Water.

Seasonal variability in slope waters penetrates only the upper 200 m of the water column. In the winter months, cold temperatures and storm activity create a well-mixed layer down to about 100-150 m, but summer warming creates a seasonal thermocline overlain by a surface layer of low-density water. The seasonal thermocline, in combination with reduced storm activity in the summer, inhibits vertical mixing and reduces the upward transfer of nutrients into the photic zone.

Two currents found on the slope, the Gulf Stream and Western Boundary Undercurrent, together represent one of the strongest low frequency horizontal flow systems in the world. Both currents have an important influence on slope waters. Warm and cold core rings that spin off the Gulf Stream are a persistent and ubiquitous feature of the Northwest Atlantic Ocean (see section on *Gulf Stream*). The Western Boundary Undercurrent flows to the southwest along the lower slope and continental rise in a stream about 50 km wide. The boundary current is associated with the spread of North Atlantic Deep Water, and it forms part of the generally westward flow found in slope water. North of Cape Hatteras it crosses under the Gulf Stream in a manner not yet completely understood.



Map 47. Bathymetry of the U.S. Atlantic continental margin. Contour interval is 200 m below 1000 m water depth and 100 m above 1000 m. Axes of principal canyons and channels are shown by solid lines (dashed where uncertain or approximate). Source: Tucholke (1987).

7.3.2.6 Gulf Stream and Associated Features

Shelf and slope waters of the Northeast are intermittently but intensely affected by the Gulf Stream. The Gulf Stream begins in the Gulf of Mexico and flows northeastward at an approximate rate of 1 m/second (2 knots), transporting warm waters north along the eastern coast of the United States, and then east towards the British Isles. Conditions and flow of the Gulf Stream are highly variable on time scales ranging from days to seasons. The principal sources of variability in slope waters off the northeastern shelf are intrusions from the Gulf Stream.

The location of the Gulf Stream's shoreward, western boundary is variable because of meanders and eddies. Gulf Stream eddies are formed when extended meanders enclose a parcel of seawater and pinch off. These eddies can be cyclonic, meaning they rotate counterclockwise and have a cold-core formed by enclosed slope water (cold core ring), or anticyclonic, meaning they rotate clockwise and have a warm core of Sargasso Sea water (warm core ring). The rings are shaped like a funnel, wider at the top and narrower at the bottom, and can have depths of over 2000 m. They range in size from approximately 150-230 m in diameter. There are 35% more rings and meanders in the vicinity of Georges Bank than in the Mid-Atlantic region. A net transfer of water on and off the shelf may result from the interaction of rings and shelf waters. These warm or cold core rings maintain their identity for several months until they are reabsorbed by the Gulf Stream. The rings and the Gulf Stream itself have a great influence over oceanographic conditions all along the continental shelf.

7.3.2.7 Coastal Features

Coastal and estuarine features such as salt marshes, mud flats, rocky intertidal zones, sand beaches, and submerged aquatic vegetation are critical to inshore and offshore habitats and fishery resources of the Northeast. For example, coastal areas and estuaries are important for nutrient recycling and primary production, and certain features serve as nursery areas for juvenile stages of economically important species. Salt marshes are found extensively throughout the region. Tidal and subtidal mud and sand flats are general salt marsh features and are also occur in other estuarine areas. Salt marshes provide nursery and spawning habitat for many finfish and shellfish species. Salt marsh vegetation can also be a large source of organic material that is important to the biological and chemical processes of the estuarine and marine environment.

Rocky intertidal zones are periodically submerged, high-energy environments found in the northern portion of the Northeast system. Sessile invertebrates and some fish inhabit rocky intertidal zones. A variety of algae, kelp, and rockweed are also important habitat features of rocky shores. Fishery resources may depend upon particular habitat features of the rocky intertidal that provide important levels of refuge and food.

Sandy beaches are most extensive along the Northeast coast. Different zones of the beach present suitable habitat conditions for a variety of marine and terrestrial organisms. For example, the intertidal zone presents suitable habitat conditions for many invertebrates, and transient fish find suitable conditions for foraging during high tide. Several invertebrate and fish species are adapted for living in the high-energy subtidal zone adjacent to sandy beaches.

8.0 Environmental Consequences – Analysis of Impacts

The analysis of impacts is described along disciplinary lines (biology, economics, sociology) rather than by alternative or issue. This allows description of the combined effects of related alternatives (e.g. Georges Bank area access, habitat closures, scallop area rotation management, day-at-sea allocations, ring-size) without excessive repetition if the analysis were structured by alternative. Where possible however, there is a general qualitative description of the effect of individual alternatives relative to its effect on scallop biology, habitat, fish bycatch, revenue and net benefits, and social variables and communities. Additionally, there is a qualitative assessment of the enforceability of various management measures included in the Amendment 10 alternatives. This assessment includes considerations of changes in enforcement costs as well as enforcement effectiveness and potential voluntary compliance.

In addition to the analyses along disciplinary lines, the environmental consequences sections that analyze potential effects on other fisheries and related species, through proposed management alternatives that could mitigate the effects of scallop fishing on habitat, bycatch and protected species. The biological effects of these alternatives are described separately below (Section 8.5), but are incorporated into the overall analysis of economic and social impacts in Sections 8.7 and 8.8, respectively.

8.1 Cumulative Effects Analysis

8.1.1 Scoping and Opportunity for Public Comments and Participation

During the development of Amendment 10, the Council held 127 days of meetings where Amendment 10 alternatives were a primary subject under discussion (Table 147). In these open meetings, the public was offered the opportunity to comment and provide advice on developing alternatives, reports, and presentations. Of the 127 meeting days, 54% were policy-setting meetings where the Council or its committees developed and approved alternatives. At all meetings, the public was invited to comment on nearly every motion made by committee members. Thirty-seven (37) percent were technical meetings, open to the public, where comment and advice on the developing analyses or analytical reviews was often accepted.

Finally, 9% of the meetings were public hearings on the amendment, related documents, and analyses where the public was invited to attend and comment on the alternatives and amendment documents. In addition there were two opportunities for the public to provide written comment, once during an initial phase of scoping when the Council was developing the goals, objectives, and issues that the amendment should address; and a second time during a 90-day comment period on the Draft Environmental Impact Statement (DSEIS). In addition, the Council also received extensive written comment during the development phase, in between the initial round of scoping and the public hearings on the DSEIS, in particular from the Fisheries Survival Fund (Dr. Kenchington and Mr. Frulla) and Oceana (Mr. Zeman). These comments were carefully considered and much public advice was used in developing management alternatives and selecting the final alternatives that the Council approved.

Many comments became the source of alternatives that the Council included in the draft amendment and analyzed in the DSEIS. In particular, the flexible boundary rotation area management strategy that the Council ultimately approved was derived from public input, as was the Working Group EFH model analysis (Habitat Alternative 5a – 5d) and a scallop-fishery specific approach that would have prohibited scallop fishing in areas that were marginal for scallop fishing or that had high essential fish habitat value. Other public comments led to the development of alternatives on a mandatory bag tag system and an approach to simplify cooperative scallop research through the Experimental Fishing Permit process.

In some cases, strategies or approaches were recommended that the Council developed into alternatives using the expertise of its technical teams, in particular two of the habitat alternatives. Ultimately, the alternatives changed as more analysis was done and more data became available. In most cases, alternatives needed to be "fleshed out" to make them into workable solutions to the issues being addressed by the amendment. Sometimes the end result was unexpected and did not completely comport with the views of public members commenting on the developing alternatives.

In building alternatives and analyzing the potential impacts or results, the Council relied on several committees of technical experts. These experts included members of industry, academia, employees of federal or state marine resource management agencies, and employees of non-governmental organizations. These experts served as members of plan development and technical teams (Table 148), high-level technical review committees (Table 149), and advisory committees (Table 150).

Finally, the public input and expert advice culminated in the Council's choice of final alternatives to submit with a Final Supplemental Environmental Impact Statement (FSEIS). In the final document, additional analyses were provided to address deficiencies identified by the public during the 90-day DSEIS comment period and to provide better estimates of the impacts of the final alternative as a whole on valuable environmental components (VECs) that are expected to be effected by the proposed action.

Table 147. Summary of meeting days in which the public was able to provide input and comment on Amendment 10 alternatives.

Meetings	2000	2001	2002	2003	Total
Council	3	5	4	4	16
Scallop Oversight Committee	7	10	6	4	27
Scallop Advisory Committee	1	1	2	1	5
Scallop Jt O/S & Advisory Committee	4	0	1	0	5
Joint Sc & Hab O/S & Adv Meeting	1	0	0	0	1
Joint Sc & Gear Conflict Meeting	1	0	0	0	1
Joint Sc & Enforcement Meeting	1	0	0	0	1
Habitat Oversight Committee	0	1	4	2	7
Habitat Advisory Committee	0	0	0	0	0
Habitat O/S & Adv Committee	3	0	0	0	3
Enforcement Working Group	0	0	1	0	1
Adv Panel Rep Workshop	0	0	0	2	2
Scientific and Statistical Committee	0	0	2	0	2
Social Sciences Advisory Committee	0	1	1	0	2
Scallop Plan Development Team	9	9	9	2	29
Scallop Joint PDT & ADV Committee	0	2	0	0	2
Habitat Technical Team	5	3	2	1	11
Habitat Tech Team & Adv	0	0	0	1	1
Scallop scoping	3	0	0	0	3
EFH scoping	0	1	0	0	1
Scallop public hearing on DSEIS	0	0	0	7	7
Policy meetings	**21**	**17**	**18**	**13**	**69**

Meetings	*2000*	*2001*	*2002*	*2003*	*Total*
Scientific and technical meetings	**14**	**15**	**14**	**4**	**47**
Public hearings	**3**	**1**	**0**	**7**	**11**

Table 148. Plan Development Team and Habitat Technical Team members that performed analyses, contributed material to the document, and/or provided critical review of scientific advice and analysis.

Scallop PDT		Habitat Technical Team	
Member	**Affiliation**	**Member**	**Affiliation**
Mr. Pete Christopher	NMFS	Mr. Lou Chiarella	NMFS
Dr. William DuPaul	VA Institute of Marine Science	Dr. David Stevenson	NMFS
Dr. Dvora Hart	NEFSC	Dr. Steve Edwards	NOAA/NMFS/NEFSC
CDR Greg Hitchens	First Coast Guard District	Dr. David Packer	NOAA/NMFS
Dr. Paul Rago	NEFSC	Dr. Jason Link	NOAA/NEFSC
Dr. Stanley Wang	NOAA/NMFS	Dr. Page Valentine	U.S. Geological Survey
Mr. Andrew Applegate (Chair)	NEFMC	Mr. Mark Lazzari	Dept. of Marine Resources
Dr. Demet Haksever	NEFMC	Mr. Joe Pelczarski	MA Coastal Zone Management
Dr. Keven Stokesbury	UMASS SMAST, New Bedford, MA	Mr.Thomas Moth-Poulsen	MA Division of Marine Fisheries
Dr. Steve Edwards	NEFSC	Mr. Vincent Malkoski	MA Division of Marine Fisheries
Mr. Steve Correia	MA Division of Marine Fisheries	Dr. Jeremy Collie	URI
Dr. Kevin St. Martin	Rutgers University	Dr. Peter Auster	Univ. of Connecticut
Mr. Tom Hoff	MAFMC	Mr. Robert Reid	NEFSC
Dr. Jim Kirkley	VA Institue of Marine Science	**Ms. Leslie-Ann McGee (Chair)**	NEFMC
		Mrs. Deirdre Boelke	NEFMC

Table 149. NEFMC technical review committee members that provided critical review of scientific advice and analysis.

Science and Statistical Committee		Social Sciences Advisory Committee	
Member	**Affiliation**	**Member**	**Affiliation**
Dr. Vaughn Anthony	NMFS, Retired	Dr. James M. Acheson	University of Maine
Dr. Victor Crecco	Connecticut Division of Marine Fisheries	Dr. Priscilla Brooks	Conservation Law Foundation
Dr. John Hoenig (Scallop liaison)	VA Institute of Marine Science	Dr. Christopher Dyer	School for Field Studies
Dr. Francis Juanes	UMASS Amherst	Dr. John M. Gates	URI
Dr. Guy Marchesseault, Ph.D	WASTECH International	Dr. Daniel Georgianna	UMASS Dartmouth
Dr. Jean-Jacques Maguire	DFO, Canada	Dr. David Terkla	UMASS Boston
Dr. Andrew Rosenburg	UNH	Dr. Ralph Townsend	University of Maine
Dr. Brian Rothschild	UMASS Dartmouth	Dr. Madeleine Hall-Arber	MIT Sea Grant College
Dr. Saul Saila	URI	Dr. Ilene M. Kaplan	Union College
Dr. Patrick Sullivan	Cornell University	Dr. Seth Macinko	Univ. of Connecticut
Dr. Desmond Kahn	State of Delaware	Dr. Robert Robertson	UNH
Dr. Alexei Sharov	Maryland Dept. of Natural Resources	Dr. Kevin St. Martin	Rutgers University
Dr. Patrick Sullivan	Cornell University	Dr. Jon G. Sutinen	URI

Science and Statistical Committee		Social Sciences Advisory Committee	
Member	**Affiliation**	**Member**	**Affiliation**
		Dr. Robert Muth	UMASS Amherst

Table 150. Advisory committee members that provided expert advice and recommendations to the Council.

Scallop Advisors		Habitat Advisors	
Member	**Affiliation**	**Member**	**Affiliation**
Barbara Bragdon	Dennisport, MA	Dr. Peter J. Auster	Groton, CT
Herman R. Bruce	Dartmouth, MA	Dr. Anthony Chatwin	Boston, MA
Daniel Cohen	Cape May, NJ	Benjamin Cowie-Haskell	Scituate, MA
Hans Davidsen	Acushnet, MA	Edward Cunnie	Narragansett, RI
Ronald Enoksen	New Bedord, MA	Clifford A. Goudey	Cambridge, MA
James Fletcher	Manns Harbor, NC	Wm. Hubbard	Rye, NH
Gary Hatch	Owls Head, ME	Dr. Les Kaufman	Boston, MA
Kirk Larson (Chair)	Barnegat Light, NJ	David Lincoln	Gloucester, MA
Frank McLaughlin	Yorktown, VA	Maggie Mooney-Seus	Gloucester, MA
William F. Peabody	Carrollton, VA	Paul Parker	No. Chatham, MA
Mark Shackelford	Hampton, VA	Maggie Raymond	So. Berwick, ME
Raymond Starvish	Fairhaven, MA	Dr. Frederick Short	Lee, NH
Richard Taylor	Gloucester, MA	**Ronald Smolowitz (Chair)**	E. Falmouth, MA
William Wells (Vice-chair)	Yorktown, VA	Willis Spear	Yarmouth, ME
Chris Zeman	River Vale, NJ	Richard Taylor	Gloucester, MA
John Fernandez III	Newport News, VA	Dr. Peter J. Auster	Groton, CT
Sheryl Harper	Southwest Harbor, ME		
Howard Nickerson	New Bedford, MA		
Barbara Bragdon	Dennisport, MA		

8.1.2 Boundaries

The geographical area encompassed by the proposed action and managed by this FMP include the seawater and seabottom of the Atlantic Ocean within US jurisdiction and includes the vessels participating in the fishery, the ports where scallop vessels tie-up, and the shore-side facilities to the point of landing. The point of landing is typically the location where a shore-side individual or entity takes possession of the catch for processing and re-sale. Most of the scallop population under US jurisdiction ranges from the coastline of Maine, south to Georges Bank, then from offshore of Long Island, NY running south and southwest to off the coast of North Carolina in the Mid-Atlantic region. Adult scallops are found in depths ranging from a few meters in the north, to 20 to 40 fathoms through most of the range, and sometimes much deeper although scallops in deeper areas have low meat yields and may not contribute to spawning activity as much as other scallops. Scallop larvae exist in the water column from the bottom to the surface layers and drift with prevailing currents, throughout the NW Atlantic Coastal Shelf.

8.1.3 Sources of Impacts (Pathways)

Most of the environmental impacts that are regulated by this FMP arise from the act of fishing for sea scallops. Impacts occur because fishing gear makes contact with and disturbs the sea bed environment, because the scallop fishing gear selectively removes various species from the environment (some of which are discarded as unwanted or regulatory bycatch), and because the retain catch is landed at coastal ports which generates revenue and economic activity. Environmental impacts on scallops, scallop larvae, and scallop habitat through activities that degrade water quality, suspend sediments in the water column, and change circulation.

8.1.4 Time series

Various time series of impacts apply, depending on the context of analysis and evaluation. The FMP has existed since 1982, which is also when the modern annual scallop survey began. The scallop fishery, however, began in the late 1800's in the Gulf of Maine, and expanded to the South Channel area off Cape Cod, MA in the early 1900's, and then expanded throughout the range in the 1960's and 1970's. Although resource surveys using different gear configurations and vessels began in the late 1950s, most of the information before 1982 was derived from reported landings.

More pro-active management and data collected began in 1994, with implementation of Amendment 4 to the FMP. This action implemented limited access, vessel monitoring systems that recorded fishing activity and locations, and vessel trip reports. Although sampling was sparse for the sea scallop fishery, the Sea Sampling Observer Program began in 1992. Collection and analysis of VMS data became better over time and many of the impact analyses that use scallop fishing distribution as an input use 1998 – 2000 VMS data that was available for analysis in this document.

8.1.5 Valuable Environmental Components (VEC)

The following concerns represent valuable environmental components that the Sea Scallop FMP and Amendment 10 affect. Practically, the act of scallop fishing changes their condition or character or derive a benefit from the vessel activity and/or landings. For some VECs, more fishing would cause a decline in biomass or abundance of the VEC. For other VECs, their condition improves with greater sustainable landings. Others experience change depending on how and where scallop fishing effort occurs, or the complexity of the rules governing scallop fishing.

8.1.5.1 Sea Scallop Resource under US jurisdiction

This includes all scallop larvae in the water column and juvenile and adult scallops that settle and grow on the seabed.

8.1.5.2 Scallop fishing fleet and infrastructure (suppliers, maintenance facilities, processors)

This includes all vessels with limited access and general category scallop permits, the dealers that buy and process sea scallops from the vessels, and primary suppliers to the vessels that sell them gear, engines, boats, etc.

8.1.5.3 Vulnerable Finfish Resources Caught as Bycatch in the Scallop Fishery

This includes all regulated species that fishermen catch in scallop dredges and trawls, except for sea scallops. Fish and shellfish other than scallops that are landed are not bycatch and are not included. Species that are frequently included as bycatch are discarded individuals of monkfish, yellowtail flounder, and various species of skates (including barndoor).

8.1.5.4 Essential Fish Habitat (EFH) for Finfish, Scallops, and Shellfish Under Federal Management

This includes all marine habitats deemed essential to the well-being and reproduction of managed marine species. The geographical distribution and characteristics of EFH are defined in the management plans that regulate the fisheries targeting marine species.

8.1.5.5 Protected Species

This VEC includes marine mammal and turtle species that are classified as endangered or threatened under the Endangered Species Act and which have interactions with scallop fishing gear or are otherwise affected by scallop fishing.

8.1.5.6 Human Safety at Sea

This includes the health and well-being of captains, crew, and other individuals while aboard at-sea scallop vessels.

8.1.5.7 Fishing Dependent Communities

This includes coastal communities with fishing ports, whose economies and social structure are substantially dependent on or affected by scallop fishing activity and income.

8.1.5.8 Marine Fisheries Law Enforcement and Administration

This includes USCG and NMFS Law Enforcement resources that are assigned to enforcing and administering scallop fishery regulations and programs.

8.1.6 Mitigation and Monitoring

No mitigation is needed because the proposed action is expected to reduce adverse impacts on the environment. Monitoring of the scallop resource, fishing activity and catches, bycatch, and interactions with protected species is needed to ensure the FMP meets its objectives, produces optimum yield, and identifies ways to enhance yield (through rotation closures and mortality control) and minimize impacts.

8.1.7 Interactions among environmental effects and significance of cumulative effects of past, proposed, and reasonably foreseeable future actions

The following tables summarize the direct, indirect, and cumulative effects of past management measures, proposed management measures and reasonably foreseeable future effects on the environment, classified by valuable economic components (VECs). To keep this analysis in context of the FMP, the effects related to the current and proposed management alternatives are listed. No change or neutral effect means that the expected cumulative, direct, or indirect effects are expected to be no different than they had been under past and present actions. Not applicable means that the relevant action did not exist in the past or present, or it will not apply in the future under a reasonably foreseeable future action. An unknown or none identified designation means that the Council is unable to foresee an action that would have an effect, but one might exist in the future. An uncertain effect means that a past, present, proposed, or future action is certain to have an effect, but the Council cannot determine whether the effect will be positive, neutral, or negative.

Past activities include fisheries, fisheries management, and non-fishing activities that occurred since Amendment 4 implementation in 1994. Proposed activities include the final alternatives in Amendment 10. Reasonably foreseeable future actions include probable or potential federal activities and permitted activities that occur within the boundaries of this analysis. Examples include management of fisheries by other plans (particularly the management by the Northeast Multispecies FMP of fisheries that adversely effect groundfish EFH); management measures needed to reduce interactions and protect sea turtles; sediment disposal, dredging, and seabed drilling; and windfarms.

Table 151. Summary of cumulative effects: **VEC = Sea Scallop Resource under US jurisdiction.** Impacts on the scallop resource generally occur through changes in the fishing mortality rate and the fishery's size selection. Generally management measures that reduce mortality or select larger scallops benefit the scallop resource.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Rotation area management	Sections 7.2, 8.1.1, and 8.2	Past ad hoc rotation management has allowed higher biomass levels, while maximizing yield and (although uncertain) potentially improving recruitment.	Increases potential to keep biomass around Bmsy and increases yield from the fishery. Reduces mortality on small scallops through closure, having a positive conservative effect.	Uncertain effects which depend on implementation of future management actions. Actions in other plans that limit access under area rotation rules could mitigate the positive effect of rotation area management. Projection indicated that most strategies will be beneficial.	Very positive cumulative effect when combined with 4" rings and area-specific DAS allocations.
Georges Bank area access	Sections 7.2, 8.1.1, and 8.2	Georges Bank area access has been positive for the scallop resource, by reducing fishing mortality on scallops in open fishing areas.	Similar positive effects are anticipated.	Rules that minimize bycatch and habitat impacts may have a negative effect if they force fishing effort onto smaller scallops in other places.	Area access will have positive cumulative effects by maintaining high biomass in the groundfish closed areas, with periodic access.
Hudson Canyon Area controlled access	Sections 7.2, 8.1.1, and 8.2	Also positive for the scallop resource, but the effects have been less certain because fishing effort hasn't risen to desired targets.	Positive effects similar to the Georges Bank area access are anticipated.	Conversion to a fully-open status may occur at a different time than 2006 under a future framework action, also having a positive effect.	Hudson Canyon Area access has been and will continue to benefit the resource.
Area-specific DAS and trip allocations, with DAS tradeoffs	Sections 7.2, 8.1.1, and 8.2	Not applicable.	Significant positive effect through reductions in mortality where scallops are smaller and increases in mortality where they are larger.	Same as proposed action.	When combined with the status quo overfishing definition target mortality, the DAS allocations may continue allowing effort to exceed MSY levels in open fishing areas, unless future action is taken.
One-to-one controlled access area trip exchanges	Sections 7.2, 8.1.1, and 8.2	Not applicable.	No appreciable effect.	No effect.	None identified.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Broken trip exemptions (DAS adjustments)	Sections 7.2, 8.1.1, and 8.2	Negative effect because existing rules have discouraged fishing in controlled access areas.	Positive effect anticipated, because it reduces the business risk of loosing controlled access area DAS allocations during a broken trip.	Same as proposed action.	Could have a positive cumulative effect by allowing the FMP to meet area-specific mortality targets and maximize sustainable yield.
Carry over DAS	Sections 7.2, 8.1.1, and 8.2	No effect observed.	No effect expected.	Same as proposed action.	None identified.
Prohibit limited access vessels from fishing for scallops under general category rules	Sections 7.2, 8.1.1, and 8.2	Not applicable.	Positive, because it allows better control of fishing effort to prevent exceeding fishing mortality thresholds.	Positive effect, because measure prevents uncontrolled increases in fishing mortality if rules in other fisheries become more restrictive or scallop prices rise.	Positive cumulative effect.
Management of general category fishery (status quo option)	Sections 7.2, 8.1.1, and 8.2	Possible negative effect on inshore scallop resources.	No change.	Negative impacts if rules in other fisheries become more restrictive or scallop prices rise.	Uncontrolled fishing effort could have a negative cumulative impact.
Status quo overfishing definition	Sections 7.2, 8.1.1, and 8.2	Effects have been both positive and negative. Effort reductions to achieve the fishing mortality targets has promoted stock rebuilding, but fishing mortality targets that incorporate permanently closed areas allow too much fishing effort in fully-open fishing areas, particularly in the Mid-Atlantic region.	No change.	Future framework actions that define different mortality targets or DAS allocations have the potential to keep biomass near the target.	Mixed, but problems are projected for the Mid-Atlantic scallop resource unless future action is taken.
4" minimum ring size	Sections 7.2, 8.1.1, and 8.2	The increase to 3½" rings has been very positive for the resource.	Projected to increase biomass and yield, therefore positive.	Same as proposed action.	Positive cumulative effects are anticipated, especially when combined with area rotation and area-specific DAS allocations.
10" minimum twine top	Sections 7.2, 8.1.1, and 8.2	Twine top mesh size has had little effect on the scallop resource.	No effect anticipated.	Same as proposed action.	No cumulative effect on the scallop resource anticipated.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Habitat closure alternative 6	Sections 7.2, 8.1.1, and 8.2	Mixed effects: overlapping Georges Bank closed areas have allowed for rapid scallop stock rebuilding, but have prevented the benefits from translating into yield.	Similar effects as before Amendment 10, but may promote access to less sensitive parts of the Georges Bank closed areas.	Actions in other plans may limit bottom tending mobile gear, promoting habitat restoration.	Reduces fishing effort in areas with above average numbers of EFH designations and in areas containing sensitive and complex bottom habitats, having a positive effect.
TAC/DAS set-asides for habitat research	Sections 7.2, 8.1.1, and 8.2	Not applicable.	No effect.	No effect.	None identified.
TAC/DAS set-asides for scallop research	Sections 7.2, 8.1.1, and 8.2	Positive effects because it has funded research to map and measure scallops densities to support ad hoc area rotation and Amendment 10.	Continuation of benefits expected to occur through suitable rotation area management.	Funds may increase and allow data collection on a larger scale.	Positive cumulative effects are anticipated.
TAC/DAS set-asides to increase sea sampling	Sections 7.2, 8.1.1, and 8.2	No measurable effect on VEC.	No effect anticipated.	Same as proposed action.	Neutral cumulative effect.
Proactive protected species framework	Sections 7.2, 8.1.1, and 8.2	Same as above.	Same as above.	Same as above.	Neutral cumulative effect.
Revised bi-annual framework adjustment procedure	Sections 7.2, 8.1.1, and 8.2	Framework adjustments have allowed the FMP to respond to changing resource conditions.	Framework adjustment procedure will allow active management through area rotation and DAS allocations.	Same as proposed action.	Positive cumulate effect.
Other Alternatives					
New overfishing definition	Sections 7.2, 8.1.1, and 8.2	Not applicable.	Positive effect that keeps mortality near appropriate levels for regional resource conditions.	Same as proposed action	Particularly with area rotation and habitat closures, positive cumulative effects through better control of fishing mortality.
Other habitat closed area alternatives	Sections 7.2, 8.1.1, and 8.2	Not applicable.	Maintains high biomass and reproduction, but may not maximize yield.	Developing habitat alternatives in other FMPs may provide more conservation for scallops overall, but lead to declining yield from the resource.	May be overly conservative for the scallop resource when combined with existing closures.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Area specific possession limits for finfish	Sections 7.2, 8.1.1, and 8.2	Some benefits may have occurred by discouraging fishing in portions of controlled access areas having high bycatch.	No change.	No change.	Small positive cumulative effect.
Long-term closures with high bycatch	Sections 7.2, 8.1.1, and 8.2	Not applicable.	Could provide more conservation for the scallop resource, but lead to declining yield.	Same as proposed action.	May be overly conservative for the scallop resource when combined with existing closures.
Incidental catch and general category permits	Sections 7.2, 8.1.1, and 8.2	Not applicable.	Possible positive effect by allowing for better control of scallop fishing mortality.	Same as proposed action.	Could have positive cumulative effect, particularly for inshore scallop resources.
Restriction on rock chains	Sections 7.2, 8.1.1, and 8.2	Not applicable.	No appreciable effect anticipated.	Same as proposed action.	None identified.
No action/Status quo	Sections 7.2, 8.1.1, and 8.2	When combined with above average recruitment and closures, status quo management has promoted stock rebuilding.	Expected to cause declines in scallop biomass when scallop recruitment returns to average levels and promotes a rapid decline in open area biomass and catches if scallop recruitment becomes below normal.	Would require more access to closed areas to keep landings up – a long term negative.	Generally, status quo could increase fishing mortality and fishing effort if scallop recruitment declines, having cumulative effects on the scallop resource and other VECs.
Other federal activities having potential VEC effects	Sections 7.2 and 8.1.1	No effects have been noted, except for possible isolated events.	Not applicable.	Other fisheries using bottom tending mobile gear may cause non-catch mortality or discard mortality, having a negative effect. Proposed windfarm locations appear to have no impact, unless they occur on offshore banks or along coastal Maine. Seabed pipeline construction that passes through scallop habitat could have a negative effect on the scallop resource if disturb sediments are not contained.	Cumulative effects can be negative for activities that degrade water quality or increase sedimentation in offshore areas.

Table 152. Summary of cumulative effects: **VEC = Scallop fishing fleet and infrastructure (suppliers, maintenance facilities, processors).** Fishery impacts generally occur through the amount of revenue derived from fishing and the costs of fishing. Generally management measures that improve yield or reduce fishing costs have positive effects on the fishing industry.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Rotation area management	Sections 7.1, 8.7, and 8.8	Ad hoc rotation has been a positive effect on the fishing industry, although management difficulties have created business uncertainty.	Positive effect to fleet due to higher landings and to consumers due to lower prices. Total economic effect from area rotation is at least 3 - 7 % increase in net benefits.	Actions in other FMPs that hinder scallop access and rotation management could reduce benefits.	Area rotation will reduce fishing effort and mortality on smaller scallops, helping to maintain biomass and spawning activity at target levels, which will have positive effect on the VEC.
Georges Bank area access	Sections 7.1, 8.7, and 8.8	Results have been mixed because while access has had positive effects, some portions of the areas have remained closed and continued access has been difficult to achieve.	Effects are expected to be positive through a more permanent identification of access areas and a plan for regular mechanical rotation.	Actions in other FMPs could change how much of the scallop resource in the Georges Bank closed areas is accessible, having either positive or negative effects.	Access has had and will have positive effects by reducing bycatch and habitat impacts, while increasing optimum yield. Efficiency increases for fishing in the closed areas during a mechanical rotation program. Inability to access the areas means that scallops do not contribute to yield and eventually biomass declines from natural mortality or catastrophic loss from predation and/or infections.
Hudson Canyon Area controlled access	Sections 7.1, 8.7, and 8.8	Effects have largely been positive by delaying mortality on small scallops during 1998-2000. Benefits have accrued through upslope scallop movement and by controlled access fishing during 2001-2003, both making larger scallops available.	Controlled access in 2004–2005 is expected to have positive benefits through higher landings of large scallops.	Positive effect, because the FMP will re-evaluate by framework action whether controlled access should continue in 2006, or the Hudson Canyon Area should revert to a regular, open fishing area.	Ad hoc rotation of the Hudson Canyon Area is probably the most successful result of ad hoc area rotation, because the fleet has been able to fish in the area after scallops reach optimum size.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Area-specific DAS and trip allocations, with DAS tradeoffs	Sections 7.1, 8.7, and 8.8	DAS tradeoffs have had positive effects by shifting effort away from and reducing mortality in regular, open fishing areas. Some vessels however have not used the days to fish in controlled access areas, mitigating the expected positive effect.	Greater benefits are expected because controlled access area DAS allocations cannot be used in regular, open fishing areas. Some negative distributional effects are anticipated for less mobile fishing vessels.	Changes in biomass levels may be required to adjust the DAS tradeoff. DAS may fluctuate due to changes in scallop abundance and size frequency.	The DAS allocations and tradeoff have had a positive effect by controlling fishing mortality, which will be enhanced by area-specific allocations, resulting in optimum yield for specific areas.
One-to-one controlled access area trip exchanges	Sections 7.1, 8.7, and 8.8	Not applicable.	Positive effect expected because it allows fishing industry flexibility to fish in preferred locations, potentially reducing fishing costs.	Other federal actions that limit where scallop vessels may fish could reduce positive effects.	Positive effects are anticipated because it allows the scallop fleet to reduce costs while still deriving the benefits of area-specific DAS allocations.
Broken trip exemptions (DAS adjustments)	Sections 7.1, 8.7, and 8.8	The existing program has generally had negative effects by curbing fishing in controlled access areas.	New system is expected to address existing problems and encourage fishing in appropriate locations. Positive effects are therefore expected.	None expected.	Combined with area-specific DAS allocations and controlled access, it will have positive effects.
Carry over DAS	Sections 7.1, 8.7, and 8.8	Positive effects by allowing more flexibility, potentially reducing fishing costs.	Continued positive effects are expected.	None expected.	Same as above.
Prohibit limited access vessels from fishing for scallops under general category rules	Sections 7.1, 8.7, and 8.8	Not applicable.	Positive effects for the industry as a whole, but negative effects on some vessels that augment scallop income by fishing off the clock.	Possible positive effect by allowing more future limited access DAS allocations than if this practice were continued..	Although this could have a positive effect on the VEC, it could have a negative cumulative effect by encouraging more fishing for other species.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Management of general category fishery (status quo option)	Sections 7.1, 8.7, and 8.8	Positive effect realized by giving smaller vessels an option to fish on a rebuild resource, however local effects on scallop yield from inshore scallop populations have been negative.	No change.	More restrictive management in other FMPs or higher scallop prices could lead to more scallop fishing. On one hand, this has a positive effect by providing options to small vessels in other fisheries. On the other hand, it could reduce optimum yield from inshore scallop populations.	Helps to supply local scallop markets in small ports.
Status quo overfishing definition	Sections 7.1, 8.7, and 8.8	Fishing mortality reductions to meet existing biological reference point goals have promoted rebuilding and boosted income and economic activity.	In the short term, it allows the FMP to allocate at least 120 DAS to scallop vessels, allowing them to continue to be profitable. In the long-term, producer surplus is expected to decline if the overfishing definition allows DAS allocations to increase when fewer scallops are available.	DAS adjustments will be needed to match scallop productivity. The revised framework adjustment process sets optimum yield as a specific goal to be achieved which may have positive effects.	Cumulative effects on VEC have been very positive and will be positive in the short term, but it may allow too much effort in some areas, unless the FMP sets lower mortality targets and DAS allocations by framework adjustment. Effort allocations are not negatively effected by large area closures for habitat or other conservation objectives, which have a short-term positive effect, but may have long-term negative implications.
4" minimum ring size	Sections 7.1, 8.7, and 8.8	Increasing ring size to 3½ inches has been very positive, because it has increased small scallop escapement and boosted yield-per-recruit.	Similar positive effects are anticipated as long as areas having large scallops are open to fishing. Operating costs are expected to decline because the dredge will be more efficient. A short-term cost will accrue as suppliers and the industry switch gear.	None expected.	Effects are expected to be very positive when combined with rotation area management, which focuses fishing effort on large scallops.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
10" minimum twine top	Sections 7.1, 8.7, and 8.8	Other than the cost of the gear, the effects have been neutral, because the larger mesh has been deployed in areas with large scallops that are retained by the mesh.	Since the scallop resource has rebuilt and larger scallops are available, neutral effects are anticipated other than the short term costs to the fleet and suppliers for changing gear.	Habitat or groundfish closures that encompass areas having large scallops will have a negative effect by shifting effort into areas with small scallops that will not be retained by the larger mesh.	Area rotation promotes fishing on larger scallops and would therefore prevent negative effects that might occur by using large twine tops where small scallops exist.
Habitat closure alternative 6	Sections 7.1, 8.7, and 8.8	Similar closures associated with groundfish closed areas have had negative effects by preventing fishing on valuable scallop resources.	Preventing access to valuable scallop resources within the area will have negative effects on the VEC.	Different habitat closure alternatives in the Multispecies FMP may allow more access, having positive effects. Habitat closures in other plans that conflict could cause larger closures than intended.	Although long-term closures have a negative effect on the scallop industry, the habitat closure as a means to minimize habitat impacts helps to justify more regular access to and fishing effort in other areas.
TAC/DAS set-asides for habitat research	Sections 7.1, 8.7, and 8.8	Not applicable.	Slight negative effect by reducing the portion of OY available to the fleet. Neutral effect on processors and suppliers.	None expected.	Uncertain.
TAC/DAS set-asides for scallop research	Sections 7.1, 8.7, and 8.8	Positive effect from applying results of scallop research to present management.	Same as before, but Amendment 10 will make more funds available, increasing beneficial scallop research.	None expected.	Positive by improving management and increasing OY.
TAC/DAS set-asides to increase sea sampling	Sections 7.1, 8.7, and 8.8	Positive effect, because it has allowed access to areas where bycatch monitoring is important.	Slight negative effect by reducing the portion of OY available to the fleet. Neutral effect on processors and suppliers.	Changes in allowable catches of finfish could require more observers and increase the need for funding through higher set-asides.	Long-term benefits will outweigh the costs, having a positive effect.
Proactive protected species framework	Sections 7.1, 8.7, and 8.8	Not applicable.	No effect at the present time.	Possible actions may restrict scallop fishing to reduce turtle encounters or changes in fishing gear may be required, both having negative impacts.	Could have positive effect by allowing scallop fishing to continue by addressing issues with less costly methods.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Revised bi-annual framework adjustment procedure	Sections 7.1, 8.7, and 8.8	Framework adjustments have had a positive impact by allowing the FMP to respond to changing conditions.	Revised procedure will allow the FMP to adjust and could reduce business uncertainty and risk.	None expected.	Positive effects because framework adjustments will allow the FMP to achieve OY.
Other Alternatives					
New overfishing definition	Sections 7.1, 8.7, and 8.8	Not applicable.	Short term negative effect, because DAS reductions would be applied. Long-term positive effect by maximizing yield and reducing fishing costs.	Not applicable.	Large area closures that overlap scallop fishing areas could cause drastic reductions in DAS allocations, having a very negative effect in the short-term.
Other habitat closed area alternatives	Sections 7.1, 8.7, and 8.8	Not applicable.	Mostly negative effect unless it allows access to groundfish areas that are now closed or expected to be closed.	Habitat closures in other plans that conflict could cause larger closures than intended.	Could cause problems with ability to manage area rotation.
Area specific possession limits for finfish (not adopted, but available as a frameworkable measure)	Sections 7.1, 8.7, and 8.8	Possible positive effect by keeping controlled access areas open when finfish bycatch may have reached a TAC and close areas to fishing.	May have similar positive effect, depending on implementation by framework action.	Limits imposed by other FMPs could reduce income.	Positive cumulative effect when appropriately applied to reduce the risk of closing areas when finfish TACs are met.
Long-term closures with high bycatch	Sections 7.1, 8.7, and 8.8	Not applicable.	Year-round closures would have had a substantial negative effect. Seasonal closures would have had a slightly negative effect.	Unknown.	Increases in groundfish and monkfish stock biomass could cause localized increases in bycatch because catches exceed finfish possession limits.
Incidental catch and general category permits	Sections 7.1, 8.7, and 8.8	Positive effect for small vessels and local infrastructure. Slight negative effect on limited access vessels and associated businesses because it raises fishing mortality.	Possible positive effect by achieving a higher sustainable yield from inshore scallop populations.	Would have been successful of limiting impacts from more restrictive management actions in other FMPs or increases in scallop price.	Positive effect from effective control of fishing mortality on scallops that general category vessels typically target.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Restriction on rock chains	Sections 7.1, 8.7, and 8.8	Rock chains have had a positive effect on the VEC by improving safety and making more of the scallop resource accessible to fishing.	Potentially negative effect on VEC, because it could increase fishing costs and reduce accessibility of scallops to the fleet.	Requirements for rock chains to reduce turtle interactions, if it becomes necessary may cause conflicts.	Negative impacts are anticipated from reducing the ability to use rock chains.
No action/Status quo	Sections 7.1, 8.7, and 8.8	Existing management has had positive effects on the scallop industry.	Negative impacts are expects, because the policies are no longer suitable given the condition of the scallop resource.	Complicated framework actions would be required to avert negative impacts of no action.	Although positive effects have occurred because the scallop resources has rebuild, negative cumulative effects are anticipated if fishing effort were not adjusted to respond to current conditions.
Other federal activities having potential VEC effects	Sections 7.1 and 7.2	Groundfish closures have had a very negative effect due to not achieving OY.	Not applicable.	Windfarms may negatively effect the ability for scallop vessels to use Nantucket Sound to transit from Georges Bank scallop areas to New Bedford and other MA ports. Ocean disposal, dredging, and other sea bed activities near scallop populations could reduce growth and recruitment or increase mortality and have a negative effect on OY and scallop revenue. Area closures to address protected species issues or protect manmade seabed structures could similarly have a negative effect.	Cumulatively, actions that adversely affect scallop productivity or make scallops inaccessible to fishing have a negative effect.

Table 153. Summary of cumulative effects: **VEC = Vulnerable Finfish Resources Caught as Bycatch in the Scallop Fishery.** Bycatch impacts generally occur through the selectivity of the fishery, where fishing occurs relative to the distribution of finfish species, and when fishing occurs. Generally management measures that reduce the overlap between the target fishery and species that are vulnerable to capture during scallop fishing have positive effects on bycatch.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Rotation area management	Sections 7.2.4 and 8.3	Ad hoc area rotation and access has been beneficial for most species. Catches may increase for some species concentrated in re-opened areas.	Expected to be beneficial for most species due to decreases in fishing time per DAS and per unit of scallop landings.	The "Elephant Trunk" area in the Mid-Atlantic region will reopen in 2008 and have similar effects as the Hudson Canyon Area controlled access program.	Combined with 4" rings and 10" twine tops, rotation management area is expected to reduce fishing time and minimize finfish bycatch.
Georges Bank area access	Sections 7.2.4 and 8.3	Beneficial for most species. Catches of most finfish species were low. Barndoor skate catches may have increased but were a very low fraction of total biomass.	Amendment 10 projects substantial decreases of fishing time in the groundfish closed areas and is therefore beneficial.	Framework Alternative 39 will implement additional measures to minimize impacts on groundfish.	Minimal impacts on groundfish stock biomass and rebuilding
Hudson Canyon Area controlled access	Sections 7.2.4 and 8.3	Beneficial for most species.	Continued benefits for most species.	Hudson Canyon Area will open fully to scallop fishing in 2006, but this is unlikely to have a negative effect for most species.	Effort could increase in the Hudson Canyon Area with area-specific DAS allocations, reducing total fishing time in the Mid-Atlantic.
Area-specific DAS and trip allocations, with DAS tradeoffs	Sections 7.2.4 and 8.3	Not applicable.	Could have positive impacts for many species due to effect on minimizing fishing time.	Same as proposed action.	Measure helps to focus fishing activity where it is most efficient. Very positive when combined with 4" rings and 10" twine tops.
One-to-one controlled access area trip exchanges	Sections 7.2.4 and 8.3	Not applicable.	Neutral effect.	Neutral effect.	Neutral effect.
Broken trip exemptions (DAS adjustments)	Sections 7.2.4 and 8.3	Has had negative impacts on VEC because effort was mis-applied in regular, open areas.	Positive effect because it encourages DAS use in controlled access areas where full-time per DAS is low.	Same as proposed action.	Postive when combined with area rotation, 4" rings, and 10" twine tops.
Carry over DAS	Sections 7.2.4 and 8.3	Neutral effect.	Neutral effect.	Same as proposed action.	Neutral effect.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Prohibit limited access vessels from fishing for scallops under general category rules	Sections 7.2.4 and 8.3	Unquantified, but possible negative effect by encouraging nearshore fishing in New England.	Positive effect because it reduces fishing effort outside of the limited access DAS program.	Positive effect because a greater amount of fishing will occur under limited access rules.	Difficult to quantify.
Management of general category fishery (status quo option)	Sections 7.2.4 and 8.3	Same as above.	Unquantified, but possible negative effect by encouraging nearshore fishing in New England.	Same as proposed action.	Requiring 4" rings and 10" twine tops will have positive benefits.
Status quo overfishing definition	Sections 7.2.4 and 8.3	Negative. It encouraged overexploitation of scallops in open fishing areas and reduced scallop catch rates.	Negative. Effort in open fishing areas will be higher than that needed to produce maximum yield.	Possibly positive or neutral if the Council chooses lower mortality targets in future framework actions.	Depends on how the area-specific DAS allocations are set under future framework adjustments.
4" minimum ring size	Sections 7.2.4 and 8.3	Increases from 3" to 3 ½ " rings may have had positive, but unmeasurable effects.	Expected to have positive impacts by reducing fishing time in areas having larger scallops. Gear comparison research shows substantial benefits for most finfish.	Same as proposed action.	Expected to have positive impacts when combined with area rotation, where fishing effort will focus on larger scallops, minimizing scallop loss through the rings.
10" minimum twine top	Sections 7.2.4 and 8.3	Increases from 6" to 8" in open areas and to 10" in controlled access areas had positive, although difficult to measure, impacts.	May have positive impacts, depending on the distribution of fishing.	Same as proposed action.	Expected to have positive impacts when combined with area rotation, where fishing effort will focus on larger scallops, minimizing scallop loss through the twine top.
Habitat closure alternative 6	Sections 7.2.4 and 8.3	Similar to groundfish area closures. Mixed benefits due to effort shifts.	Beneficial effects for some species that concentrate in the closed area.	Same as proposed action.	When combined with status quo overfishing definition, may have negative effects for species concentrated in other areas.
TAC/DAS set-asides for habitat research	Sections 7.2.4 and 8.3	Not applicable.	No measurable effect.	Same as proposed action	No measurable effect.
TAC/DAS set-asides for scallop research	Sections 7.2.4 and 8.3	Assisted research on more selective gear modifications.	No measurable effect and program will not increase finfish bycatch compared to normal commercial scallop fishing.	May be beneficial if research identifies more selective gear or methods of fishing to minimize bycatch or bycatch mortality.	Unknown.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
TAC/DAS set-asides to increase sea sampling	Sections 7.2.4 and 8.3	Improved ability to quantify bycatch and their effects.	Expanded program will provide more complete picture. Program will not increase finfish bycatch compared to normal commercial scallop fishing.	May identify bycatch "hotspots' for future framework actions to address, therefore beneficial.	Unknown.
Proactive protected species framework	Sections 7.2.4 and 8.3	Not applicable.	No effect.	Depending on the types of management measures needed to reduce interactions, it could increase finfish bycatch.	Combined with status quo overfishing definition mortality targets, closures to reduce interactions would have negative effect on finfish bycatch.
Revised bi-annual framework adjustment procedure	Sections 7.2.4 and 8.3	Past framework actions have provided more opportunity to address bycatch issues, therefore have been positive.	Effect no different than past actions.	Same as proposed action. Goal to achieve optimum yield may have a positive effect, depending on future mortality targets and management measures established by framework.	Administration of rotation area management by framework could have positive or negative impacts, depending on fishing mortality targets and area-specific DAS allocation amounts.
Other Alternatives					
Alternative overfishing definition	Sections 7.2.4 and 8.3	Not applicable.	Positive effect due to effects of maximizing yield from the available resource with much less fishing time and area swept.	Same as proposed action	Positive effect because of interactions with area-specific DAS allocations, crew limits, 4" rings, and 10" twine tops.
Other habitat closed area alternatives	Sections 7.2.4 and 8.3	Not applicable.	Cannot be measured due to lack of data.	Unknown.	Larger closures could have negative impacts when combined with the status quo overfishing definition.
Area specific possession limits for finfish	Sections 7.2.4 and 8.3	Has had positive effects by inducing vessels to fish in areas where catches are less for species they cannot keep.	Depends on future implementation by framework action.	May be applied in controlled access areas to modify fishing behavior to avoid catches that cannot be retained and for which a hard TAC is applied.	Could be positive when combined with controlled access area management.
Long-term closures with high bycatch	Sections 7.2.4 and 8.3	Not applicable.	Positive effect by closing areas with statistically high bycatch levels.	Not applicable.	Could have had a positive effect when coupled with the alternative overfishing definition.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Incidental catch and general category permits	Sections 7.2.4 and 8.3	Unmeasurable. Finfish bycatch may be high in coastal New England areas.	Finfish bycatch may be high in coastal New England areas.	Same as proposed action	Enhanced sea sampling may be available to characterize bycatch.
Restriction on rock chains	Sections 7.2.4 and 8.3	Not applicable.	Continuation of rock chain use has unknown impacts. May have negative impacts by allowing fishing activity in sensitive and complex habitats where small fish are more abundant.	Same as proposed action.	Unknown.
No action/Status quo	Sections 7.2.4 and 8.3	Finfish catches have substantially declined from larger rings, larger twine top mesh, lower DAS allocations and less fishing time per DAS.	Not applicable.	Not applicable.	Continued overexploitation of scallops in open fishing areas are predicted to reverse gains made in recent years due to stock rebuilding.
Other federal activities having potential VEC effects	Assessed in other FMPs.	Georges Bank area closures may have helped reduce impacts, but the closures increase fishing pressure in other areas with groundfish.	Not applicable.	Habitat closures in other plans may have important impacts on finfish bycatch in the scallop fishery, due to effort shifts.	Unknown.

Table 154. Summary of cumulative effects: **VEC = Essential Fish Habitat (EFH).** EFH impacts generally occur through contact with the seabed by bottom tending gear that removes, disturbs, or buries benthic epifauna. The quality and quantity of adverse impacts are related to the amount and distribution of fishing activity, as well as the type of gear in use. Generally management measures that reduce fishing time, focus fishing in less sensitive areas, or modify gear so that it has less contact with the bottom have positive effects on EFH.

Final Alternative	Analysis of Direct and Indirect Impacts on EFH	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Rotation area management	Sections 7.2.6, 8.1.9, and 8.5	Past ad hoc rotation management (through access programs) has allowed higher biomass levels, while maximizing yield and (although uncertain) potentially improving recruitment. Since effort and bottom contact time are expected to be lower under RAM, EFH may benefit under this type of management strategy. Therefore, there have been some positive impacts on EFH from controlled access programs implemented in the past, which are similar to RAM.	Specific impacts of area rotation will vary depending on the type and vulnerability of habitat types present in the area, its size, the intensity of scallop fishing prior to closure, recovery times for critical habitat features, etc., but overall, RAM is expected to have positive effects because effort on gravelly sand sediment types is expected to decline. However, negative impacts may also occur because more effort is expected to shift to areas with more EFH for juvenile species with vulnerable EFH. Therefore, there may be both positive and negative cumulative impacts on EFH from RAM..	According to the analysis, effort under a rotational area management strategy in the long-term has a bias toward areas having more than 6 EFH designations for species with vulnerable EFH. Therefore, there may be negative cumulative impacts on EFH from RAM as an overall strategy, but normal scallop fishing may have a negative cumulative impact on EFH as well. **Other FMPs:** There is potential for negative cumulative effects on rotation area management if areas are closed to scallop fishing in other plans. For example, if mortality closures or habitat closures are implemented through Amendment 13 to the Multispecies FMP, that could benefit EFH, but reduce the effectiveness of RAM if the boundaries do not overlap and cause area swept to increase in open areas, which would have negative impacts on EFH.	The distribution of sediment types and EFH associated with projected scallop fishing effort within rotational management varies depending on which RMAs are open, and which are closed. The long-term projections suggest that scallop effort may be shifted toward areas with EFH vulnerable to bottom tending gear, however previous actions similar to RAM (access programs) have decreased area swept, so there may be some positive impacts on EFH. Overall, RAM will have cumulative impacts on EFH; positive on areas outside access areas, and negative for the EFH within RAMs.

Final Alternative	Analysis of Direct and Indirect Impacts on EFH	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Georges Bank area access	Sections 7.2.6, 8.1.9, and 8.5	These areas were closed to groundfish gear (including scallop dredges) in 1995 and opened to scallop dredging on a limited basis in 1999 and 2000. Therefore, some of the habitat benefits accrued in these areas over time has been reduced. Permitting some access into the Georges Bank areas may reduce habitat benefits in those areas, but it may also improve habitats in areas outside by reducing bottom contact time. Opening them to scallop dredging will have a direct negative effect on the EFH within the closures, particularly in Closed Area I because hard bottom habitat in this area is more vulnerable to fishing than sandy bottom in other areas.	No change from past actions.	Under rotation area management, it is likely that areas on Georges Bank will be part of the rotational strategy in order to harvest MSY. Thus, it is probable that these areas will be subject to fishing activity in the short and long term. Thus the positive and negative impacts on EFH described in the past actions column still apply. **Other Plans:** It is possible that Amendment 13 may implement additional mortality or habitat closures in this area. That would likely benefit the EFH within the access program, but displace scallop effort in other areas, which could have negative impacts on EFH in the overall region.	Cumulative effects of Georges Bank access over time are thus neutral, both positive and negative. Access to Georges Bank has localized negative impacts on EFH, but overall access programs have reduced bottom contact time and may have reduced fishing effort in areas with "sensitive" habitat in areas outside access programs, which would benefit EFH.

Final Alternative	Analysis of Direct and Indirect Impacts on EFH	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Hudson Canyon Area controlled access	Sections 7.2.6, 8.1.9, and 8.5	Permitting some access into the Hudson Canyon area may improve habitats in areas outside by reducing bottom contact time, and since the habitats in the Hudson Canyon area are not considered "sensitive", there have been positive cumulative impacts on EFH from this controlled access program. Short-term closures do not provide significant habitat benefits, but there may be additional EFH benefits from the DAS tradeoffs.	No change from past actions.	It is possible that the Hudson Canyon area could reopen as an uncontrolled area in the future. It is likely that the negative impacts on EFH and small scallops would increase in that area if the control access program expires. Continued access will be reevaluated in future actions. **Other Plans:** There are no RFFAs that would have an impact on the Hudson Canyon access program that the Council is aware of that would impact EFH.	While there may be some direct negative impacts to the EFH in the HC closure by providing access to the scallop fleet, the substrate in that area is not considered to be as "sensitive" as areas outside the closure. There have been indirect beneficial impacts on the EFH in areas outside the HC closure as a result of the access program. Overall, cumulative impacts are positive because effort has shifted onto less "sensitive" bottom as a result of the access program, and bottom contact time has declined.
Area-specific DAS and trip allocations, with DAS tradeoffs	Sections 7.2.6, 8.1.9, and 8.5	Negative impacts on EFH in the past because vessels have used DAS in areas where bottom contact time increases, potentially having negative impacts on EFH.	As a stand-alone measure, this should decrease bottom contact time by preventing vessels from using DAS in an area that is inappropriate.	Same as proposed action. **Other Plans:** There are no RFFAs that would have an impact on area specific DAS and trip applications that the Council is aware of that would impact EFH.	Positive cumulative impact on EFH from this measure, if bottom contact time is reduced and vessels are shifted into areas that are more appropriate/efficient for harvesting scallops.
One-to-one controlled access area trip exchanges	Sections 7.2.6, 8.1.9, and 8.5	No predictable effect on EFH.	No predictable effect on EFH.	None identified.	Cumulative effects on EFH are uncertain.

Final Alternative	Analysis of Direct and Indirect Impacts on EFH	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Broken trip exemptions (DAS adjustments)	Sections 7.2.6, 8.1.9, and 8.5	It is probable that fishing time in open areas has increased under past management due to this measure because there is a reduced incentive to fish in controlled areas since there is risk of losing DAS if a vessel has to return to port early. This measure may have prevented more vessels from participating in controlled access programs., thus increasing effort in outsides areas having negative impacts on EFH.	The proposed change to the broken trip exemption will hopefully reduce the risk for vessels to participate in access programs. Thus more effort will be shifted into access areas, where bottom contact time is lower, potentially having some indirect benefit to EFH in outside areas.	Same as proposed action. **Other Plans:** There are no RFFAs that would have an impact broken trip exemptions that the Council is aware of that would impact EFH.	Potentially, this measure will increase the number of vessels that participate in access programs. Overall, the measure has neutral cumulative impacts on EFH, but if significantly more vessels participate in access programs as a result of this adjustment for broken trips, then the EFH in outside areas may benefit.
Carry over DAS	Sections 7.2.6, 8.1.9, and 8.5	No expected impact.	No expected impact.	Same as proposed action. **Other Plans:** There are no RFFAs that would have an impact on carry over days that the Council is aware of that would impact EFH.	No expected impact.
Prohibit limited access vessels from fishing for scallops under general category rules	Sections 7.2.6, 8.1.9, and 8.5	Not Applicable because limited access vessels have been able to fish under general category rules in the past.	The impacts of this action on EFH are uncertain. It is possible that limited access vessels will do something else to replace this lost scallop revenue, but specifically what cannot be predicted.	**Other Plans:** If vessels want to replace lost income and fish in other fisheries, but other FMPs have restrictions that prevent them from shifting effort, then the effects on EFH may be positive because those limited access scallop vessels will not be fishing.	Overall the cumulative impacts of this action are difficult to predict because shift is effort are dependent on whether vessels will try to replace potential lost income. Cumulative impacts on EFH are uncertain.

Final Alternative	Analysis of Direct and Indirect Impacts on EFH	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Management of general category fishery (status quo option)	Sections 7.2.6, 8.1.9, and 8.5	General category vessels primarily fish inshore and in areas with complex bottom. Thus this fishery has had negative impacts on EFH, but so have other fisheries in the region.	Amendment 10 proposes to allow general category vessels to fish in newly reopened areas, which it did not before, so that will increase effort, an indirect negative impact on EFH.	**Prices of scallops could impact the amount of general category activity. Increased prices could increase effort, that would have potentially negative impacts on EFH. Or prices could go down, thus less effort, so benefits for EFH.** **Other FMPs:** It is possible that as a result of restrictions implemented in Amendment 13, vessels with general category permits will shift to scallop fishing from groundfish fishing to replace lost income. This will have a neutral impact on EFH because those vessels were fishing already.	This measure will potentially increase fishing effort in certain areas that are now accessible to general category vessels, thus the cumulative impacts are potentially negative for EFH. It is important to note that the incremental effect on EFH from the general category vessels may be negligible given much higher effort by limited access vessels. Therefore, the overall cumulative impacts from this measure may be slightly negative, compared to the level of other fishing activities in the region.
Status quo overfishing definition	Sections 7.2.6, 8.1.9, and 8.5	Effort has declined significantly under the Amendment 7 (status quo) overfishing definition. Since Amendment 4, effort levels have decreased; thus, there have been positive impacts on EFH with lower effort levels.	In the short-term, there is no change to effort levels and impacts on EFH from this overfishing definition, but it the long-term; this overfishing definition will have negative impacts on EFH because effort will increase over time.	Council may set lower targets and DAS in a future framework to prevent increased effort under the status quo definition that could reduce effort, which would then have indirect positive impacts on EFH. Otherwise, effort is expected to increase in the future under this definition, which could mean negative impacts on EFH.	Cumulatively, this overfishing definition has neutral impacts because effort reductions in the past have had positive impacts on EFH, but projections indicate that effort will increase as a result of this overfishing definition, so habitat impacts in the future may be negative unless future action is taken.

Final Alternative	Analysis of Direct and Indirect Impacts on EFH	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
4" minimum ring size	Sections 7.2.6, 8.1.9, and 8.5	The size of rings has changed in the past from 3 inches to 3.25 etc. This has aided stock rebuilding, and as a result bottom contact time has declined having positive impacts on EFH.	Four inch rings will slightly increase dredge efficiency for larger scallops, thus reducing bottom contact time in recently opened areas where large scallops are abundant, a positive impact on EFH. But four inch rings will reduce catch rates and increase bottom time in areas where medium-small sized scallops are prevalent, thus having a negative impact on EFH.	None identified.	Increasing ring size in the past has had positive impacts on EFH because it has aided recruitment, and allowed the fishery to harvest larger scallops, thus reducing bottom contact time. However, if 4 inch rings cause bottom contact time to increase because of high levels of escapement, then EFH will be negatively impacted. The cumulative impacts of this action on EFH are uncertain and are dependent on the recruitment levels of scallops.
10" minimum twine top	Sections 7.2.6, 8.1.9, and 8.5	None	Ten-inch twine tops will reduce by-catch, but have no direct habitat effects.	None identified.	No cumulative impacts on EFH from this measure.
Habitat closure alternative 6	Sections 7.2.6, 8.1.9, and 8.5	The cod HAPC is the only habitat closed area in this region (implemented under the Multispecies FMP). While it is difficult to measure, there are most likely habitat benefits from this area, as well as the long-term, large mortality closed areas on Georges Bank and in the Gulf of Maine.	The areas within Alternative 6 have been closed since 1994, so keeping these areas closed will improve habitat recovery and most likely have EFH benefits for the EFH within these areas.	Amendment 13 to the Multispecies FMP has identified two habitat closed area alternatives as preferred alternatives (Alternatives 10a and 10b in A13). If these areas are added to the habitat closure implemented in Amendment 10, EFH will benefit as a result. It is also possible that these areas could replace Alternative 6 in a subsequent framework, which would still benefit EFH in the region.	Overall, long-term closed areas are expected to have a cumulative benefit on EFH. If the areas outside closures are more "sensitive" however, then benefits on EFH for the entire region will be lower because effort will be displaced onto more "sensitive" areas.

Final Alternative	Analysis of Direct and Indirect Impacts on EFH	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
TAC/DAS set-asides for habitat research	Sections 7.2.6, 8.1.9, and 8.5	Not Applicable	Could indirectly benefit habitat when habitat research is funded and provides better information for future management decisions	Future research projects funded by this TAC set-aside could help identify better ways to minimize impacts on EFH.	Overall this measure will have indirect benefits on EFH. However, the actual scientific research will most likely have negative impacts on EFH when gear used in the research will come into contact with the bottom. These negative impacts are very small in comparison to normal fishing activity and will probably be outweighed by the indirect positive impacts on EFH from the results of the research.
TAC/DAS set-asides for scallop research	Sections 7.2.6, 8.1.9, and 8.5	Not Applicable	Could indirectly benefit habitat when scallop research is funded and provides better information for future management decisions.		Overall this measure could have indirect positive impacts on EFH if the research focuses on habitat as well, but the benefits will be less than research specifically designed for habitat purposes (see above).
TAC/DAS set-asides to increase sea sampling	Sections 7.2.6, 8.1.9, and 8.5	Not applicable	No effect	No Effect	No effect

Final Alternative	Analysis of Direct and Indirect Impacts on EFH	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Proactive protected species framework	Sections 7.2.6, 8.1.9, and 8.5	Not applicable	No effect	Closed areas in the Mid-Atlantic region for protected species may shift effort to Geroges Bank and the Gulf of Maine-which are made up of more complex bottom-an indirect negative impact on EFH.	The cumulative impacts of this action on EFH depends on the specific action that is taken, but if it includes closed areas that will shift effort into more "sensitive" areas there could be negative impacts on EFH. In addition, if effort is shifted into areas that are less efficient for harvesting scallops, then bottom contact time could increase, causing a negative impact on EFH.
Revised bi-annual framework adjustment procedure	Sections 7.2.6, 8.1.9, and 8.5	Uncertain impact	No habitat effects; Council can take action under a framework action to protect EFH.	Uncertain impact	Uncertain impact
Other Alternatives					
Alternative overfishing definition	Sections 7.2.6, 8.1.9, and 8.5	Not applicable	This overfishing definition would decrease bottom contact time, thus having positive impacts on EFH.	None	Cumulative effects of this measure on EFH would be positive, because fishing time would be less.

Final Alternative	Analysis of Direct and Indirect Impacts on EFH	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Other habitat closed area alternatives	Sections 7.2.6, 8.1.9, and 8.5	The cod HAPC is the only habitat closed area in this region (implemented under the Multispecies FMP). While it is difficult to measure, there are most likely habitat benefits from this area, as well as the long-term, large mortality closed areas on Georges Bank and in the Gulf of Maine.	There is a diverse group of closed area alternatives designed to minimize impacts on EFH in Amendment 10 (11 total). The EFH benefits vary for each alterantive, but each one would increase the amount of ocean floor closed for fishing for the long-term, a direct benefit on EFH.	Almost all of these alternatives are also being considered in Amendment 13, and could include prohibitions on scallop deredge gear. Amendment 13 also contains additional closed area alternatives that are not in Amendment 10 that have been identified as preferred alternatives (Alternatives 10a and 10b in A13). If these areas are added to the habitat closure implemented in Amendment 10, EFH will benefit as a result. It is also possible that these areas could replace Alternative 6 in a subsequent framework, which would still benefit EFH in the region.	Overall, long-term closed areas are expected to have a cumulative benefit on EFH unless effort is displaced to more vulnerable EFH, outweighing the benefits of the closure. The specific level of benefit to EFH varies between the eleven closed area alternatives under consideration.
Area specific possession limits for finfish	Sections 7.2.6, 8.1.9, and 8.5	Not applicable	Uncertain impacts	Uncertain impacts	Uncertain impacts
Long-term closures with high bycatch	Sections 7.2.6, 8.1.9, and 8.5	Not applicable	If closures are implemented, then it can be assumed that the EFH for those species with high bycatch will benefit as a result of the closure.	None	There could be cumulative benefits to the EFH of species with high levels of bycatch if closures are implemented, assuming that the areas with high levels of bycatch are also areas that have been designated as EFH for those species.

Final Alternative	Analysis of Direct and Indirect Impacts on EFH	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Incidental catch and general category permits	Sections 7.2.6, 8.1.9, and 8.5	Not applicable	Could impact the level of effort, but the impacts on EFH are uncertain.	None	One requirement under this measure is VMS for general category vessels. There may be some indirectcumulative benefits to EFH if all general category vessels are required to have VMS.
Restriction on rock chains	Sections 7.2.6, 8.1.9, and 8.5	Not applicable	This measure could reduce effort in hard and complex bottom areas which would benefit EFH, or this measure could increase impacts on EFH because gear will no longer "roll-over" complex substrate, it will remove or displace it.	None	Cumulative impacts from this measure are uncertain.
No action/Status quo	Sections 7.2.6, 8.1.9, and 8.5	As compared to past actions such as Amendment 4 and Amendment 7, the NA/SQ alternative would have positive impacts on EFH. However, not as positive as compared to more recent fishing years and management actions.	The No Action alternative would have positive impacts on EFH because it cuts DAS significantly. The status quo alternative would have negative impacts on EFH because it proposes to increase DAS and area swept projections increase.	The measures proposed in Amendment 10 will impact the No Action and Status Quo alternative in terms of EFH impacts. Specific measures will be in place to minimize the impacts on EFH, most notably habitat closed area alternative 6.	Overall, scallop fishing has a negative impact on EFH. Cumulatively, past and present management actions have reduced some of those impacts; for example through DAS reductions, closed areas and gear restrictions.

Final Alternative	Analysis of Direct and Indirect Impacts on EFH	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Other federal activities having potential VEC effects	Section 7.2.6	There are many actions that have had negative impacts on EFH over time, many not under NMFS jurisdiction. For example, coastal development, marine pollution, dumping, and offshore oil and gas exploration. There have also been many actions that have had positive impacts on EFH, especially from restrictions within FMPs. Long-term closed areas in the region have had cumulative benefits on EFH-specifically the groundfish closed areas and the Stellwagen Bank Marine Sanctuary. Other FMPs have reduced effort, which has beneficial impacts on EFH. Furthermore gear restrictions have been implemented in the past, and have had positive impacts on EFH.	Not applicable	It is possible that future actions will continue to have both negative and positive impacts on EFH. Some projects being proposed in the region that could have negative impacts on EFH are windfarms, offshore pipelines, potential leasing for sand and gravel mining, and offshore dumping. The Council is not aware of any FMP actions that will increase the negative impacts on EFH, that do not also have measures within the plan to minimize those negative impacts.	Over time, there have been many actions that have had negative impacts on EFH. More recently, steps have been taken to minimize those impacts, which will have cumulative benefits on EFH.

Table 155. Summary of cumulative effects: **VEC = Protected Species.** Protected species impacts generally occur because of where fishing occurs relative to the distribution of protected species, and when fishing occurs. Generally management measures that reduce the overlap between the target fishery and protected species have positive effects.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Rotation area management	Sections 7.2.7 and 8.3.1	No effects due to area closures	Impacts vary, depending on what areas remain open and the area-specific DAS allocations	Re-opening the Hudson Canyon Area to regular scallop fishing in 2006 may cause impacts if opened when turtles are present.	Scallop fishery may have an effect on some species of sea turtles if interactions exceed potential biological removals (PBRs).
Georges Bank area access	Sections 7.2.7 and 8.3.1	Positive effect from effort shifts from the Mid-Atlantic region.	Same positive effects can be anticipated.	Limits due to bycatch and habitat concerns may restrict access, although area access during the late-summer and early-fall will be positive to divert effort from the Mid-Atlantic.	Generally positive, because of lower fishing time and effort shifts from areas with turtles.
Hudson Canyon Area controlled access	Sections 7.2.7 and 8.3.1	Unknown effects, although interactions have been higher than anticipated. Some interactions may be related to fishing intensity and fishing activities in the Hudson Canyon Area.	No change expected.	Protected species rules may change fishing methods or seasons, having a positive effect.	Generally positive for sea turtles, because fishing time per DAS is lower for Hudson Canyon Area trips.
Area-specific DAS and trip allocations, with DAS tradeoffs	Sections 7.2.7 and 8.3.1	Not applicable.	Positive effects because it will reduce fishing effort in the Mid-Atlantic region, particularly in areas where sea turtles are usually present.	Same as proposed action.	DAS limits have been generally positive, because they limit fishing effort.
One-to-one controlled access area trip exchanges	Sections 7.2.7 and 8.3.1	Not applicable.	No effect expected.	No effects expected.	None identified.
Broken trip exemptions (DAS adjustments)	Sections 7.2.7 and 8.3.1	May have been negative, because it discouraged fishing in the controlled access areas and increased fishing effort elsewhere.	Positive effect because it encourages fishing in the controlled access areas, which reduces total fishing time.	Same as proposed action.	None identified.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Carry over DAS	Sections 7.2.7 and 8.3.1	No effect observed.	No change.	No change.	No cumulative effect identified.
Prohibit limited access vessels from fishing for scallops under general category rules	Sections 7.2.7 and 8.3.1	Takes in the general category scallop fishery are unknown.	Uncertain effects.	Uncertain effects.	No cumulative effect identified.
Management of general category fishery (status quo option)	Sections 7.2.7 and 8.3.1	Same as above.	Same as above.	Same as above.	Same as above.
Status quo overfishing definition	Sections 7.2.7 and 8.3.1	May be negative due to the high level of DAS use and fishing time in open areas in the Mid-Atlantic region.	No change in effect.	Future framework adjustment could set lower fishing mortality targets and/or area-specific DAS allocations, reducing DAS use and fishing time in the Mid-Atlantic region, where turtle catches are higher.	Habitat or bycatch area closures in the Georges Bank region and possibly the Gulf of Maine may force more scallop fishing effort into the Mid-Atlantic region, where turtle catches are higher unless future action is taken.
4" minimum ring size	Sections 7.2.7 and 8.3.1	Ring size does not appear to be a factor in determining the rate of sea turtle interactions.	No change in effect. Gear comparison research in the Mid-Atlantic does not show a difference related to ring size.	No change.	None identified.
10" minimum twine top	Sections 7.2.7 and 8.3.1	Uncertain, but no increases in interaction were reported when increasing mesh size from 6 to 8". Turtle catches in the Hudson Canyon Area do not appear to be related to 10" twine top mesh.	Uncertain, but no change in effect is expected.	Protected species monitoring by observers will be able to detect a change.	No apparent cumulative effect related to mesh size.
Habitat closure alternative 6	Sections 7.2.7 and 8.3.1	Not applicable.	No effect by itself.	Other habitat closure alternative under evaluation may increase impacts if they close areas with more scallop biomass.	Has a negative effect on sea turtles when combined with the status quo overfishing definition. This would allocate more DAS in open areas, which the fishery in open areas often focuses on the Mid-Atlantic region.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
TAC/DAS set-asides for habitat research	Sections 7.2.7 and 8.3.1	Not applicable.	No effect.	No effect.	None identified.
TAC/DAS set-asides for scallop research	Sections 7.2.7 and 8.3.1	Positive. Research has been conducted to identify ways to avoid or reduce turtle interactions.	Potentially positive, if TAC/DAS set aside funds are used for research to evaluate gear modification that reduce sea turtle interactions.	Future management changes may include gear modifications identified by research that have minimal impacts on other VECs.	None identified.
TAC/DAS set-asides to increase sea sampling	Sections 7.2.7 and 8.3.1	Positive. Controlled access areas observer programs, funded by scallop set-asides, have identified problems that were thought to be minimal.	Expansion of set-aside to include regular, open fishing areas will help identify the distributions and distinguish conditions that cause more frequent sea turtle interactions.	Causes of interactions identified by sea sampling data may be used in future management adjustments to minimize interactions.	Identification of the problem is the first step in a solution.
Proactive protected species framework	Sections 7.2.7 and 8.3.1	Not applicable.	No effect at present.	Potential to expedite management actions to address protected species issues.	Potentially positive.
Revised bi-annual framework adjustment procedure	Sections 7.2.7 and 8.3.1	No effect.	No effect.	No effect.	None identified.
Other Alternatives					
New overfishing definition	Sections 7.2.7 and 8.3.1	Not applicable.	Positive through effort reductions, particularly in the Mid-Atlantic region where sea turtle interactions are higher.	Not applicable.	Would be beneficial overall by reducing fishing time, but could lead to fishing method changes which have uncertain effects.
Other habitat closed area alternatives	Sections 7.2.7 and 8.3.1	Not applicable.	No effect.	No effect.	Combined with the status quo overfishing definition, alternatives with greater overlap with scallop biomass could increase fishing effort elsewhere, particularly in the Mid-Atlantic region.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Area specific possession limits for finfish	Sections 7.2.7 and 8.3.1	No effect.	No effect.	No effect.	No cumulative effect, unless finfish discards attracts turtles to areas intensively fished under area rotation rules.
Long-term closures with high bycatch	Sections 7.2.7 and 8.3.1	Not applicable.	Most areas identified are in the Georges Bank region and Southern New England, where few sea turtle interactions have been observed.	Same as proposed action.	Combined with the status quo overfishing definition, alternatives with greater overlap with scallop biomass could increase fishing effort elsewhere, particularly in the Mid-Atlantic region.
Incidental catch and general category permits	Sections 7.2.7 and 8.3.1	Unknown.	Unknown.	Unknown.	None identified.
Restriction on rock chains	Sections 7.2.7 and 8.3.1	Not applicable.	May cause increases or conflict with a possible solution to reduce turtle interactions.	May have a negative effect if rock chains turn out to be a viable solution to reducing Mid-Atlantic turtle interactions.	Potentially negative cumulative effect if the use of rock chains is limited.
No action/Status quo	Sections 7.2.7 and 8.3.1	Possible negative impact because of high fishing effort levels in the Mid-Atlantic region.	No change.	No change.	Possible negative impact because of high fishing effort levels in the Mid-Atlantic region.
Other federal activities having potential VEC effects	Assessed in Biological Opinions for Protected Species	Georges Bank closed areas caused an effort shift into the Mid-Atlantic region, having a potentially negative impact.	No cumulative or interactive effect known.	Alternatives that prevent scallop fishing on the Georges Bank stock could have a negative impact.	Area closures in the Georges Bank region and possibly in the Gulf of Maine could have a negative cumulative effect.

Table 156. Summary of cumulative effects: **VEC = Human Safety at Sea.** Safety is affected by how and when the fishery operates and any regulatory limits that affect it. Generally management measures that allow flexibility for fishermen to determine where and when to fish have positive effects on safety.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Rotation area management	Sections 6.1.10 and 7.1.1	Ad hoc area rotation has caused few impacts on the VEC. Rules for transiting closed scallop rotation areas have been modified to reduce impacts.	No change.	Increases in rotation area management closures could increase impacts from transiting and forcing vessel to fish in unsuitable or unfamiliar areas.	Area rotation guidelines mitigate impacts by distributing closed rotation management areas across the region and by limiting the amount of area closed at one time.
Georges Bank area access	Sections 6.1.10 and 7.1.1	No effect.	No change.	Same as proposed action.	Area-specific DAS allocations may force vessels to fish in areas where the vessel is ill-suited and the crew is unfamiliar. Trip exchanges mitigates this concern.
Hudson Canyon Area controlled access	Sections 6.1.10 and 7.1.1	No effect.	No change.	Same as proposed action.	See above.
Area-specific DAS and trip allocations, with DAS tradeoffs	Sections 6.1.10 and 7.1.1	Not applicable.	Area-specific DAS allocations may force vessels to fish in areas where the vessel is ill-suited and the crew is unfamiliar	Same as proposed action.	Trip exchanges mitigates impacts.
One-to-one controlled access area trip exchanges	Sections 6.1.10 and 7.1.1	Not applicable.	Positive impact because vessels will be allowed to fish in familiar and suitable areas.	May be negative, because suitable and familiar areas may be unavailable in some years.	None identified.
Broken trip exemptions (DAS adjustments)	Sections 6.1.10 and 7.1.1	Negative impact due to existing rules forcing vessels to remain in controlled access areas to avoid loosing days, despite adverse conditions.	Will reduce negative impacts because of automatic adjustment procedure allows vessel to make more rational choice to terminate a trip early due to adverse conditions.	No foreseeable actions would impact the positive effect of the new rules.	Changes in scallop prices may change the value of the two DAS penalty.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Carry over DAS	Sections 6.1.10 and 7.1.1	Positive impact because vessels are not forced to fish under adverse conditions at the end of the year.	No change.	No foreseeable actions would impact the positive effect of this rule.	Vessels may change their plan to use or carry over DAS due to regulations in other fisheries, changes in scallop price,
Prohibit limited access vessels from fishing for scallops under general category rules	Sections 6.1.10 and 7.1.1	No effect, other than those related to the amount of fishing time.	No effect, other than those related to the amount of fishing time.	No foreseeable actions would impact the positive effect of this rule.	None identified.
Management of general category fishery (status quo option)	Sections 6.1.10 and 7.1.1	Same as above.	Same as above.	Same as above.	None identified.
Status quo overfishing definition	Sections 6.1.10 and 7.1.1	Same as above.	Same as above.	Same as above.	None identified.
4” minimum ring size	Sections 6.1.10 and 7.1.1	No safety issues have been identified from increasing the ring size from 3 to 3½“	No safety issues have been identified from gear comparisons using 4” rings.	Same as proposed action.	None identified.
10” minimum twine top	Sections 6.1.10 and 7.1.1	No safety issues have been identified from increasing the mesh size from 6 to 8“	No change expected.	Same as proposed action.	None identified.
Habitat closure alternative 6	Sections 6.1.10 and 7.1.1	Slight negative impacts associated with gear stowage rules for transiting closed areas.	No change expected, especially since boundaries coincide with existing closed area boundaries.	Changes in habitat closures under other plans may increase transiting.	OSHA rules may make transiting more difficult, if they apply to commercial fishermen.
TAC/DAS set-asides for habitat research	Sections 6.1.10 and 7.1.1	Not applicable.	No effect.	No effect.	None identified.
TAC/DAS set-asides for scallop research	Sections 6.1.10 and 7.1.1	Not applicable.	No effect.	No effect.	None identified.
TAC/DAS set-asides to increase sea sampling	Sections 6.1.10 and 7.1.1	No effect has been observed.	No change.	Same as proposed action.	If required to carry observers, some vessels may have to improve vessel conditions related to safety.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Proactive protected species framework	Sections 6.1.10 and 7.1.1	Not applicable.	No effect.	Future rules could cause impacts on safety.	None identified.
Revised bi-annual framework adjustment procedure	Sections 6.1.10 and 7.1.1	Not applicable.	No effect.	Unknown.	Unknown.
Other Alternatives					
New overfishing definition	Sections 6.1.10 and 7.1.1	No effect, other than those related to the amount of fishing time.	No effect, other than those related to the amount of fishing time.	No foreseeable actions would impact the positive effect of this rule.	None identified.
Other habitat closed area alternatives	Sections 6.1.10 and 7.1.1	Not applicable.	Possibly negative. Changes in habitat closures under other plans may increase transiting under gear stowage rules.	Same as proposed action.	Multiple gear stowage requirements may cause safety issues to increase.
Area specific possession limits for finfish	Sections 6.1.10 and 7.1.1	No effect observed.	No change.	Unknown.	Unknown.
Long-term closures with high bycatch	Sections 6.1.10 and 7.1.1	Not applicable.	Possibly negative. Changes in habitat closures under other plans may increase transiting under gear stowage rules.	Same as proposed action.	Multiple gear stowage requirements may cause safety issues to increase.
Incidental catch and general category permits	Sections 6.1.10 and 7.1.1	No safety issues other than those normally associated with fishing have been observed.	No change.	Same as proposed action.	Unknown.
Restriction on rock chains	Sections 6.1.10 and 7.1.1	Positive. Rock chains are thought to promote safety by deflecting large rocks that would be otherwise caught in the dredge.	Negative. Removing rock chains could increase crew injuries by requiring removal of more and larger rocks from dredges at sea.	Protected species management may require rock chains to reduce turtle interactions.	Habitat alternatives in other FMPs could reduce interactions with rocks due to closures of areas with complex bottom habitats.
No action/Status quo	Sections 6.1.10 and 7.1.1	General downward trend in casualties possibly related to DAS reductions and safety programs for commercial fishing vessels.	Not applicable.	Not applicable.	Unknown.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Other federal activities having potential VEC effects	Assessed in Scallop SAFE Reports	No apparent increase in causalities related to crew limits.	No interactive effects on safety known.	Same as proposed action	Closed area management in other FMPs could have safety implications.

Table 157. Summary of cumulative effects: **VEC = Fishing Dependent Communities.** Community impacts generally occur through the amount of revenue derived from fishing and related employment. Generally management measures that improve yield and fishery activity have positive effects on fishing communities.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Rotation area management	Sections 7.1.1 and 8.8	Depending on mobility of a fishing-dependent community's vessels, temporary area closures can have negative effects, but re-opened controlled access areas can have the opposite effect.	Effects similar to past ad hoc rotation.	Actions in other plans that limit the effectiveness of area rotation could have negative effects on nearby communities.	Higher landings, revenues and employment will have a positive effect on communities.
Georges Bank area access	Sections 7.1.1 and 8.8	Mostly positive effects, but vessel re-location from Mid-Atlantic ports may have had negative local effects.	Effects similar to past access programs.	Same as above.	Unlike past actions, vessels may not need to re-locate to take advantage of Georges Bank area access, because they will be able to exchange trips with other vessels. This will reduce negative local effects and improve benefits overall.
Hudson Canyon Area controlled access	Sections 7.1.1 and 8.8	Past controlled access has had positive effects for communities in the Mid-Atlantic and negative local effects in New England ports have been modest.	Effects similar to past access programs.	Same as above.	Same as above.
Area-specific DAS and trip allocations, with DAS tradeoffs	Sections 7.1.1 and 8.8	Positive effect through ability to use controlled access area DAS allocations to fish in regular, open areas.	Potential negative effect, because the use of DAS allocations is more restricted, possibly causing vessels to move.	No effect.	Positive long-term effects will be realized by reducing fishing mortality in regular, open fishing areas, improving yield and economic activity.
One-to-one controlled access area trip exchanges	Sections 7.1.1 and 8.8	Not applicable.	Positive effect from allowing more flexibility for vessels to fish locally.	No effect.	Positive cumulative effects are anticipated.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Broken trip exemptions (DAS adjustments)	Sections 7.1.1 and 8.8	Possible negative effect because the existing program provided a disincentive for vessels to access area with higher scallop productivity.	Positive effect because the proposed action reduces the risk of fishing in more productive areas, also addressing risk and safety issues.	No effect.	Trend toward positive impacts.
Carry over DAS	Sections 7.1.1 and 8.8	This measure provides flexibility for fishermen to determine when to fish, possibility have a positive impact on communities.	No change.	No effect.	Positive effects on communities.
Prohibit limited access vessels from fishing for scallops under general category rules	Sections 7.1.1 and 8.8	Not applicable.	Negative impacts on some communities whose vessels fished for scallops off the clock to supply local seafood markets.	Vessels may need to fish for other species from other ports to replace lost income causing negative impacts to some communities.	Slightly negative impact.
Management of general category fishery (status quo option)	Sections 7.1.1 and 8.8	Positive impact on communities by providing regular fishery income in small ports.	No change.	May provide an option for vessels to target scallops in response to more restrictive management measures in other FMPs, having a positive impact on communities.	Positive impacts, particularly for small ports with groundfish vessels facing more restrictive fishery management.
Status quo overfishing definition	Sections 7.1.1 and 8.8	Reducing mortality to meet overfishing definition reference points has promoted stock rebuilding, which has had a very positive impact on communities due to higher fishery revenue and port activity.	Possible negative effects if the overfishing definition mortality targets allow depletion of regional scallop biomass, causing vessels to relocate or fish in remote areas.	Larger habitat or bycatch closures in other FMPs could affect regional fishing mortality rates and scallop biomass levels, having a potential negative effect on nearby communities.	Trend toward negative effects, particularly if there are large permanent closures, unless future action is taken.
4” minimum ring size	Sections 7.1.1 and 8.8	Increasing ring size to 3½“ has had positive impacts by improving yield, revenue and employment.	Similar positive effects are anticipated.	No effect.	Positive effects are expected, but disposal problems caused by old fishing gear may effect communities.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
10" minimum twine top	Sections 7.1.1 and 8.8	Bycatch reductions benefit other fisheries that may occur in communities that depend on other landings; therefore increasing mesh has positive effects.	Increasing the mesh to 10 inches is expected to have similar positive effects.	No effect.	Indirect positive effect from lower bycatch helping to rebuild other fish stocks.
Habitat closure alternative 6	Sections 7.1.1 and 8.8	Negative effects for nearby fishing communities.	Negative effects on communities because it prevents fishing on a productive part of the scallop resource.	Habitat closure alternatives in other FMPs may change the impacts on communities.	Communities will derive less income from the scallop industry, which will employ fewer people as a result.
TAC/DAS set-asides for habitat research	Sections 7.1.1 and 8.8	Not applicable.	Possible positive effect by increasing local employment.	No effect.	Possible positive community effect.
TAC/DAS set-asides for scallop research	Sections 7.1.1 and 8.8	Possible positive effect by increasing local employment.	No change.	No effect.	Same as above.
TAC/DAS set-asides to increase sea sampling	Sections 7.1.1 and 8.8	Same as above.	No change.	No effect.	Same as above.
Proactive protected species framework	Sections 7.1.1 and 8.8	Not applicable.	No effect.	Possible negative effect, depending on measures needed to address protected species issues.	Possible negative effect.
Revised bi-annual framework adjustment procedure	Sections 7.1.1 and 8.8	Positive effect on communities because framework adjustments have increased DAS allocations which improve port activity.	No change.	Unknown.	Positive cumulative effect by changing DAS allocations and improving yield.
Other Alternatives					
New overfishing definition	Sections 7.1.1 and 8.8	Not applicable.	Negative short-term impact from lower DAS allocations, but a positive long-term impact from higher scallop yield.	Habitat and bycatch closures in other FMPs would have a greater negative effect if the alternative overfishing definition were in place.	Positive cumulative effects due to higher landings, revenue, and employment.
Other habitat closed area alternatives	Sections 7.1.1 and 8.8	Not applicable.	Potential negative effects when combined with groundfish closed areas.	Potential for large community impacts if the closures conflict with habitat closures chosen in other FMPs.	Potential negative effects on communities because of an inability to access nearby scallop resources.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Area specific possession limits for finfish	Sections 7.1.1 and 8.8	Positive effects have occurred because finfish possession limits have prevented closures of access areas if finfish catches reach the TACs.	No change.	Future framework actions may have similar positive effects as past actions.	Positive.
Long-term closures with high bycatch	Sections 7.1.1 and 8.8	Not applicable.	Could have substantial community impacts if areas affect nearby ports.	Unknown.	Negative.
Incidental catch and general category permits	Sections 7.1.1 and 8.8	Not applicable.	Could have limited access to the fishery by small vessels from fishery dependent communities, causing a negative effect.	Unknown.	Negative.
Restriction on rock chains	Sections 7.1.1 and 8.8	Not applicable.	May have had local effects on fishery dependent communities that are near areas with rough bottom requiring rock chains.	Unknown.	Potentially negative.
No action/Status quo	Sections 7.1.1 and 8.8	Existing management has had positive effects on fishery dependent communities with scallop vessels and industry.	Negative impacts are expected, because the policies are no longer suitable given the condition of the scallop resource.	Complicated framework actions would be required to avert negative impacts of no action.	Although positive effects have occurred because the scallop resources has rebuild, negative cumulative effects are anticipated if fishing effort were not adjusted to respond to current conditions.
Other federal activities having potential VEC effects	Sections 7.1.1	Groundfish closures have had a very negative effect due to not achieving OY, reducing landings, scallop revenue, and employment.	Not applicable.	Ocean disposal, dredging, and other sea bed activities near scallop populations could reduce growth and recruitment or increase mortality and have a negative effect on OY and scallop revenue. Area closures to address protected species issues could similarly have a negative effect.	Cumulatively, actions that adversely affect scallop productivity or make scallops inaccessible to fishing have a negative effect on fishery dependent communities that rely on scallop fishing and landings.

Table 158. Summary of cumulative effects: **VEC = Marine Fisheries Law Enforcement and Administration.** Impacts on law enforcement and administration generally occur the complexity of regulations. Generally management measures that simplify regulations or improve compliance have positive effects.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Rotation area management	Section 8.9	Ad hoc rotation management has increase enforcement costs, but related rules have mitigated costs.	Negative effect, because flexible boundaries could increase monitoring and enforcement costs.	Unknown. Depends on future framework actions.	Framework actions may limit irregular boundaries or changes in boundaries once established. Other fishing regulations may make less costly boundaries and administration difficult.
Georges Bank area access	Section 8.9	Area access has increase enforcement costs, but related rules have mitigated costs.	Same as past management	Same as proposed action	Enforcement may become more complicated and costly when there are other special access programs at the same time. Broken trip adjustment could increase monitoring costs.
Hudson Canyon Area controlled access	Section 8.9	Controlled access has increase enforcement costs, but related rules have mitigated costs.	Same as past management	Areas reverting to fully open scallop fishing status will limit related enforce costs over time.	Broken trip adjustment could increase monitoring costs.
Area-specific DAS and trip allocations, with DAS tradeoffs	Section 8.9	Not applicable.	Slight negative impact from increased monitoring costs, i.e. two allocations to monitor instead of one.	Possible negative impact from increased monitoring costs, i.e. two or more allocations to monitor instead of one.	This management measure may apply to more fisheries that develop VMS monitoring.
One-to-one controlled access area trip exchanges	Section 8.9	Not applicable.	Negative impact from monitoring, administration, and enforcement of vessel-specific maximum number of trips by area.	Multiple controlled access areas open in the same fishing year could become complicated.	This management measure may apply to more fisheries that develop VMS monitoring.
Broken trip exemptions (DAS adjustments)	Section 8.9	Limited number of exemptions granted have limited monitoring and enforcement costs to a manageable level.	Negative impact due to higher enforcement and monitoring costs.	Negative impact due to higher enforcement and monitoring costs.	This management measure may apply to more fisheries that develop VMS monitoring.
Carry over DAS	Section 8.9	Slight negative impacts, but costs have been low.	No change.	Same as proposed action.	This management measure may apply to more fisheries that develop VMS monitoring.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
Prohibit limited access vessels from fishing for scallops under general category rules	Section 8.9	More vessels fishing with a 400-lb. possession limit could have higher costs, but monitoring has been sporadic.	Could lower enforcement costs because fewer vessels would be targeting scallops.	Same as proposed action.	May have neutral impact because limited access scallop vessels may target other species in lieu of scallops when not on a DAS.
Management of general category fishery (status quo option)	Section 8.9	Many vessels and many ports make enforcement difficult and costly.	No change.	No change.	More restrictive fishery regulations in other fisheries or a scallop price increase could cause an explosion in scallop fishing activity under a possession limit.
Status quo overfishing definition	Section 8.9	No effect.	No effect.	No effect.	Unknown.
4" minimum ring size	Section 8.9	3 ½ " ring enforcement has been effective and relatively easy to monitor despite the need for at-sea enforcement.	No expected increase in monitoring cost.	Same as proposed action	Could increase incentive to cheat with liners if large scallops are unavailable to the fishery due to habitat or other closures.
10" minimum twine top	Section 8.9	Enforcement monitoring has been effective and not too costly despite the need for at-sea enforcement, but fishermen can mitigate the effects by changing the way they hang the twine top.	No expected increase in monitoring cost, although the incentive to mitigate the effects could increase.	Same as proposed action.	May help lower finfish possession limit enforcement costs because finfish catches will be lower.
Habitat closure alternative 6	Section 8.9	Not applicable.	No change because boundaries coincide with existing closed areas.	Different habitat closures that are under development and review may create a new set of boundaries to monitor.	Could decrease the costs of other marine activities that adversely affect scallops.
TAC/DAS set-asides for habitat research	Section 8.9	Not applicable.	Slight negative impact to monitor special fishing activities.	Same as proposed action.	Other enforcement needs may decrease monitoring capabilities.
TAC/DAS set-asides for scallop research	Section 8.9	Monitoring and enforcement costs have been low.	Slight negative impact to monitor special fishing activities.	Same as proposed action.	Other enforcement needs may decrease monitoring capabilities.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
TAC/DAS set-asides to increase sea sampling	Section 8.9	Slight positive, because higher sea sampling frequency may have discouraged cheating.	Slight positive, because higher sea sampling frequency may discourage cheating.	Same as proposed action.	Could reduce controlled area access program enforcement needs, allowing enforcement resources to target other fisheries.
Proactive protected species framework	Section 8.9	Does not apply.	No effect.	Future rules may require costly enforcement.	Unknown.
Revised bi-annual framework adjustment procedure	Section 8.9	No tangible effect.	Less frequent management changes could improve enforcement and compliance.	Same as proposed action.	Unknown.
Other Alternatives					
New overfishing definition	Section 8.9	Not applicable.	No effect.	Lower fishing activity could reduce enforcement costs.	Unknown.
Other habitat closed area alternatives	Section 8.9	Not applicable.	New areas and boundaries to enforce and monitor would increase enforcement costs and decrease compliance.	Same as proposed action.	Actions in other fisheries could complicate enforceability.
Area specific possession limits for finfish	Section 8.9	Close monitoring with sea sampling and VTRs have kept costs low.	No change.	Possible increase in costs due to an increase in the number of possession limits.	Monitoring and enforcement of multiple possession limits for different fisheries could become very costly.
Long-term closures with high bycatch	Section 8.9	Not applicable.	Negative impact, because it would have required different or more closure areas.	Same as proposed action.	Monitoring and enforcement of fishery-specific area closures to avoid bycatch could become unmanageable.
Incidental catch and general category permits	Section 8.9	The number of participants and ports has complicated scallop possession limit monitoring.	No change.	Special access programs in rotation management areas could increase need to carefully monitor scallop bycatch.	More restrictive fishery regulations in other fisheries or a scallop price increase could cause and explosive growth in fishing activity under a possession limit and increase monitoring and enforcement costs.
Restriction on rock chains	Section 8.9	Not applicable.	Enforcement costs and training costs may have increased.	Protected species management may require rock chains to reduce turtle interactions.	Unknown.

Final Alternative	Analysis of Direct and Indirect Impacts	Effect of Similar Past & Present Actions or Other Federal Actions	Effect of Proposed Amendment 10 Actions	Effect of Reasonably Foreseeable Future Actions	Cumulative Effects
No action/Status quo	Section 8.9	Replacement of the meat count standard has improved enforcement and compliance.	Not applicable.	Not applicable.	Unknown.
Other federal activities having potential VEC effects	Section 8.9	Other enforcement activities and requirements may have limited enforcement of scallop regulations.	Other enforcement activities and requirements may limit enforcement of scallop regulations.	Same as proposed action.	Different regulations that apply to vessels participating in multiple fisheries reduce compliance and complicate enforcement.

8.1.8 Scallop Fishery Management

The overall intent of the Atlantic Sea Scallop FMP and Amendment 10 is to maximize the sustainable benefits from the scallop resource while minimizing adverse environmental effects, including those on habitat, bycatch, and the economy. The Scallop FMP has been highly successful in achieving these goals since 1994 by limiting access to the fishery, by reducing fishing effort to levels that improve sustainable yield, and by requiring gear modifications that reduce bycatch and possibly reduce impacts on habitat. Some of the cumulative impacts of these regulations are discussed below, but a detailed description of past scallop management is given in Section 7.1.2.

Since 1994, when the Council developed the limited access/day-at-sea program to manage the scallop fishery, nominal effort (measured in days-at-sea) have been halved and the number of vessels fishing for sea scallops have declined. There were 454 vessels that were initially eligible for a limited access permit, based on their historic fishing activity before 1993. Initially, vessels that qualified for a full-time permit were authorized to fish for scallops on 204 days, resulting in almost 45,000 days being actually used to fish for sea scallops. Day-at-sea use during 1991 and 1992, when the abundant year class was caught in the South Channel, approached 60,000 days and vessels used dredges with 3" rings (often at least triple linked) and a considerable amount of chafing gear, donuts, and cookies which limited escapement of small scallops, finfish, and other invertebrates. Often these heavy dredge bags full of small scallops and other bycatch were towed for hours on end, only to have the crew (often numbering more than 11) pick through the catch piles for scallops that were large enough to comply with a meat count regulation that applied at that time.

In contrast, there were 310 vessels with limited access permits in use (i.e. the vessel used one or more scallop days), generating 27,639 days of fishing effort. Most of these vessels furthermore were using dredges with 3.5-inch rings (double linked), with no chafing gear, cookies, or donuts allowing for more escapement of small scallops and bycatch. Eight-inch minimum twine top mesh allowed for greater escapement of finfish and a seven-man crew limit constrained fishing capacity per day-at-sea. Seventy-eight (78) vessels that qualify or hold limited access scallop permits were either inactive in the fishery or held a Confirmation of Permit History (i.e. the permit was not attached to a fishing vessel).

While nominal effort has been halved, effective fishing effort (measured in cumulative annual area swept by scallop fishing) has declined by about 80 percent. Resulting from measures developed in Amendment 4 and amplified in Amendment 7, the recovery of the resource coupled with crew limits and gear restrictions have produced this marked decline in effective effort. The scallop biomass has recovered from low levels because of the synergy between management measures in the FMP (i.e. effort reduction, gear restrictions, and closed areas) and favorable recruitment. Now the resource is considered rebuilt and the FMP is effectively reducing total area swept and keeping mortality near the fishing mortality targets, while producing the highest official landings on record with positive economic benefits to both producers and consumers.

During the four years from 1998 to 2001, the fleet revenue more than doubled despite the decrease in scallop prices by 40% from its 1998 level. The increase in revenues not only led to an increase in the incomes of fishers, it also had positive effects on the regional incomes and communities through the multiplier impacts of higher sales revenue from scallops. Sea scallop consumers benefited as well from the increase in the supply of scallops at lower prices. The yield per day-at-sea (LPUE) also improved dramatically from about 450 pounds per day-at-sea in 1998 to more than 1,200 pounds per day-at-sea in 2001 fishing year, lowering the operational costs (such as fuel, oil, water, ice and food) per pound of scallops significantly. This decline in operational expenses, combined with increase in revenues, benefited scallop fishers by increasing their surplus, that is, the sum of profits and crew shares. As a result, the total benefits to the nation, measured by the sum of consumer and producer benefits, increased significantly during the same period.

The increase in the abundance of the scallop resource and productivity, as reflected by the higher LPUE's and lower price per pound, also helped to increase the competitiveness of the domestic scallop industry relative to the scallop imports from foreign countries. The import prices for scallops declined from an average $5.96 per pound during the early 1980's to below $4.00 per pound after 1992 as several countries competed to increase their exports to the U.S. market. In 2001, the average import price of scallops declined to $3.25 per pound. The increase in the productivity of the scallop resource and landings helped the domestic industry to lower its prices and increase its share of the overall scallop market despite the influx of cheaper imports. For example, the importing of scallops to the U.S. declined to 40 million pounds in 2001 from 54 million pounds in 2000, whereas the share of the domestic scallops in total supply (i.e., domestic landings plus imports) increased from 37% in 2000 to 53% in 2001.

The increase in profits allowed vessel owners to re-invest and better maintain their vessels. Crewmembers, many lacking a formal high school or college education, are earning more than $50,000 per year. Some are now able to invest in homes or another business. Vessels are better maintained, partly because the vessel fishes less time per year than in the early 1990's and partly because the vessel owner is deriving more profit from the catches. Money and time are available to haul out the vessels for repair and/or hire people to better maintain the equipment.

Building on the success of the FMP to lower mortality and rebuild the resource, the Council initiated Framework Adjustment 11 to the FMP, allowing controlled access to the surplus biomass in the southern half of Closed Area II. The Council leveraged the high biomass and catch rates expected there to reduce scallop mortality overall and reduce impacts, while achieving a higher net benefit from scallop fishing. To do this, the Council required vessels to use larger twine top mesh, restricted fishing to the less sensitive areas, restricted fishing by season to minimize bycatch, and set a yellowtail flounder bycatch TAC with mandatory observers to monitor it. Overall mortality and impact reduction was achieved by charging more days for each controlled access trip than were actually taken. In the first year of the program (1999), trips averaged 5 – 6 days, yet the vessels were charged 10 days-at-sea, thus reducing the amount of days the participating vessels could use elsewhere to target scallops.

Due to its success and the perceived environmental benefits, the Council continued and expanded the program in 2000, with Framework Adjustment 13. After an extended debate to analyze and consider the potential effects on habitat, finfish bycatch, and gear conflict, the Council established new access areas in portions of Closed Area I and the Nantucket Lightship Area, applying similar measures that were in place within Closed Area II in the previous year. Areas were defined where the bycatch and habitat concerns were the least, typically over sandy and small gravel areas within the groundfish closed areas. In addition to the added fishing restrictions for vessels fishing for scallops in these areas, the program reduced the total day-at-sea allocation by nearly 7,000 days that year through the day-at-sea tradeoff procedure. Just as important, vessels fishing in the controlled access program typically fished much less per day-at-sea, because the catches greatly exceeded the crew's shucking capacity. Vessels therefore often did not actively fish for large periods, while the crew caught up. Instead of only reducing the effective day-at-sea allocation by 7,000 days (about 20%), the bottom contact time compared to a day fishing elsewhere decline by 80 to 90 percent.

Unlike the groundfish closed areas, the Hudson Canyon and VA/NC Areas were closed to scallop fishing in 1998 specifically to postpone mortality on a strong year class. Fortunately, a second strong year class also appeared in 1999 within the Hudson Canyon Area. Again, building on the success of the controlled access program in the above framework actions, the Council designed a similar controlled access program for these areas in 2001, 2002, and 2003 (Framework Adjustments 14 and 15) for the Hudson Canyon and VA/NC Areas. While the direct effects of the day-at-sea tradeoff were not as great (trips averaged 8.5 days for a 10 day charge), the program enabled the Council to again close the Georges Bank closed areas to scallop fishing, while improving net benefits. As a result, scallop effort and mortality on Georges Bank were extremely low.

While recent management has been highly successful in reducing fishing effort, scallop mortality, and environmental effects, Amendment 10 proposes new alternatives that could improve the effectiveness of management and further reduce the environmental effects of scallop fishing. To do this, Amendment 10 introduces rotation area management that would actively control the distribution and amount of fishing effort to take advantage of heterogeneities in the resource and the environment. In addition, Amendment 10 may also expand on the progress to date by requiring larger rings and twine top mesh to improve escapement without causing scallop loss, since more large scallops are now available in the fishery. In places, the benefits of closing areas to protect sensitive and valuable habitat could exceed the cost from closing the areas to fishing. Amendment 10 also considers and analyzes the potential effects of this management approach, considering the practicality of those management alternatives to achieve an environmentally sustainable result.

Most of the alternatives in Amendment 10 will not have an adverse cumulative effect on other laws and regulations. In fact, some of the alternatives could enhance the ability of other FMPs to achieve their goals and objectives. Larger twine top mesh, larger dredge rings, seasonal closures to reduce bycatch, bycatch TACs, and projected reductions in effective fishing effort (from area rotation) have the potential to lower bycatch, reducing mortality on species managed by other FMPs. Amendment 10 proposes alternatives that would establish controlled area access programs for areas that are presently closed to scallop fishing. The Georges Bank groundfish closed areas were originally closed to scallop fishing under the NE Multispecies FMP to "gear capable of catching groundfish" to enhance rebuilding potential and to protect spawning habitat. The controlled access program, as it pertains to the Georges Bank groundfish closed areas, will include seasons, enhanced observer coverage, 10-inch twine top mesh, bycatch TAC(s), and possibly other measures to minimize the cumulative impacts on other managed species.

Although vessels with limited access scallop permits hold a variety of other fishing permits (Table 51), there is no reason to expect that the alternatives in Amendment 10 by themselves would cause scallop vessels to increasingly target other species. Lower day-at-sea allocations, however, may be needed to achieve the scallop mortality objectives of the FMP, due mostly to an increasing number of active scallop permits and a greater use of allocated days by active scallop vessels, coupled with annual fishing mortality targets that have followed a gradual reduction schedule from Amendment 7[60]. Some vessels may try to make up for changes in scallop revenue by targeting other species while not on a day-at-sea, provided they have the needed permit. Most scallop vessels, however, are designed to tow dredges and are poorly designed to use other types of fishing gear, but vessel owners may make the needed modifications to do so. Nevertheless, the economic analysis (Section 8.7) estimates that the day-at-sea allocations in Amendment 10 will be above break-even levels due to the high catches expected in the projections (Section 8.2.1).

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60 Amendment 7 gradually reduced fishing mortality to achieve the rebuilding objectives and anticipated a reduction to F=0.15 to achieve rebuilding. Once rebuilt, the fishing mortality target is 80% of F_{max}, currently estimated to be F=0.24. Since reducing full-time day-at-sea allocations from 142 to 120, the annual fishing mortality target in Amendment 7 has declined from 0.28 in 1999 to 0.20 in 2003, or a 29 percent reduction. Further reductions of days were deemed unnecessary in 2000 to 2003, because of the conservative effects from the day-at-sea tradeoffs, crew limits, and closed areas.

Habitat closures may reduce the day-at-sea allocations (with the proposed overfishing definition) and are likely to reduce total scallop catch, on the other hand. Since bottom habitat tends to be more complex and sensitive in New England, the proposed habitat area closures are unevenly distributed. The overall economic impacts of the habitat closure alternatives are analyzed in Section 8.7.4.5, and the distributional impacts on fishing communities and ports are analyzed in Section 8.8.4. On one hand, communities and ports in New England states will loose a disproportionately high share of scallop revenue, but on the other hand these same ports are more likely to benefit from the improved condition of essential fish habitat that occur nearby.

Amendment 10 also proposes new procedures for adjusting management measures and a different fishing year. These measures are proposed to make administration less burdensome and enable the management of an area rotation plan. Additional reporting requirements or landings procedures may also be required for vessels with limited access or general category permits. It is not expected that these changes will have an adverse effect on NMFS, the Council, or the Coast Guard to administer and/or enforce regulations for other fisheries or laws.

Recent observations and information has found that scallop fishing with dredges have more interactions with sea turtles than previously thought. Thus cumulative impacts on endangered and threatened species may occur when rotation area management policies close areas in the northern part of the scallop range and more intensively fish rotation management areas in the southern part of the range under a controlled access program when areas re-open to scallop fishing. To mitigate these potential impacts, Amendment 10 includes a procedure for minimizing these impacts when they are anticipated under area rotation. The Council may, for example, allow controlled access to rotation management areas that overlap sea turtle distributions only during those portions of the year when sea turtles not as prevalent.

As filter feeders, scallops are sensitive to pollutants and suspended sediment. Besides the obvious effect of toxic pollutants that could increase scallop mortality, reduce settlement, and/or decrease marketability, activities that increase sediment suspension could alter feeding behavior and make the area less suitable for scallop growth and survival. This environmental dependence is described in Section 7.2.1. Activities that could have these types of impacts include but are not limited to bottom dredging (e.g. sand mining), ocean dumping, and oil and gas drilling, when they occur in optimum areas for scallops. These areas are characterized by relatively clear moving water; having shell, sand, to moderate gravel substratum, within depth and temperature ranges described in Section 7.2.1. Especially important area areas with persistent oceanic fronts that concentrate larvae over suitable settlement areas. Many of these areas are found within the circulation pattern around Georges Bank and adjacent to the Great South Channel. The Hudson Canyon Area and the Atlantic shelf in the DelMarVa region are also important areas for settlement and strong year classes.

Although formal mitigation is not required due to actions taken by the FMP and potential actions taken in this amendment, Amendment 10 could enhance reporting requirements and sea sampling to collect better information with which to manage the fishery and/or identify cumulative effects that require action through future amendments and/or framework adjustments.

Quantitative and qualitative analysis of the direct and indirect effects on the human environment are presented in detail in the following sections.

8.1.9 Essential Fish Habitat

Cumulative impacts are the combined outcome of numerous actions and stresses, which alone may have relatively minor impacts, yet add up to severe habitat degradation or loss (Vesta et al., 1995). Fishing and non-fishing activities influence habitat function. Depending on the characteristics of habitat, including spatial and temporal variations, physical, biological, and chemical properties, both human and natural threats can impact habitat differently.

It is important to recognize that although the cumulative impacts of the scallop fishery have impacted habitat, there have also been significant limits on the fishery, which have potentially improved essential fish habitat in certain areas of the Northwest Atlantic. Scallops in New England have been managed since 1982 by a multitude of management strategies that primarily focus on reducing fishing mortality of some stocks, and rebuilding all stocks to sustainable biomass levels. Many of these measures have had incidental benefits on habitat such as large year-round closures, reduced effort, and gear restrictions. Although these measures were not originally intended for habitat purposes, it is important to consider their cumulative benefit, and if they remain unchanged, some of these measures in place may potentially continue to benefit essential fish habitat for scallops and other species.

Measures to manage Atlantic sea scallops (Placopecten magellanicus) were initially implemented through emergency measures on May 15, 1982. The Council's fishery management plan, which mirrored the emergency rules, took effect shortly thereafter. The FMP instituted a meat count standard of 40 meats per pound for shucked scallops and a minimum shell height of 3 ¼ inches for scallops landed in the shell. These measures remained in effect during a one-year phase-in period, after which measures were to be adjusted to 30 meats per pound and a 3 ½ inch minimum shell height standard. In June 1983, however, the NMFS Regional Director invoked the Plan's temporary adjustment provision and set the meat count at 35 meats per pound and the shell height standard at 3 3/8 inches. From 1982 through 1993, the FMP relied exclusively on age-at-entry (meat count) controls, measures which were based on how large and therefore how old a scallop was before it was legally harvestable. Amendment 4 changed the primary management strategy to an effort control program for all resource areas.

Since the original plan, there have been nine (9) amendments and fifteen (15) framework adjustments. A description of these actions can be found in Section 7.1.2. In summary, however, the sea scallop fishery is governed primarily by day-at-sea allocations, crew limits, gear restrictions, and ad hoc area closures to achieve annual fishing mortality targets and achieve maximum sustainable yield (MSY). These efforts have been very successful, reducing fishing mortality and allowing biomass to recover nearly to the long-term targets well ahead of schedule. During the last seven years, the amount of fishing effort has declined from 45,000 days in 1992-1993 to 23,000 days in 2000-2001. At the same time, the number of limited access permits has declined from around 450 in 1994 to 340 in 2000. Only 276 of the 340 limited access permits used allocated days-at-sea in the 2000 fishing year. At the same time, age 2 and 3 scallops have become less vulnerable to the fishery because of gear restrictions, crew limits, and the Hudson Canyon and VA/NC Area closures. Overall fishing mortality on the Georges Bank stock has declined from 1.51 in 1991 to 0.15 in 1999 (NMFS 2001a), while biomass has increased from 1.30 kg/tow in the 1991 survey to 9.08 kg/tow in the 2000 survey.

Amendment 10 does recognize that there will be increased benefits to habitat from Amendment 13 to the Multispecies FMP as well as Amendment 2 to the Monkfish FMP, which are reasonably foreseeable actions. Additionally, there are little man-made impacts in these offshore fishing grounds because most of the impacts are in estuarine and coastal waters. Just about the only impact, with the exception of some cables, pipelines etc, are due to fishing activities. Since the passage of the EFH components of the Magnuson Act (SFA) in 1996, impacts to habitats are being minimized due to the new

EFH mandates. This will most likely be the continued trend unless the MSA reauthorization weakens EFH protections.

8.2 Biological Impacts on Scallops

Impacts on scallop biology, yield, and management are related to the combined effect of many alternatives. The primary effects are likely to arise from alternatives for scallop area rotation, effort allocation, habitat closures, and gear changes.

8.2.1 Projections of stock biomass, mortality, and catch

This section describes the biological projection and simulation models, including methods and assumptions. In addition, the projection results for all the rotation alternatives and criteria options are described and presented. This model, developed by Dr. Dvora Hart at the Northeast Fisheries and Science Center in Woods Hole, MA has been successfully used in recent annual framework adjustments to set TACs and day-at-sea allocations. The Scallop PDT and the Councils Scientific and Statistical Committee have reviewed the model and assumptions, which been revised to accommodate a higher degree of resolution associated with proposed area rotation policies. One limit of the model, however, is estimating the recruitment dynamics by an area size that is too small relative to the available information from the survey. In addition, the model was run in a stochastic form, accounting for annual variability in recruitment as described below. As a result, computational time also becomes an issue for doing the analysis at a finer scale of resolution.

The rotation management areas that were chosen by the PDT for purposes of analysis have been retained throughout the amendment, although the boundaries of the areas may be modified based on public comment. The PDT has advised that reasonable boundary changes (size, configuration, number of areas) will not significantly alter the long-term steady-state results. Over shorter periods, however, significant boundary changes and the size of area closures that start the rotation program will dictate downstream results. The effects of these potential changes on yield and management when rotation management areas re-open to fishing in 2007 or 2008 will have to be re-analyzed during the framework adjustment process, based on updated information and hopefully more detailed data from cooperative industry surveys that augment the R/V Albatross resource-wide annual survey.

Because of these issues, it is not currently possible to run the rotation management area projections and simulations for flexible boundary, adaptive rotation management alternative (Section 5.1.3.2). Based on analysis of survey sampling error, the PDT thinks that flexible area boundaries could increase sustainable yield by an additional five to ten percent compared with a fixed boundary area rotation system. With both fixed and flexible rotation management area boundaries, strong year classes of small scallops will be protected. The flexible boundary system may be advantageous, however, with respect to not closing areas that are older than optimum size (i.e. older scallops populations loose biomass from natural mortality rate exceeding the growth rate) and with respect to closing areas with parts of strong year classes of small scallops that might not otherwise close because of a partial overlap with a fixed boundary area.

8.2.1.1 Introduction

The simulation model used in Amendment 10 is an extension of the model used to project abundances and landings in Frameworks 12/13/14 (see the 2000 Scallop SAFE Report [NEFMC 2000]).

This model was successful in forecasting the increases in sea scallop abundance, landings, and catch rates that have been observed during the last several years.

The main extensions to the model that are new in this version include (1) division of the resources into more areas to accommodate rotational plans (2) a new stochastic recruitment submodel which takes into account spatial autocorrelation of recruitment among subareas (3) a simple "fleet dynamics" submodel, which simulates the spatial behavior of fishermen based on biomass and location and (4) rule-based closures and reopenings, based on scallop growth rates, as part of an adaptive rotation plan.

For these simulations, there were two regions, Georges Bank and Mid-Atlantic. Georges Bank was divided up into 14 subareas, 6 in the groundfish closed areas and 8 in the open areas. Mid-Atlantic divided into 9 subareas (see Map 7). This configuration allowed for simulation of a particular fixed boundary rotation plan. However, modest changes in the boundaries should not substantially affect the outcomes of the simulations.

8.2.1.2 Model Scenarios

Five non-rotational scenarios for the areas outside the groundfish closed areas were simulated. *NR-1*: A mean *F* of 0.2 in the open areas, *NR-2*: like NR-1, but with 4" rings, *NR-3*: No action, so that the Amendment 7 DAS schedule used, *NR-4*: 26000 DAS, roughly approximating the current DAS use, and *NR-5*: *F* = 0.2 in all open subareas (Table 159). The last scenario approximates Alternative 1e; area management without rotation, where the fleet dynamics model was not used because fishing mortalities are controlled by area.

Three main classes of rotational models were considered. In the two mechanical rotation simulations, areas were opened and closed according to a fixed periodic schedule (*M-1*: three years closed and then three years opened, and *M-2*: five years closed and one year opened). In the adaptive rotation strategies with fixed closure durations (AFC), areas were closed according to a growth rule criterion. For each subarea, its growth rate, i.e., the percent increase in scallop biomass in a year, excluding new recruitment, was calculated. If this growth rate was larger than a threshold, the area was a candidate for closure. A maximum percent of biomass that could be closed (at the time of closure) was specified for each run. If the total biomass of areas already closed, together with areas that are candidates for closures, is larger than this maximum, then areas were closed in order of their growth rates until the maximum is met. When an area is closed, it remains closed for a fixed duration. Table 159 lists the twelve AFC model runs. The "Strategy" column gives the closure rule (percent) followed by the number of years that a closure lasts. The "Mxcl" column indicates the maximum percentage of biomass closed in that simulation. The "Rings" column indicates the gear ring size (for the 4" simulations, 3.5" rings are used from 2001-2003, and 4" rings are used thereafter).

In the five adaptive closures and reopening (ACR) scenarios, closures are triggered by a growth rate criterion as above, and the area remains closed until the growth rate decreases below a second growth rate threshold. The closure threshold, followed by the reopening threshold, are listed under the "Strategy" column in Table 159.

Groundfish closed area access options are listed in Table 160. The following access options were analyzed. No access, access to southern part of Closed Area II only, as had been authorized in Framework 11 (F11), access to the areas reopened as part of Framework 13 (F13), and access to all portions of the groundfish closed areas. For each option, fishing the area at a constant rate of *F* = 0.1 and *F* = 0.2 was considered.

Alternative 1b calls for an adaptive rotation system as described above in the open areas, together with using parts of the groundfish closed areas as a "reservoir". The level of access to the groundfish closed areas would depend on the expected landings in the open areas. When open area landings are expected to be below a specified target level, groundfish closed area access would be granted to bring the total landings up to the target.

This idea serves two purposes: first, to reduce the variability in landings that can be accentuated by rotation, and secondly, to increase mean landings by allowing access to productive but less sensitive portions of the closed areas, while still keeping high biomass in these areas. Two access options under this plan are considered: a mechanical rotation of the Framework 13 areas, for which one year of fishing in the Nantucket Lightship and Closed Area I access areas is follow with three years of fishing in the southern portion of Closed Area II (this pattern is used so as to match the very high productivity and size of the Closed Area II access area with the smaller productivity and size of the Nantucket Lightship and Closed Area I access areas). The other access option involves using the southern portion of Closed Area II only (as in Framework 11). Various targets between 18,000 MT and 21,000 MT were set (see Table 159, options R-1 through R-6).

8.2.1.3 Comparisons of projections using various area rotation strategies and area management criteria

Long-term results are given in Table 159 and Table 160. The baseline NR-1 alternative gives long-term mean yields in the portion of the resource outside the groundfish areas of about 15,000 MT. This yield can be enhanced by 4" rings or by area management without rotation by about 4%. Note that because of the higher efficiency of the 4" ringed dredges, area swept (and hence bycatch) in the 4" ring alternative is lower than in NR-1. On the other hand, the area management without rotation scenario NR-5 increases bottom contact time and bycatch over NR-1 by about 20%, because the lack of aggregation of effort under this plan. The "no action" (NR-3) alternative produces long-term landings slightly lower because of underfishing, while the 26000 DAS alternative (NR-4) reduces long-term yields by about 60% due to overfishing. The latter would also induce much higher levels of bottom area swept and bycatch than any of the other scenarios considered.

All the rotational alternatives modestly increase long-term yields and scallop biomass over the baseline non-rotation scenario (NR-1). However, they increase the variability of landings to a much greater extent. These landings fluctuations may make these alternatives less desirable from a socioeconomic perspective than the no rotation alternatives, even though they give slightly higher yields.

The mechanical rotation alternatives (M-1 and M-2) give good long-term yields, but like scenario NR-5, increase bottom contact time and bycatch more than they increase yields. Also, these scenarios require 50-83% of the fishing grounds to be closed at any one time, which may require some vessels to make long steams to open areas.

In the adaptive rotation alternative with fixed closure durations (AFC-1 through AFC-12), increasing the closure duration to more than three years, or increasing the maximum biomass closed to over 25% results in only slight improvements in mean yields, while considerably increasing yield variability. On the other hand, decreasing the closure growth threshold from 40% to 20% increases long-term yield while decreasing variability. Strategy AFC-6, which calls for a 20% growth rate threshold, 3 year closures, and 25% maximum biomass closed, increases yields by about 6% over scenario NR-1, while having less variation in yield than many other rotation scenarios. If in addition 4" rings are required (AFC-12), an addition 3% increase in long-term yield would be obtained, while affecting a decrease in bottom area swept and bycatch. The adaptive closures and reopening scenarios (ACR-1 through ACR-5) give slightly better yield, but considerably greater variation in yield, compared to the fixed closure adaptive rotations.

Alternative 1a (adaptive rotation with flexible boundaries) could not be directly simulated because sufficient data is not available on the small scale required in this alternative. However, the likely result of such a strategy can be inferred. Reducing the area of the rotational units has the effect of increasing the variability in recruitment in any of the units. To test the effect of this, a model rotational simulation was done where recruitment variability was increased by a factor of two. This resulted in slightly increased yields (about 1%) over the corresponding original simulation. Thus, it is probable that this alternative would have slightly greater yields than other rotational scenarios. It is likely also that it could do this with less area closed at any given time, due to the more flexible boundaries. However, this alternative would require additional costs in terms of supplemental surveys etc.

Long-term analysis of the groundfish closed area options are given in Table 160. Access to the groundfish closed areas can add (long-term) between about 10 and 20 million lbs of landings a year, on average. Even the most limited access scenario – fishing the southern portion of Closed Area II only at F = 0.1 - gives around 10 million lbs in yield annually. This option also would sweep only a minimal bottom area and have low bycatch, due to the very high level of biomass remaining in the area. Other options give more yield, but at a cost of increasing amounts of bottom area swept and bycatch.

The reservoir rotation options are effective in the goals of high landings together with relatively low variability in the landings. Because the permitted access to the closed areas is modest, the increase in area swept and bycatch because of this access is limited.

Short-term simulations of the non-rotational options are shown in Figure 45. Scenario NR-1 gives fairly steady short and long term landings of about 15,000 MT. Scenarios NR-2 (4” rings) and NR-5 (area management without rotation) improve on this yield by about 4% long-term, but reduce yield in the short term. The no-action alternative NR-3 reduces landings in the short term (due to the very restrictive Amendment 7 DAS schedule) without a corresponding long-term benefit. The 26000 DAS scenario gives good short-term landings, but reduces both landings and biomasses to a lower level than any other alternative considered here long-term.

Sample short-term simulations of sample rotational strategies are given in Figure 47. These simulations indicate a drop in landings short-term, as areas area closed without any corresponding opening, but modest increases in yields and biomasses long-term. The increase in the variability in the landings is also apparent from these graphs.

Short-terms landings for groundfish closed area access options are given in Figure 49. At F = 0.1, short term annual landings in 2003-5 range from about 9,000 MT (F11 access only), to about 13,500 MT (all areas open). At F = 0.2, short-term annual landings in 2003-5 range from 17,000 MT (F11 access only) to 25,500 MT (all areas open). Landings gradually decline to long-term steady-state levels.

8.2.1.3.1 Updated simulations using the 2002 NMFS survey

A new set of simulations were run using updated 2002 information. The new runs were restricted to the basic non-rotational options, the one adaptive rotation option that appears to give the best results (20% closure growth criterion, 25% maximum closed, and 3 year closures), and a number of groundfish closed area access options. The relative advantages and disadvantages of options not re-examined (e.g., 4” rings in the open areas) should not change with the new information. Only short-medium term results are presented, as the new information would not alter the long-term results.

The updated information used in the new projections were: (1) the 2002 NMFS sea scallop survey data, (2) continuation of the present management regime (e.g., 120 DAS for full-time vessels, with no access to the groundfish areas) until 2004, as called for under Framework 15, so that the Amendment 10 alternatives would begin with the 2004 fishing year, and (3) an increase in the current total annual DAS use from 26,000 to over 29,000 due to reactivation of effort. The actual number of DAS used by limited access vessels in 2001 was about 28,600, but there were additionally about 2 million lbs. landed by general category vessels, corresponding to the equivalent of about another thousand DAS by the limited category fleet. Thus, it was assumed that total effort (limited access + general category vessels) was about 29,600 DAS.

Figure 5 gives updated short and medium-term landings, biomass, and area swept for the open areas for three non-rotational alternatives: 29,600 DAS, effort reduction to $F = 0.2$, and no action (Amendment 7 DAS schedule), and one rotational alternative (20% closure criterion, 3 year closures, and 25% maximum closure; AFC 6 in Table 159). The rotational alternative was initialized to close the three areas recommended by the PDT in 2004 (Mid-Atlantic areas 3-4, where the 2002 survey indicated a very strong 2001 year class, which would recruit to the fishery in 2004, and Georges Bank area 2). The 29,600 DAS scenario shows steeper declines in landings and biomass than in the previous simulations, due to the extra 3,600 DAS per year, the year delay in implementing Amendment 10 and because the 2002 survey indicated poor recruitment in most scallop grounds (except in the southern Mid-Atlantic). Similarly, the other options, which involve effort reduction measures, predict less landings short-term than those indicated previously. As was the case with the previous simulations, long-term open area landings at $F = 0.2$ will stabilize at about 15,000 MT, with rotation giving slightly greater long-term landings and biomass than effort reduction alone.

The open area rotation alternative discussed above were combined with a number of possible groundfish closed area access alternatives, thereby giving comprehensive rotational fishing packages where portions or all of the groundfish closed areas are reopened while three portions of the open areas are closed in 2004. Four groundfish access options were considered: (1) reopening Closed Area I and a portion of Nantucket Lightship Area for one year (at $F = 0.4$) in 2004, followed by three years of access to the southern portion of Closed Area II (at $F = 0.2$) in 2005-2007. This four-year rotation pattern was repeated in the simulations for the following years. (2) Reopening the southern portion of Closed Area II only at a constant rate of $F = 0.2$ (as in Framework 11). (3) Reopening the portions of the closed areas fished under Framework 13, each fished at $F = 0.2$. (4) Reopening all of the groundfish closed areas to fishing at $F = 0.2$. The latter three alternatives were assumed to be continued indefinitely.

Total landings (including both open and closed areas), biomass and area swept projections for these scenarios are given in Figure 51 to Figure 53. All options that include some closed area access give fairly steady landings of 40 million pounds or more. On the other hand, the effort reduction and rotational closures in the open areas, combined with groundfish area access, would reduce total area swept to about half present levels. Thus, these options can maintain landings near their present high levels while at the same time reducing bottom contact to about half of what occurs presently. Highest landings are achieved by Option 4 (access to all areas), followed by Option 1 (rotational access to the closed areas), Option 3 (Framework 13 access) and Option 2 (access to Closed Area II-south only/Framework 11 access). On the other hand, Option 4 would sweep the most area (about 800 nm^2) in the groundfish areas, while Option 2 would sweep less than one third as much (about 240 nm^2), even though landings under Option 4 are less than twice those under Option 2. The closed area rotation Option 1 would induce only slightly more bottom area swept in the closed areas (averaging about 290 nm^2) than Option 2, while producing landings that are about 30% higher than Option 2. Option 3 (Framework 13 access) would cause greater bottom area swept than Option 1, even though Option 1 gives greater landings, because Option 1 would allow access to all of Closed Area I if none of that area was made a habitat closure, whereas Option 3 allows access to only the central portion of Closed Area I, and because Option 1 slightly underfishing the access areas, which induces a relatively large reduction in area swept compared to the small decrease in landings. Actual DAS are estimated to range from about 15,000 for rotation without groundfish area access, to around 23,000 if all the groundfish areas are accessible. Actual allocated effort could be higher because of unused latent effort and DAS closed area tradeoffs. On the other hand, it is likely that about 1000 DAS needs to be allocated to general category vessels to account for their fishing activity, thus reducing limited access days. All alternatives (other than the "status quo" 29,600 DAS option) keep fishing mortality rates at or below the current F_{MAX} = 0.24 threshold and maintain biomass in both regions above their respective targets.

All the alternatives indicate a dip in landings in the 2006-2007 fishing year. This is because the higher fishing mortality rate in the Hudson Canyon area would end in 2006, but the three areas that would be closed in 2004 would not reopen until 2007. A number of measures could be taken to smooth out this dip, including (a) spreading out the high harvest fishing mortality rate in the Hudson Canyon area for another year or (b) modestly increasing fishing mortality in the closed areas during that year. The latter possibility would be permissible under the new "time-averaged" overfishing definition, and would especially be appropriate with Option 1, because the time-averaged fishing mortalities in the access areas would be below 0.2 long-term under this option (this essentially an implementation of the "reservoir rotation" alternative, where groundfish closed area access is varied in order to smooth out landings variations).

Table 159. Steady state (long-term) simulation results

	Strategy			Minimum ring size (in)	Mean biomass (g/tow)[1]	Biomass standard deviation (g/tow)[1]	Mean GB biomass (g/tow)	Mean GB open area biomass (g/tow)	Mean MA biomass (g/tow)	Mean scallop ladings (mt)[2]	Scallop landings standard deviation (mt)[2]	Mean meat count[2]	Landings per day-at-sea used[2]	Used days-at-sea[2]	Total area swept (nm^2)	Area swept per mt	Mean percent of biomass closed	Mean closure duration
	Non-rotational scenarios																	
NR-1	F=0.2, No rotation, status quo			3.5	13732	4047	23554	5573	5228	14945	2314	17.2	2314	14559	2334	0.156	0	
NR-2	F=0.2, No rotation, status quo			4	14237	4064	23884	6188	5884	15561	2397	15.2	2397	14267	1996	0.128	0	
NR-3	No action (13411 DAS)			3.5	14995	4423	24581	7488	6696	14620	1511	16.0	2410	13358	1843	0.126	0	
NR-4	26000 used DAS			3.5	10542	3984	21289	1352	1237	10211	2901	30.6	867	26096	9124	0.894	0	
NR-5	Uniform F=0.2			3.5	13895	4050	24170	6722	5603	15644	2513	16.2	2206	15099	2751	0.176	0	
	Mechanical rotation																	
M-1	3yr closed, 3yr open			3.5	14362	4073	24299	6962	5759	15962	3030	15.6	2238	15624	2751	0.172	~50	3
M-2	5yr closed, 1yr open			3.5	14615	4086	24504	7343	6052	16198	4247	15.9	2000	17822	2751	0.170	~83	5
	Adaptive rotational closures with fixed closure duration																	
	Closure: Minimum annual biomass growth (% increase)	**Closure duration**	**Maximum percent of biomass closed**															
AFC-1	30%	3	25%	3.5	13996	4112	24009	6421	5297	15696	4207	16.0	2314	14850	2435	0.155	14.8	3
AFC-2	30%	3	50%	3.5	14009	4090	24195	6767	5414	15767	4857	15.9	2317	14879	2451	0.155	17.0	3
AFC-3	30%	3	100%	3.5	14027	4097	24012	6428	5348	15791	5229	15.8	2317	14883	2463	0.156	17.9	3
AFC-4	40%	3	25%	3.5	13913	4077	23958	6326	5215	15528	4017	16.3	2305	14751	2404	0.155	8.7	3
AFC-5	25%	3	25%	3.5	14050	4117	24050	6498	5362	15815	4151	15.9	2317	14948	2462	0.156	19.5	3
AFC-6	20%	3	25%	3.5	14085	4079	24061	6519	5448	15855	3935	15.8	2315	15005	2489	0.157	24.8	3
AFC-7	15%	3	25%	3.5	14142	4066	24058	6512	5557	15841	3547	15.8	2307	15065	2469	0.156	29.9	3
AFC-8	10%	3	25%	3.5	14193	4073	24053	6502	5656	15825	3254	15.8	2296	15137	2555	0.161	34.0	3
AFC-9	30%	4	25%	3.5	14051	4091	24104	6599	5348	15822	4924	16.0	2306	14978	2480	0.157	19.2	4
AFC-10	30%	5	25%	3.5	14129	4116	24195	6767	5414	15807	5702	16.0	2292	15000	2521	0.159	23.3	5
AFC-11	30%	3	25%	4	14428	4090	24304	6971	5878	16169	4251	14.4	2430	14697	2118	0.131	14.8	3
AFC-12	20%	3	25%	4	14532	4089	24360	7075	6022	16304	4100	14.3	2432	14560	2072	0.127	22.6	3

Strategy				Minimum ring size (in)	Mean biomass (g/tow)[1]	Biomass standard deviation (g/tow)[1]	Mean GB biomass (g/tow)	Mean GB open area biomass (g/tow)	Mean MA biomass (g/tow)	Mean scallop ladings (mt)[2]	Scallop landings standard deviation (mt)[2]	Mean meat count[2]	Landings per day-at-sea used[2]	Used days-at-sea[2]	Total area swept (nm[2])	Area swept per mt	Mean percent of biomass closed	Mean closure duration
Adaptive rotational closures and re-openings																		
	Closure: Minimum annual biomass growth (% increase)	**Re-open: Maximum annual biomass growth (% increase**	**Maximum percent of biomass closed**															
ACR-1	40%	25%	25%	3.5	13866	4061	23836	6098	5235	15462	4005	16.3	2300	14750	2406	0.156	6.9	2.6
ACR-2	30%	15%	25%	3.5	14297	4067	23988	6382	5371	15887	3811	15.6	2258	15487	2756	0.173	17.0	4.0
ACR-3	30%	15%	25%	4	14432	4090	24250	6870	5931	16161	5291	14.4	2415	14602	2117	0.131	13.8	3.9
ACR-4	20%	10%	25%	3.5	14233	4120	24124	6635	5669	15955	6593	15.9	2260	15379	2725	0.171	27.3	5.3
ACR-5	20%	10%	25%	4	14627	4133	24396	6169	7143	16434	6678	14.3	2373	15099	2320	0.141	25.0	5.1
Adaptive rotational closures, fixed closure duration (all 20-3-25 [AFCD-6 or 12]), with groundfish areas used as a stabilizing "reservoir"																		
	GB area access		*TAC (mt)*															
R-1	F11(CL2-S)		18000	3.5	12546	4066	20762	6527	5433	18229	2341	15.2	2400	16750	2552	0.140	24.8	3
R-2	F11(CL2-S)		18000	4	13019	4052	21129	7079	5997	18560	2513	13.8	2507	16316	2172	0.117	24.8	3
R-3	F11(CL2-S)		19000	4	12636	4013	19531	7073	6014	19103	2373	13.8	2516	16734	2192	0.115	24.8	3
R-4	F13*		20000	3.5	11586	4023	18693	6527	5433	19608	2074	15.1	2416	17899	2677	0.137	24.8	3
R-5	F13*		20000	4	12886	4052	19202	7079	5997	19937	2200	13.7	2526	17397	2269	0.114	24.8	3
R-6	F13*		21000	4	11541	3924	17944	7079	5997	20829	2524	13.8	2411	18174	2734	0.131	24.8	3

*Mechanical rotation in closed areas: NLS+CL1 fished 1/4 years, with CL2-S fished 3/4 years

[1]Resource-wide biomass calculated under the assumption that the open areas are uniformly fished at F=0.2 (NR-5, alternative "1e")

[2] Groundfish closed areas only

Table 160. **Groundfish closure area access options**

Access	F	Minimum ring size (in)	Mean biomass (g/tow)[1]	Biomass standard deviation (g/tow)[1]	Mean biomass in GB groundfish areas (g/tow)l[2]	Mean scallop ladings (mt)[2]	Scallop landings standard deviation (mt)[2]	Mean meat count[2]	Landings per day-at-sea used[2]	Used days-at-sea[2]	Total area swept (nm^2)[2]
None	0	NA	13895	4050	44382	0	0	NA	NA	0	0
F11 (Cl2-S)	0.1	4	11013	2434	28615	4764	4815	12.3	2939	3571	120
F11 (Cl2-S)	0.2	4	10077	1811	24260	5125	6144	14.6	2647	4204	238
F11 (Cl2-S)	0.1	3.5	10392	2298	28085	4740	4766	13.3	2839	3686	140
F11 (Cl2-S)	0.2	3.5	9450	1660	23707	4993	5942	16.2	2522	4316	279
F13	0.1	4	10490	2409	26182	5508	4843	12.3	2912	4159	181
F13	0.2	4	9408	1774	21145	5922	6177	14.6	2591	4755	361
F13	0.1	3.5	9851	2271	25569	5479	4794	13.3	2812	3604	211
F13	0.2	3.5	8762	1619	20507	5769	5973	16.2	2468	5081	421
All	0.1	4	8646	2340	17605	8291	4916	12.3	2849	6389	404
All	0.2	4	7019	1658	10037	8931	6267	14.5	2478	7826	806
All	0.1	3.5	7939	2196	16679	8246	4866	13.3	2749	6590	473
All	0.2	3.5	6304	1490	9074	8700	6061	16.2	2361	8016	940

[1]Resource-wide biomass calculated under the assumption that the open areas are uniformly fished at F=0.2 (NR-5, alternative "1e")
[2] Groundfish closed areas only

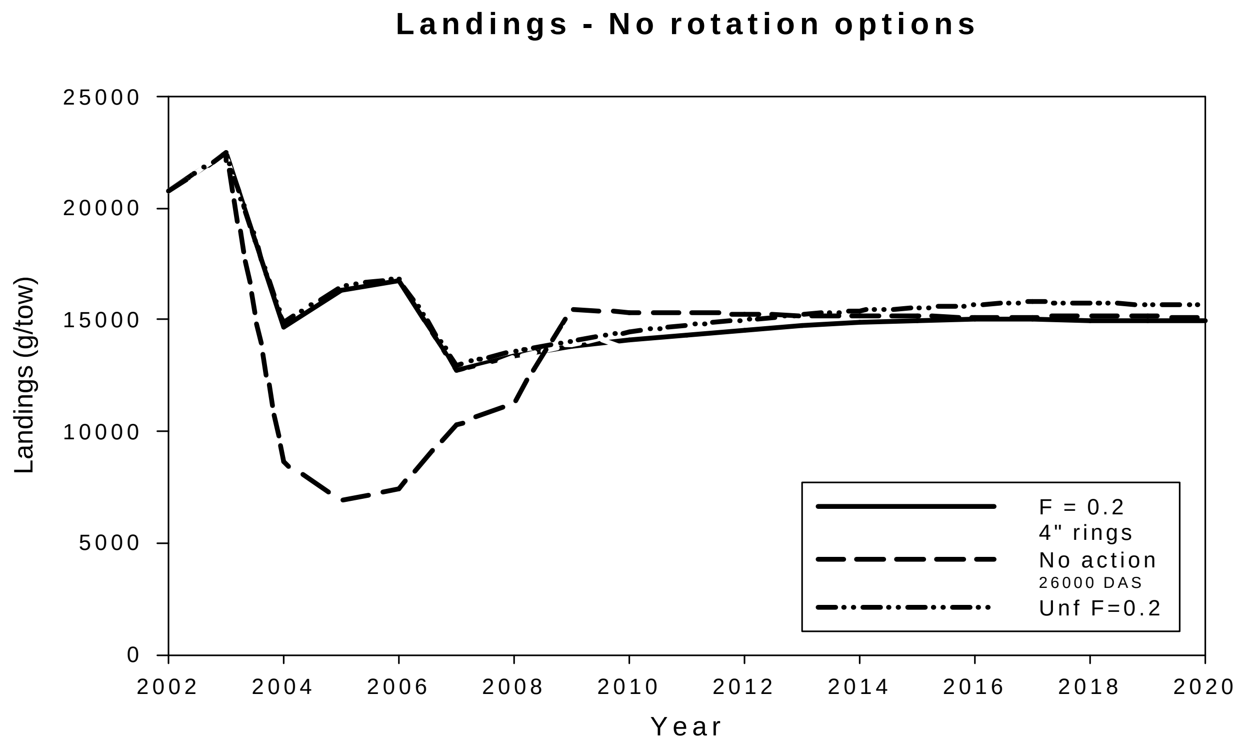

Figure 45. **Comparison of landings without rotation or Georges Bank closed area access**

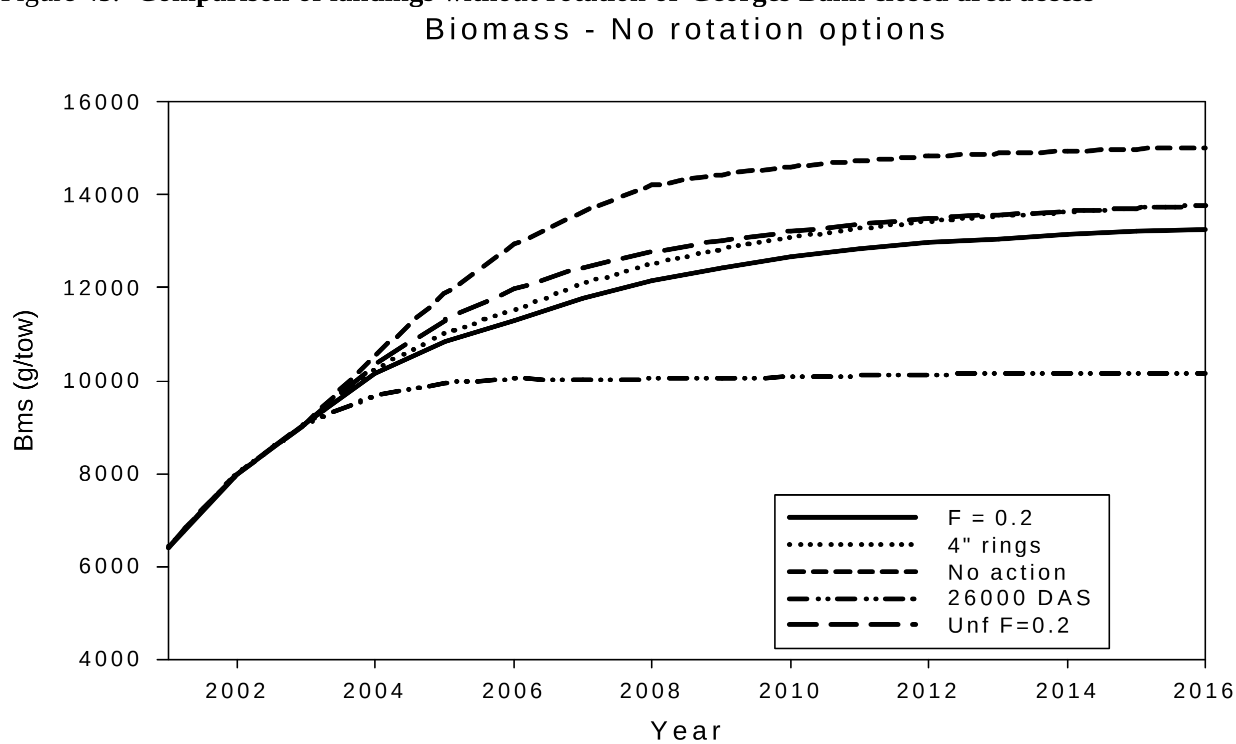

Figure 46. **Comparison of total mean biomass (Georges Bank and Mid-Atlantic added) for no rotation and without Georges Bank closed area access**

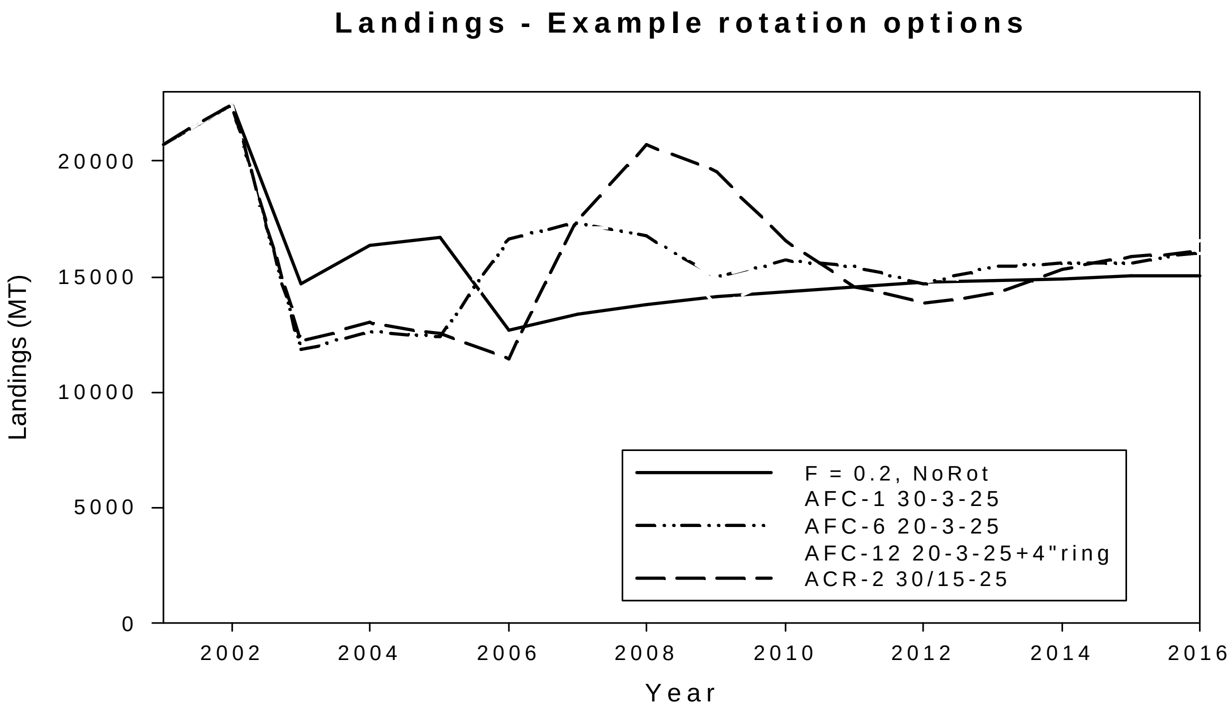

Figure 47 Comparison of annual yield projections for sample area rotation strategies

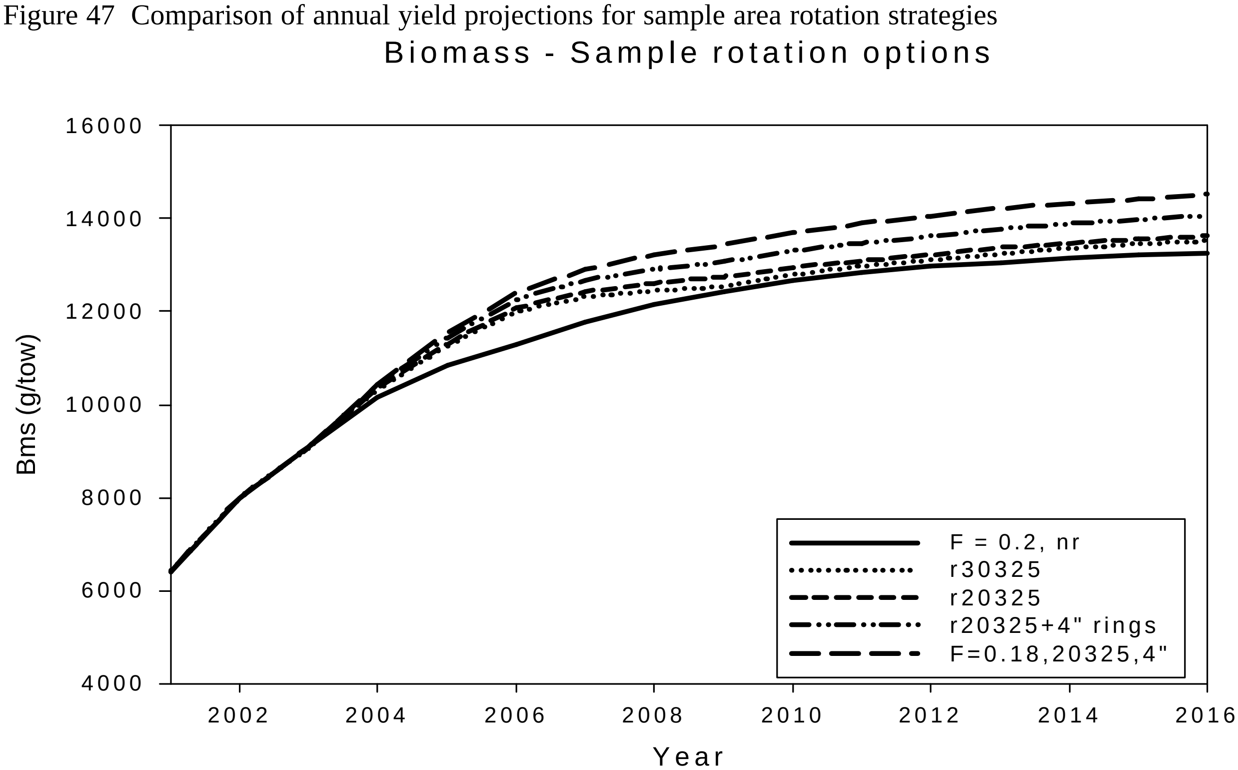

Figure 48. Comparison of annual total biomass (Georges Bank and Mid-Atlantic added together) for sample area rotation strategies

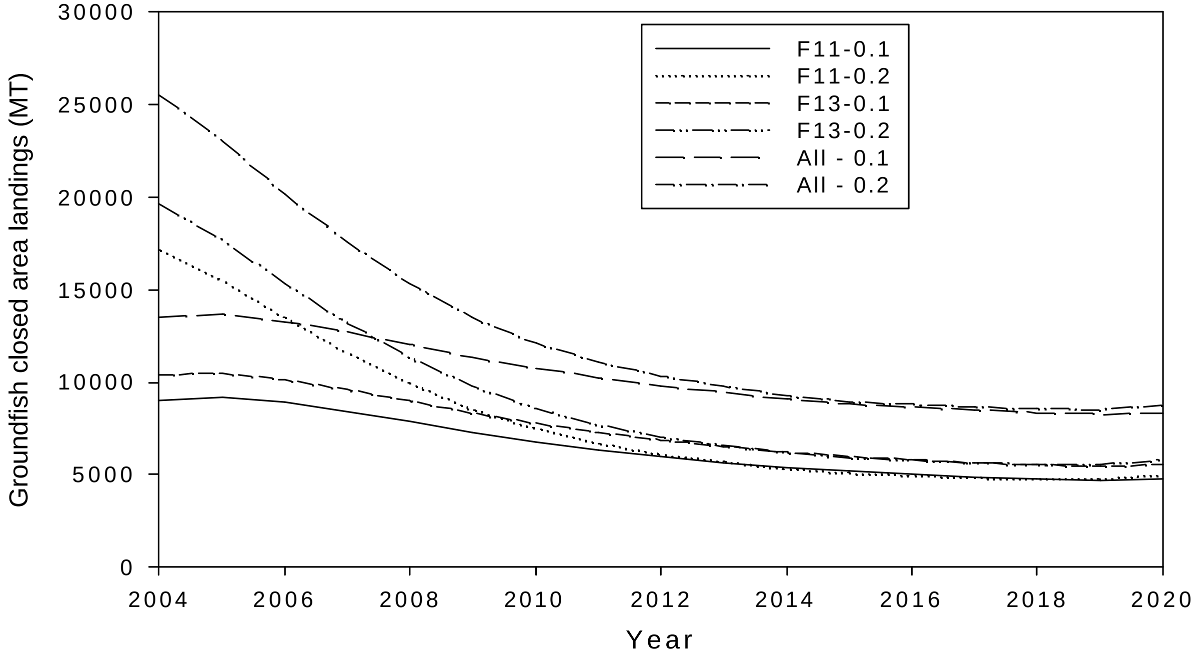

Figure 49 **Projected landings for groundfish closed access areas. Numbers in legends indicate target fishing mortality rate.**

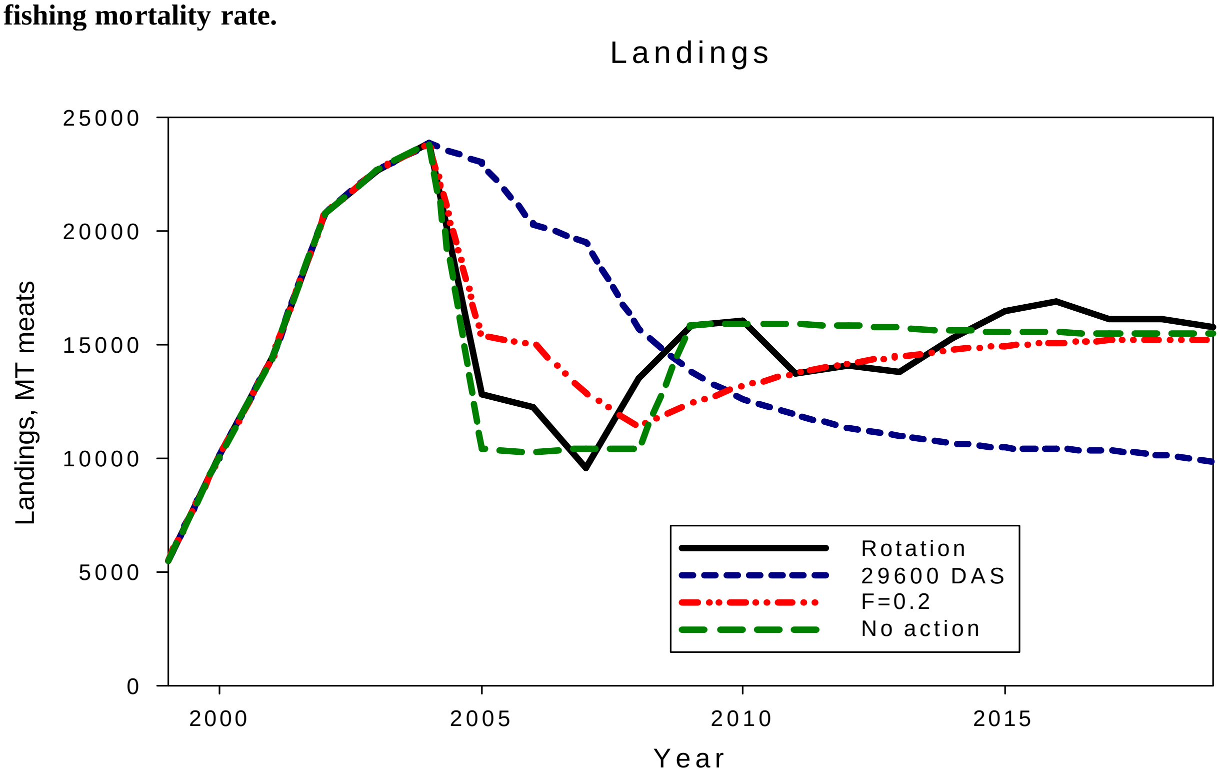

Figure 50. **Updated landings projections, assuming no access to groundfish closed areas**

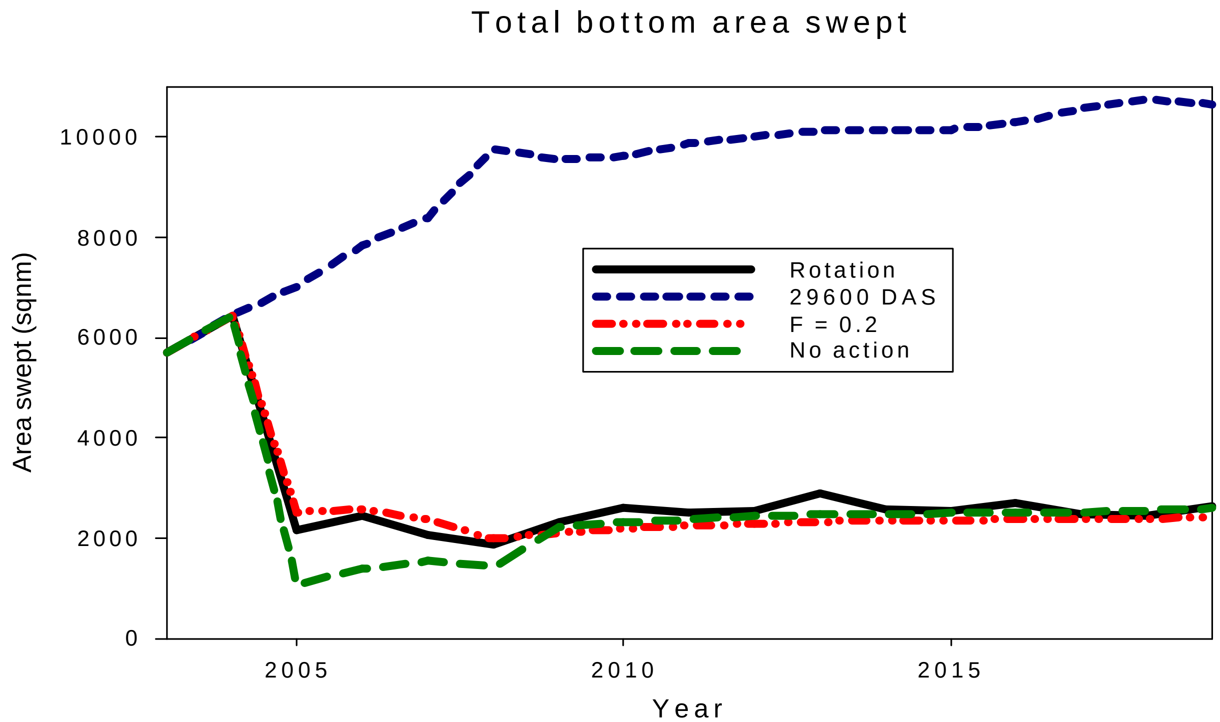

Figure 51. **Updated projections of total bottom area swept by fishing, assuming no access to groundfish closed areas**

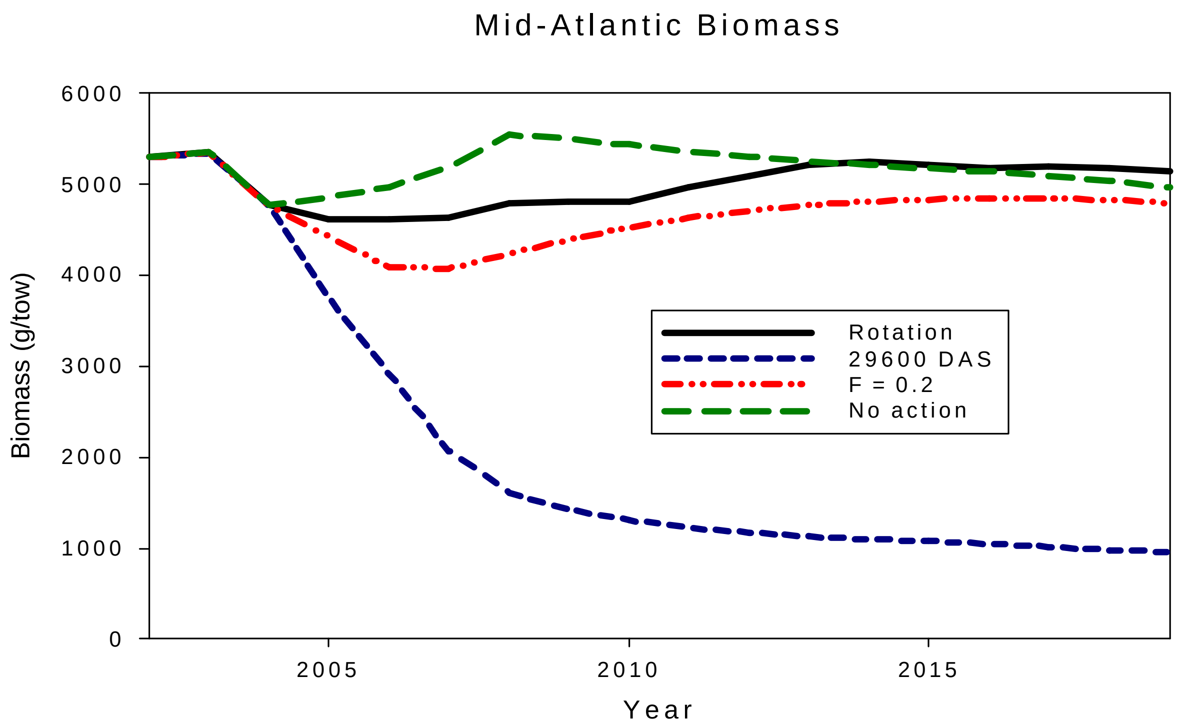

Figure 52. **Updated projections of Mid-Atlantic biomass per tow. Rotation assumes a closure when the expected biomass growth is greater than 40%, total biomass in closed rotation areas is not more than 25%, and areas close for a constant three year period.**

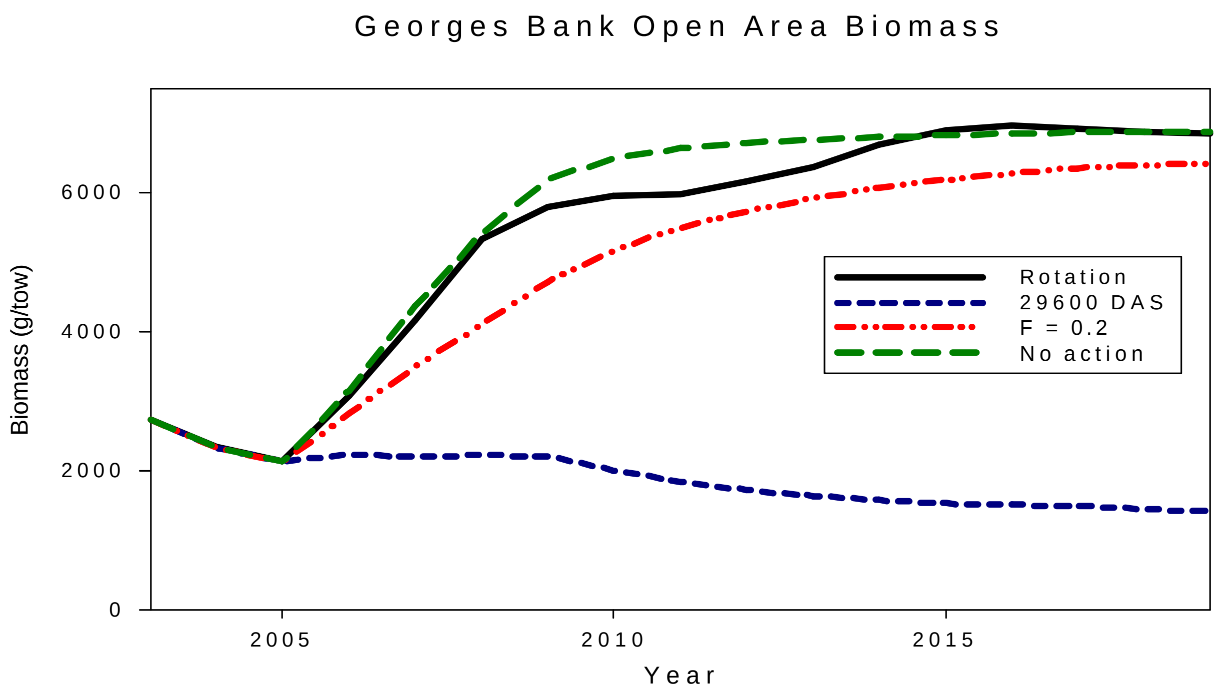

Figure 53. **Updated projections of Georges Bank biomass per tow, not including scallop biomass in the Georges Bank groundfish closed areas. Rotation assumes a closure when the expected biomass growth is greater than 40%, total biomass in closed rotation areas is not more than 25%, and areas close for a constant three year period.**

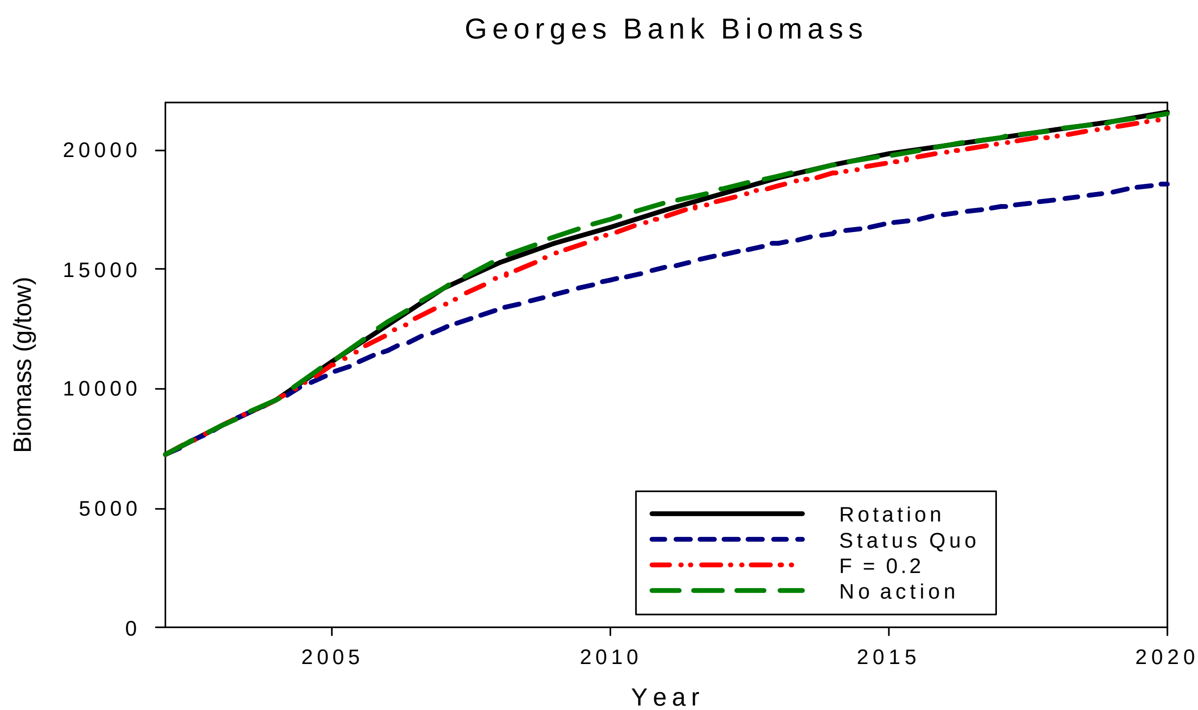

Figure 54. **Updated projections of Georges Bank biomass per tow, including scallop biomass in the Georges Bank groundfish closed areas. Rotation assumes a closure when the expected biomass**

growth is greater than 40%, total biomass in closed rotation areas is not more than 25%, and areas close for a constant three year period

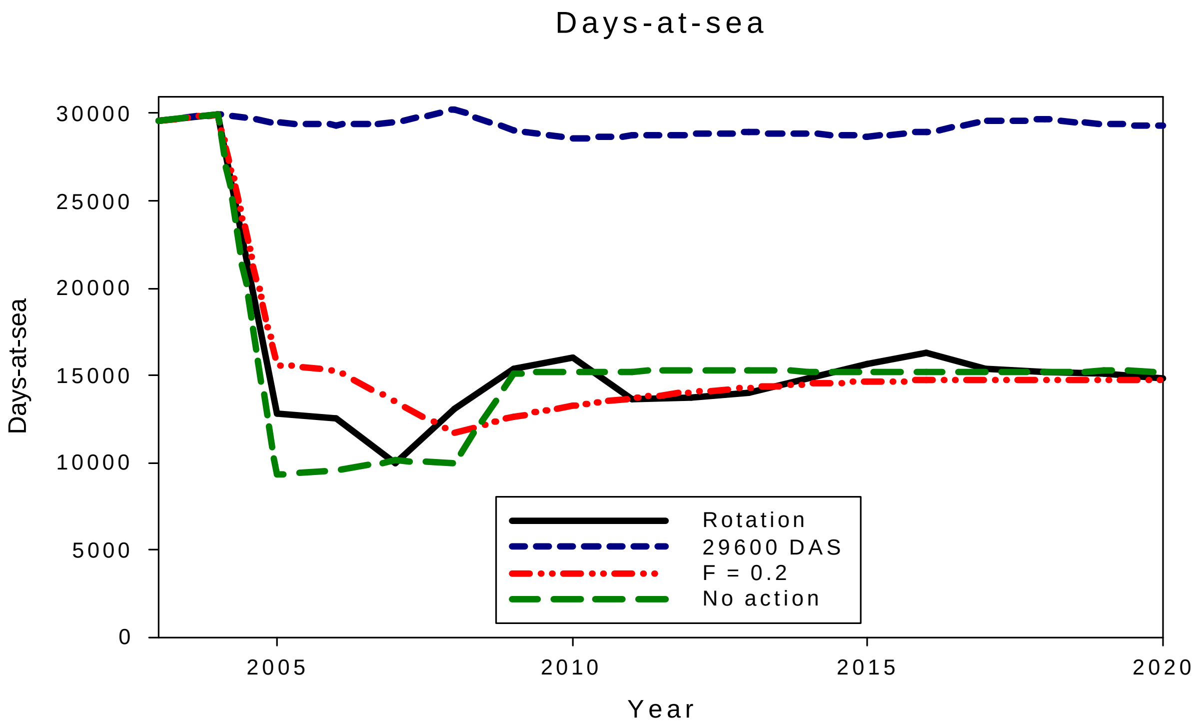

Figure 55. **Total day-at-sea use projections (including 1,000 day-at-sea equivalent for general category fishing), without access to the Georges Bank closed areas**

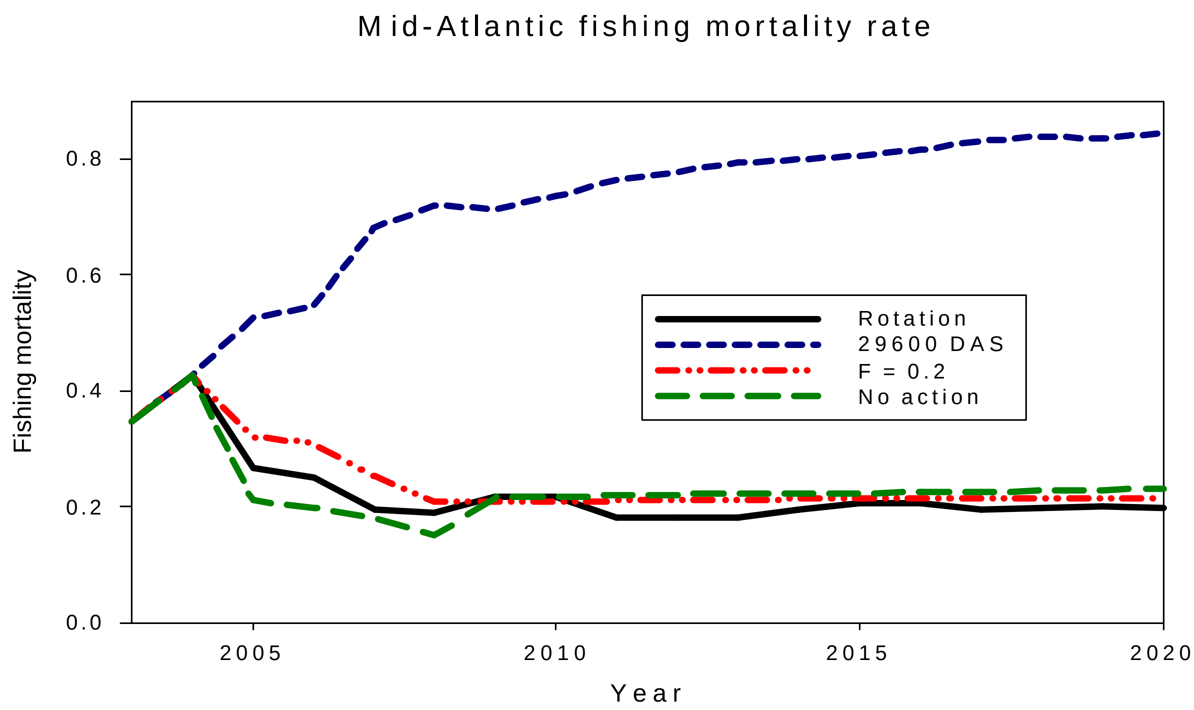

Figure 56. **Projected fishing mortality rates for Mid-Atlantic sea scallops**

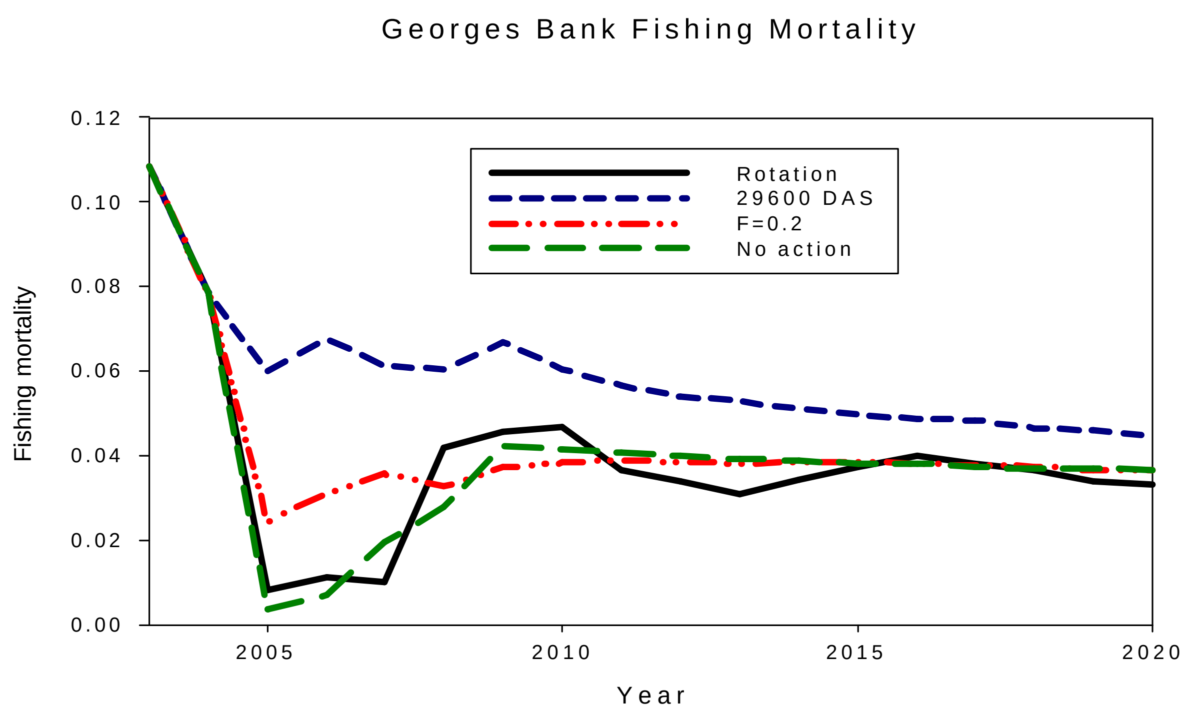

Figure 57. **Projected fishing mortality rates for Georges Bank sea scallops, with no access to the Georges Bank groundfish closed areas**

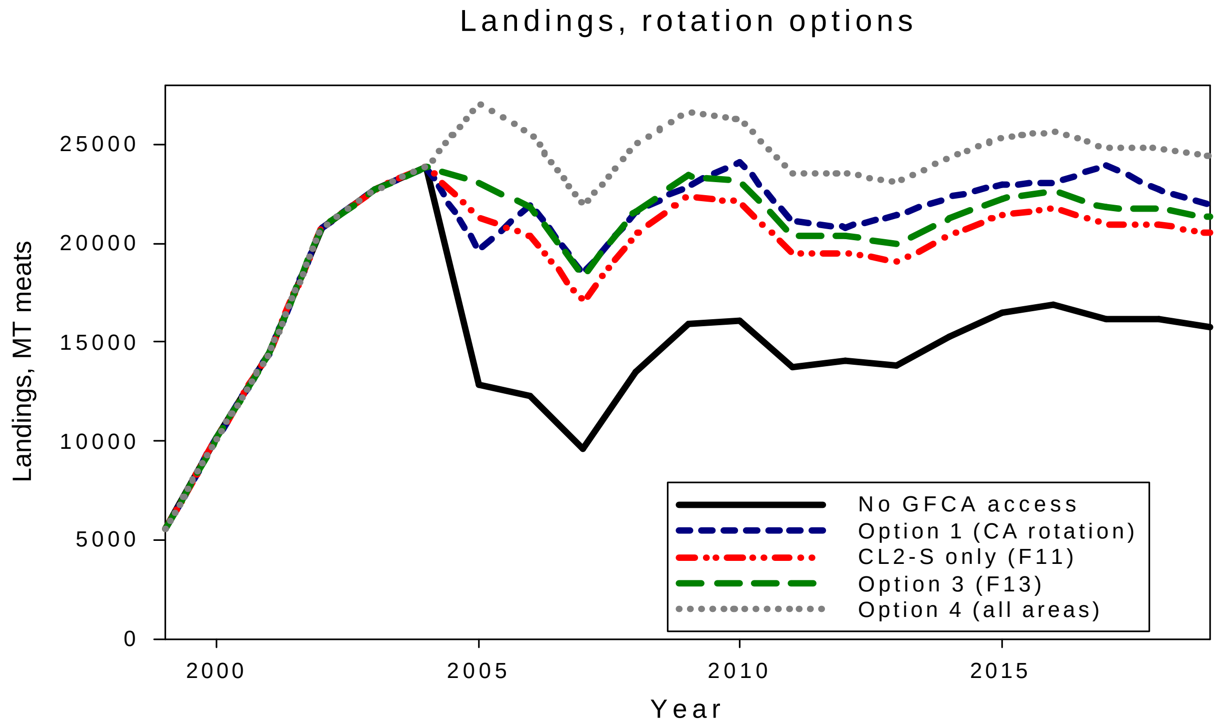

Figure 58. **Comparison of projected landings with area rotation and various options for accessing the Georges Bank groundfish closure areas**

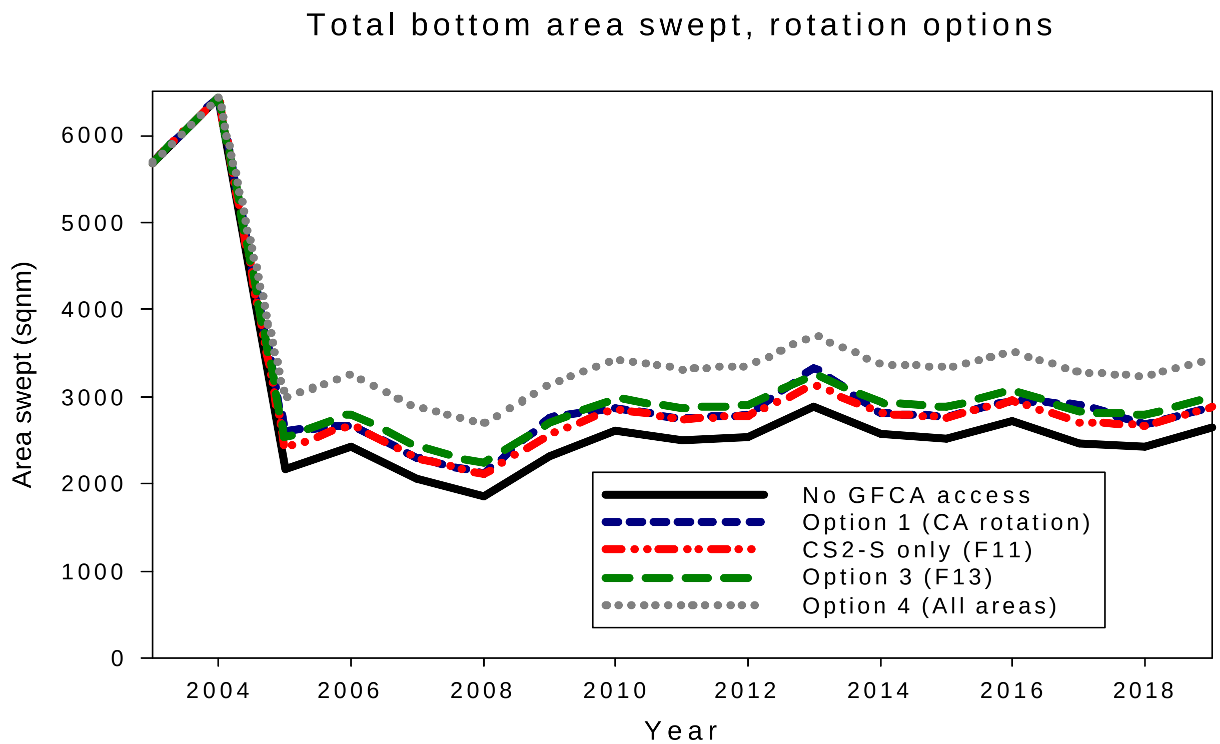

Figure 59. **Comparison of projected total bottom area swept for area rotation and various options for accessing the Georges Bank groundfish closure areas**

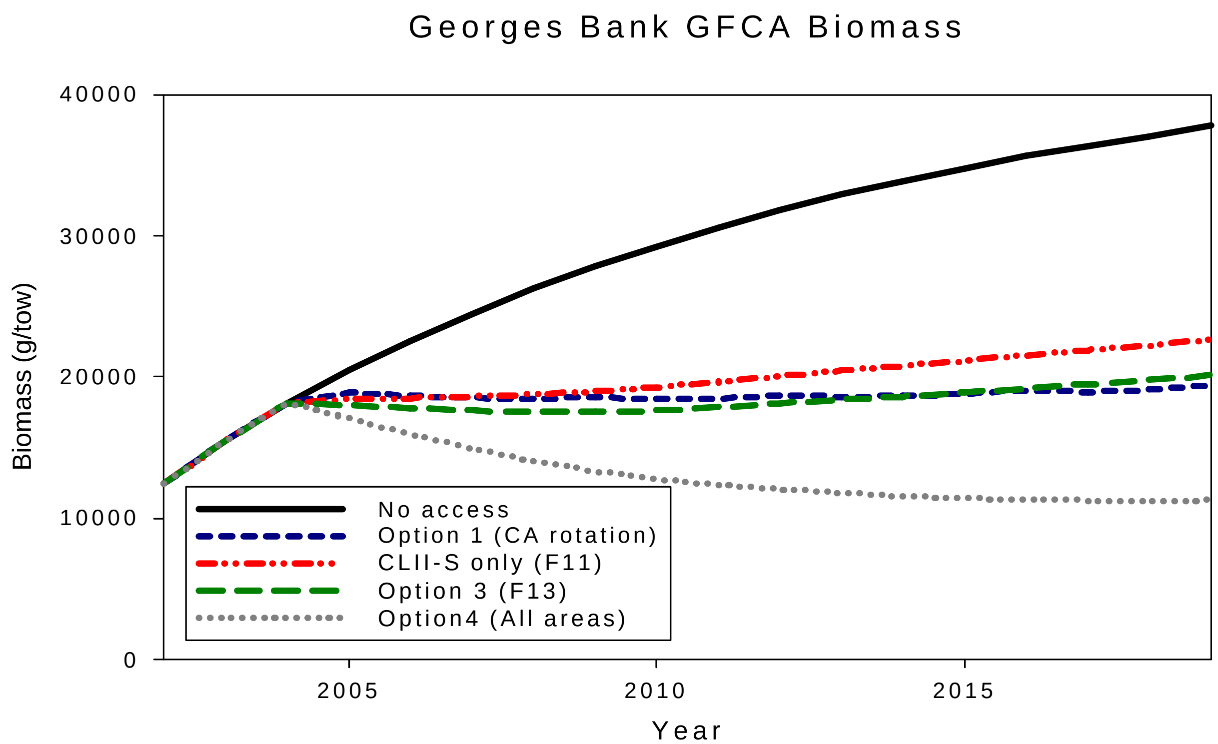

Figure 60. **Comparison of projected scallop biomass per tow in the Georges Bank groundfish closed areas versus various options for accessing the Georges Bank groundfish closure areas**

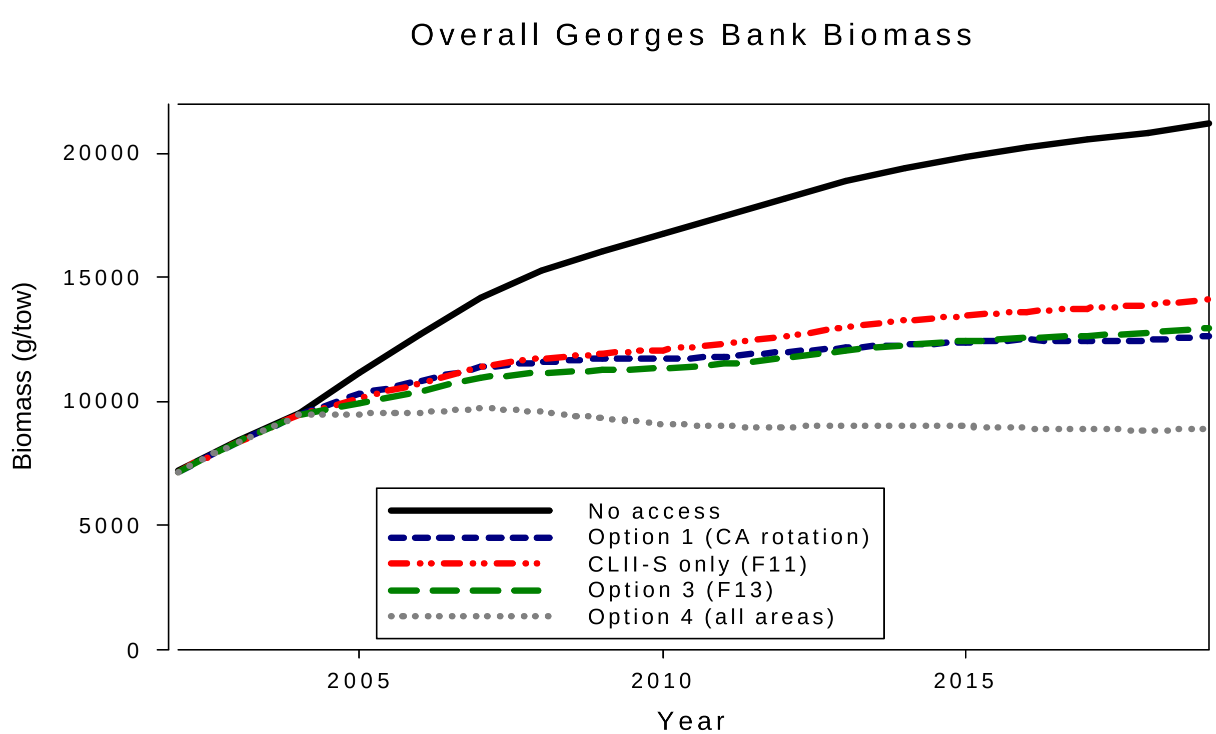

Figure 61. **Comparison of projected total scallop biomass per tow for area rotation and various options for accessing the Georges Bank groundfish closure areas**

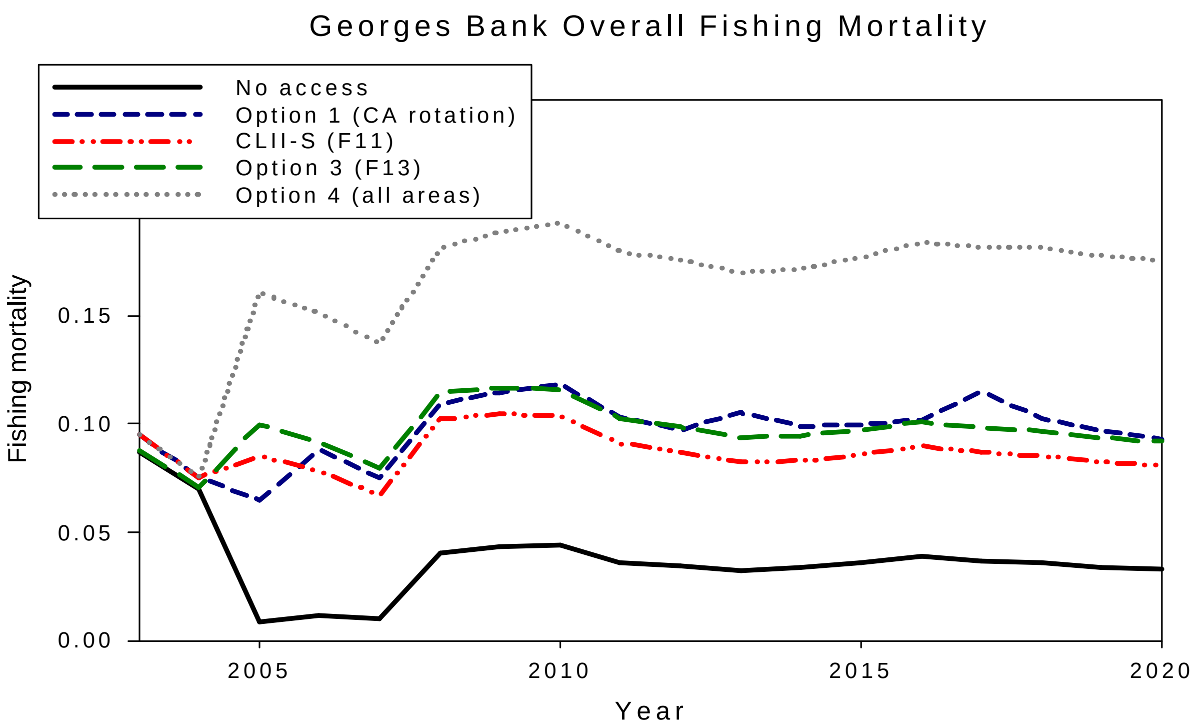

Figure 62 **Comparison of projected fishing mortality rates with area rotation and various options for accessing the Georges Bank groundfish closure areas**

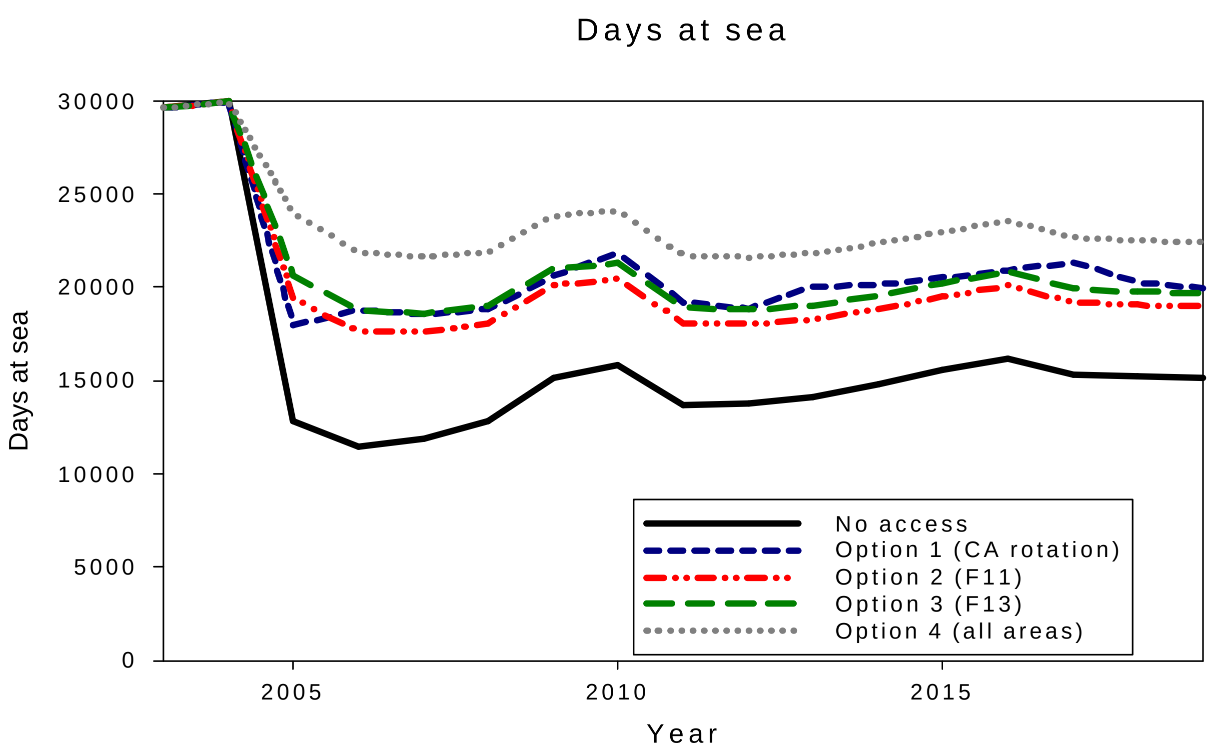

Figure 63. **Comparison of projected total day-at-sea use with area rotation and various options for accessing the Georges Bank groundfish closure areas**

8.2.2 Overfishing Definition: Status quo vs. proposed

The biomass target is the biomass expected to occur based on equilibrium yield-per-recruit calculations when the stock is fished at Fmax. The value of Bmax estimated in Amendment 7 using 1982 to 1997 data was 8.2 g/tow for scallops on Georges Bank and 4.1 g/tow for scallops on the Mid-Atlantic shelf. Amendment 10 would update these targets using 1982 – 2002 recruitment data, revising the Georges Bank target to 5.30 kg/tow and the Mid-Atlantic target to 6.26 kg/tow.

In 2002, scallop biomass was very close to the existing biomass targets for Georges Bank and for the Mid-Atlantic. Updating the biomass reference points will have little effect at this time, because current scallop biomass in both areas exceeds the existing or the proposed minimum biomass threshold.

8.2.2.1 Important differences between the status quo and proposed overfishing definitions

The existing, status quo overfishing definition and the proposed overfishing definition are the same, except in three important ways. The biomass targets for scallops on Georges Bank and the Mid-Atlantic shelf are the same for both, including the average survey biomass index derived from scallops in open and closed areas. The biomass thresholds[61] in the old and proposed overfishing definitions differ, because the proposed overfishing definition would raise the threshold from ¼ of the B_{MSY} target to ½ of that target. Under both definitions, Amendment 10 will update the recruitment data through the 2002 survey to re-estimate the value of B_{max}. Bmax is the expected stratified mean weight per tow if scallops were uniformly fished at F_{max}, the equilibrium mortality rate that would maximize yield-per-recruit.

The fishing mortality target and threshold[62] is also the same for both, derived from an equilibrium yield-per-recruit calculation (Thomson and Bell, 1934) to determine a rate of fishing that maximizes yield from a year class. This method was extended and made applicable to area rotation and sea scallop growth by Hart (in press). Due to absence of any evidence that indicated any stock-recruit relationship (except at extremely low biomass levels, obviously), the Council's Overfishing Definition Review Panel recommended using this equilibrium yield-per-recruit parameter, F_{max}, as an acceptable proxy for F_{MSY}. Details about the structure and the basis for the biomass and fishing mortality reference points for scallops are given in Applegate et al. (1998).

The Overfishing Definition Review Panel estimated the rebuilding potential for Atlantic sea scallops and based on this analysis, recommended using $\frac{1}{4}B_{MSY}$ as the minimum biomass threshold. According to the National Standard 1 guidelines, the minimum biomass threshold should be the greater of $\frac{1}{2}B_{MSY}$ or the minimum biomass that can be rebuilt in 10 years. Assuming logistic growth and $F_{max} = 0.24$, the Panel estimated that under equilibrium conditions that scallops could rebuild from $\frac{1}{4}B_{MSY}$ in 4-5 years and from $\frac{1}{2}B_{MSY}$ in 2-3 years. Due to the high fecundity and growth rate for sea scallops, the Panel

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61 The biomass threshold and targets are reference points to determine when a formal rebuilding plan is needed and when rebuilding had been achieved. Theoretically, the target is also the stock biomass needed to produce MSY when fished at a maximum sustainable level.

62 The fishing mortality threshold is the level where higher amounts would be unable to sustainably produce MSY, thereby determining levels at which overfishing occurs. The fishing mortality target, on the other hand, is established to reduce the risk of overfishing due to uncertainty in the reference point estimate and in the estimate of current fishing mortality.

originally recommended ¼B_{MSY} as the minimum biomass threshold and Amendment 7 initiated a rebuilding program. Coincidentally, sea scallop biomass in both the Mid-Atlantic and on Georges Bank reached the targets in five years. Despite this, the Scallop PDT recommended using ½B_{MSY} for the minimum biomass threshold in the proposed overfishing definition, since scallop biomass is now at the target (making further rebuilding unnecessary). Although a higher minimum biomass threshold than ¼B_{MSY} may not be biologically necessary, a higher threshold would avert negative economic consequences of low stock biomass and would also better agree with the National Standard 1 guidance on the minimum biomass threshold.

Besides the change in the biomass threshold, the two overfishing definitions differ in how the fishing mortality rate is determined and judged against the fishing mortality reference points. The proposed overfishing definition is designed to maximize the yield from scallops that are or will be available to the fishery. Although the biomass level includes scallops that occur in long-term area closures, the fishing mortality rate is calculated from the proportion of exploitable size scallops that are removed by fishing from any part of the resource that is or will be available to fishing under customary or area rotation management.

The fishing mortality target, under both definitions, is set as a percent of the maximum threshold primarily to lessen the risk of overfishing the resource due to uncertainties in the reference point and in the estimation of fishing mortality. Since in theory managers want to avoid overfishing to prevent stock collapse and permanent closed areas can act as a buffer against stock collapse, the proposed overfishing definition recognizes this intrinsic value of closed areas when determining the fishing mortality target. The conservative value of the closed areas would be recognized by allowing the fishing mortality target to increase from 80 percent of the threshold (as currently exists) to 100 percent of the target when 20 percent or more of the total scallop biomass is within long-term, indefinite closed areas.

On the other hand, the status quo overfishing definition establishes a fixed fishing mortality target and threshold, to be compared with fishing mortality rates calculated from the proportion of exploitable size scallops that are removed by fishing from any part of the resource, even if those scallops would never become available to scallop fishing via a long-term, indefinite closure. The annual fishing mortality target is fixed at 80 percent of F_{max}, to lessen the risk of overfishing due to uncertainties in the reference point or the fishing mortality rate estimates.

Amendment 10 contemplates such closures to conserve critical and sensitive essential fish habitat and for minimizing overall habitat impacts. Obviously, the calculation would include zero removals from closed areas even if they would not contribute to future yield, allowing for higher average mortality rates on exploitable scallops. The exploitable scallops would be fished at a higher average rate that exceeds F_{max}, giving a lower yield-per-recruit. Over time the higher fishing mortality rate would cause a lower scallop biomass level in open fishing areas, lower landings and revenue, and because the fishery would catch smaller scallops, lower daily catch rates.

The proposed overfishing definition would also allow more flexibility for setting annual fishing mortality targets to meet area rotation objectives. The status quo overfishing definition establishes an unvarying threshold, used to judge whether or not overfishing is occurring. There may be times, following extensive area rotation closures that the area rotation policy would dictate a higher annual fishing mortality target, but the status quo overfishing definition would not allow the Council that flexibility. Time-average mortality calculations and procedures built into the proposed overfishing definition would allow this flexibility and improve the plan's ability to maximize yield from area rotation.

8.2.2.2 Final scallop projections with and without area rotation and Georges Bank closed area access: Proposed (status quo) overfishing definition (Section 5.1.1) vs. alternative overfishing definition (Section 3.4.1)

As the Council narrowed the choices for the final alternative, some modification and refinements in the biological projections were needed to understand how the two overfishing definitions and the minimum ring size options would perform relative to pending choices in rotation management area closures and Georges Bank groundfish closure access. In the DSEIS, biological projections were run which gave a moderately high probability of a rotation management area closure in the channel (GB2) and a larger closure area in the Mid-Atlantic (MA3 and MA4, or MA4 and MA7). Additional analyses and evaluations since the DSEIS publication have modified the number and configuration of the initial rotation management area closures (see Section 8.2.5). In these scenarios, only MA4 was assumed to close under rotational management beginning in 2004.

Secondly, although the initial rotation analyses focused on scallop management in open areas, much of the rest of the document assumed that Georges Bank area access would begin on March 1, 2004 in one of four area/rotation options, or not at all (status quo). Additional projection analysis was needed to improve the comparison of the overfishing definitions without the initial Georges Bank access program and applying the selectivity and dredge efficiency assumptions for 4” rings.

And although a comparison of the performance of the status quo and proposed overfishing definitions were made in the DSEIS, it focused on a specific set of area access options to make the comparison (rather than comparing different access options and rotational closures with both overfishing definitions). The comparison of the broad range of area rotation strategies, minimum ring size alternatives, area access options, and habitat closure alternatives were done in the context of using the proposed overfishing definition that had been recommended by the PDT and favorably reviewed by the Council’s Science and Statistical Committee for use with area rotation and large, long-term closures.

In preparation for the late July Oversight Committee meetings and the August 2004 Council meeting, where the Council chose the measures for the final alternative, three pairs of biological projections were performed and reviewed by the PDT. Each pair provided a side-by-side comparison of the short and long-term performance of the status quo and proposed overfishing definitions. The status quo overfishing definition scenarios were run using an objective of achieving an annual fishing mortality rate equal to 0.2 for the total resource, irregardless of what parts were considered closed. Especially without access to the Georges Bank areas, the projections quickly failed to achieve the fishing mortality objective and after a few years an infinite amount of fishing effort could be allocated without achieving the target mortality rate because the majority of the scallop biomass would be locked up in areas with zero fishing effort and fishing mortality. Initially, an arbitrary cap of 100,000 DAS was applied to prevent the model from blowing up, which was later lowered to 38,000 DAS, equivalent to the number of DAS use associated with full-utilization of a 120 DAS allocation by the scallop fleet[63]. The fishing mortality in open fishing areas, thus increased with greater amounts of closed areas.

For the proposed overfishing definition (which the Council did not approve), the projection objective was to achieve a time-averaged fishing mortality target of 0.2 for all areas not under a long-term closure, i.e. the portions of the Georges Bank closed areas that were not open to fishing under Framework Adjustment 13, or for the baseline scenario (see below), all of the Georges Bank closed groundfish areas were excluded. Thus, the proposed overfishing definition ensures a time-averaged fishing mortality target is achieved equal to 80 percent of F_{max}.

[63] 2002 allocations of about 38,000 DAS resulted in about 31,000 DAS actually used by the fishing fleet.

The new results fall within the range of the previous projections for the preferred alternative and area access alternative 1, which were contained in the DSEIS. There was insufficient time and projection information to also merge the projection results with the habitat closure alternatives to gauge those effects too.

The tables below include the quantitative estimates of annual biomass, catch, effort, and area swept for each scenario. The tables also include a long-term mean result, which is the arithmetic mean of the last 10 years of the 30-year projection results. The annual results are themselves the arithmetic mean of 400 iterations that take into account the expected recruitment variation and its effect on rotation area management. Also included are the mean estimate for the target DAS use from all fishing areas (open and controlled access), area swept by the fleet, an equivalent full-time DAS allocation based on 2002 utilization rates and permits, average catch per DAS, as well as producer surplus and total benefits from the economic model which used the new projection data.

Three scenarios were run for each overfishing definition:

No access and no rotation closures. This scenario included controlled access management for the Hudson Canyon Area. The VA/NC Area was assumed to be open to fishing. This projection is essentially a baseline to compare with other policy choices.

Controlled access to the Georges Bank groundfish closed areas, but no rotation closures. The preferred alternative for controlled access was assumed, which would allow mechanical rotation of the three access areas. Parts of Closed Area I and the Nantucket Lightship Area would be open with a 0.4 fishing mortality target in 2004. The southern part of Closed Area II would be open with a 0.2 fishing mortality target in 2005 – 2007. The cycle was assumed to repeat in four-year blocks of time beginning in 2008.

Controlled access to the Georges Bank groundfish closed areas, and rotation closures. The preferred alternative for controlled access was assumed, which would allow mechanical rotation of the three access areas, as above.

The following rotation area management policy was also assumed:

Dredges use 3 ½ " rings in all areas
Areas close when the annual growth in biomass exceeds 25%, if the area were closed to scallop fishing.
No more than 25% of the scallop biomass would be in rotation area management closures, otherwise the areas with the highest growth rates were treated as closed.
Rotation area management closures have a fixed duration of three years.
Rotation area management boundaries were fixed and were the same as those used in the DSEIS.
No more than 38,000 days would be allocated. Some scenarios could not achieve the 0.2 fishing mortality target resource wide, even with 38,000 days-at-sea.

In addition, the following improvements were added to the DSEIS projections:

Non-random stations were added to the 2002 abundance index. These occur mainly in the closed areas and mainly affected the Nantucket Lightship Area biomass estimate, which nearly doubled, as a result.

- More consistent with the Amendment 10 optimum yield discussion for the preferred alternative, the proposed overfishing definition was run with an open area target of 0.22, instead of 0.20, which incorporated the optimum yield strategy of increasing fishing mortality up to the threshold as more of the scallop resource would be enclosed in long-term closed areas.
- Although the recruitment was assumed to return to average conditions for the projection time series, the projections were run over a wide range of recruitment ranges that were represented by the historic distribution of annual recruitment levels. The projection results are presented as the average of these stochastic simulations, similar to the analyses presented in the DSEIS.

Following the August 2004 Council meeting, two additional projections were run using only the status quo overfishing definition. At the August meeting, the Council approved continuing the use of the status quo overfishing definition to guide future management policy and require reductions in fishing mortality or rebuilding stock biomass when needed. The Council also approved a requirement for a minimum 4-inch ring beginning on Sept. 1, 2004 for the entire resource[64]. Previous analyses and DAS estimates also assumed a 9-day, 21,000 lb. controlled access tradeoff, and the Council approved a 12-day, 18,000 lb. tradeoff in September, following receipt of supplementary PDT analysis of various tradeoffs at a 1,500 lb./ DAS equivalent.

These two supplementary analyses modifications of projections 2 and 3 in the ones prepared for the August Council meeting above, but were modified to reflect the approved final alternative above, one with access to the Framework 13 areas and one without access throughout the projection duration. Although Framework Adjustment 16/39 might not allow approval and implementation of Georges Bank area access until August 2004, the projections are calculated on a survey year basis (August – July) and assumes the controlled access TACs will be taken during the survey year. No further adjustment is therefore needed to accommodate the delay in Georges Bank area access. The final projection analyses included the following two scenarios, to compared with the three pairs of projections that apply 3 ½ inch ring assumptions (see Table 161):

- No controlled access to the Georges Bank closed areas, but with adaptive area rotation to achieve a resource-wide fishing mortality target equal to 0.2, with 4-inch ring assumptions.
- Controlled access to the Framework 13 portions of the Georges Bank groundfish closed areas and adaptive area rotation to achieve a resource-wide fishing mortality target equal to 0.2, with 4-inch ring assumptions

Table 161. Summary of final projection scenarios and overfishing definitions used to evaluate final alternative options and future events. The "proposed" overfishing definition in the DSEIS was disapproved in favor of continuing the use of the status quo overfishing definition.

Management scenario	**No area rotation**		**Adaptive area rotation**	
	3½-inch rings	**4-inch rings**	**3½-inch rings**	**4-inch rings**
No area access	Status quo & proposed	None performed	None performed	Status quo
Controlled access to Georges Bank closed areas	Status quo & proposed	None performed	Status quo & proposed	Status quo

[64] This alternative was in the DSEIS, but most of the prior analyses with 4-inch rings assumed that they would be used in controlled access areas where scallops will be largest.

8.2.2.3 Comparative projections

Over the near term, the status quo overfishing definition would produce higher landings and day-at-sea allocations. Assuming access to considerable portions of the Georges Bank groundfish closed areas and no habitat closures, the status quo overfishing definition would produce greater benefits and would not jeopardize the productivity of sea scallops. Biomass, day-at-sea allocations, and daily catches would remain within acceptable ranges, but total area swept would increase. With no access or extensive habitat closures, the effects from using the status quo overfishing definition would be considerably more dramatic, as explained in the next section.

With a limited amount of closures and access to considerable parts (e.g. the areas open to fishing in Framework Adjustment 13, or equivalent) of the Georges Bank groundfish closed areas, the status quo overfishing definition would perform adequately with area rotation. Extreme recruitment variations and/or extensive closures could however produce undesirable results.

In general, the alternative proposed overfishing definition produces higher stock biomass and landings but would allow for fewer DAS allocations. Requiring 4-inch rings and applying a higher DAS tradeoff for controlled access, coupled with area-specific DAS allocations improves the performance of the approved status quo overfishing definition relative to the alternative overfishing definition.

Comparisons of all projection results for three short-term periods (2004, 2005-2007, and 2008) and for the long-term are given in Table 162 and Table 163, followed by a discussion with annual trend charts for the estimates of individual variables.

Although area swept projections for the alternative proposed overfishing definition show favorable characteristics in terms of their potential impacts on bycatch and habitat, the reduction in DAS carry a significant cost related to disruption in the fishery, inefficient use of capital, and community impacts. LPUE is also considerably lower for the status quo overfishing definition when 4" rings are required than for the proposed overfishing definition with 3½" rings. Initially, the LPUE differences are minor (2,328 vs. 2,157 lbs./day in 2004; Table 162 and Table 163), but become greater with time (2,387 vs. 1,260 in 2008).

Generally, there are important differences in the projections, depending on which overfishing definition is applies and whether or not there is access to the Georges Bank closed areas. Projected catches are affected by whether or not access occurs, but not significantly by the application of the overfishing definition. Catches for the status quo overfishing definition are 85-95 percent of those for the alternative proposed overfishing definition, but there are differences in size composition. Since scallops of different sizes or 'counts' are priced differently, this effects fleets revenue. At the same time, the biomass of scallops in open fishing areas is much lower for the status quo overfishing definition than for the alternative proposed overfishing definition. This reduces daily catch rates by as much as 50 percent and increases fishing costs. It also increases bottom contact time and area swept, because more of a DAS is used for fishing rather than by shucking[65].

[65] A scallop fishing vessels becomes shucking limited as exploitable scallop biomass increases, due to a seven man crew limit.

Because of the non-biological concerns, the Council preferred to use the status quo overfishing definition and tried to achieve some of the favorable effects of the alternative proposed overfishing definition by requiring the use of a 4” minimum ring size, by increasing the DAS tradeoff for controlled access, and making area-specific DAS allocations so that DAS could be applied in a way to increase yield-per-recruit.

Although by most measures, the alternative proposed overfishing definition has better biological characteristics (producing 10% greater catches with larger average scallop size in fewer DAS with much less area swept), the Council may choose lower annual fishing mortality targets for the resource or apply the fishing mortality targets to only open fishing areas in future actions. Under the revised framework adjustment mechanism and monitoring, the Council will need to consider the effect of the annual mortality targets on producing optimum yield.

Table 162. Comparison of overfishing definition performance with and without area rotation and Georges Bank area access, using 3½-inch ring assumptions and a 9-day, 21,000 lb. tradeoff.

		No Area Rotation No Access to Closed Areas					No Area Rotation Access to Closed Areas				Area Rotation Access to Closed Areas			
Hudson Canyon Area fishing mortality target		0.32	0.40	0.48 (2005)	Open	Open	0.40	0.48 (2005)	Open	Open	0.40	0.48 (2005)	Open	Open
Closed Area I & NLSA fishing mortality target		Closed	Closed	Closed	Closed	Closed	0.40	Closed	0.40	0.40	0.40	Closed	0.40	0.40
Closed Area II target fishing mortality		Closed	Closed	Closed	Closed	Closed	Closed	0.20	Closed	0.20	Closed	0.20	Closed	0.20
Controlled access scallop possession limit		21,000	21,000	21,000	#N/A	#N/A	21,000	21,000	21,000	21,000	21,000	21,000	21,000	21,000
DAS tradeoff		9	9	9	#N/A	#N/A	9	9	9	9	9	9	9	9
Overfishing definition	Data	2003	2004	2005-2007	2008	Long-term average	2004	2005-2007	2008	Long-term average	2004	2005-2007	2008	Long-term average
Proposed	Landings (million lbs.).	52.6	29.1	27.1	32.9	36.3	40.1	47.5	37.4	47.3	37.9	45.9	40.4	48.8
	Revenue (million 1996)	$168.4	$132.0	$125.6	$141.2	$ 148.1	$155.0	$164.1	$150.4	$ 164.4	$151.4	$162.4	$155.5	$ 166.0
	Average fishing mortality	0.27	0.13	0.10	0.10	0.09	0.16	0.16	0.13	0.14	0.14	0.15	0.13	0.13
	Target day-at-sea use	30,483	13,482	12,360	14,559	15,901	16,931	19,146	15,700	19,304	16,184	18,531	16,849	19,980
	Estimated full-time DAS allocation	120	**56**	**54**	**60**	**65**	75	82	67	79	71	79	72	82
	Landings per day-at-sea used (lb.)	1,721	**2,145**	**2,184**	**2,245**	**2,260**	**2,355**	**2,473**	**2,372**	**2,428**	**2,328**	**2,473**	**2,387**	**2,416**
	Producer surplus (million)	$134.4	$118.3	$113.1	$126.3	$ 131.7	$137.3	$143.8	$134.1	$ 143.8	$134.6	$142.8	$138.0	$ 144.7
	Total benefits (million)	$237.4	$155.7	$146.7	$172.6	$ 186.2	$202.3	$230.7	$191.9	$ 230.6	$193.6	$225.0	$203.9	$ 235.7
	Georges Bank biomass (kg/tow).	9.9	11.5	13.1	14.6	15.7	11.0	11.3	11.6	11.9	11.1	11.6	12.2	12.4
	Mid-Atlantic biomass (kg/tow)	4.8	4.6	4.3	4.5	4.6	4.6	4.3	4.5	4.6	4.6	4.4	4.6	4.7
	Combined biomass (kg/tow)	7.2	7.8	8.4	9.2	9.7	7.5	7.5	7.8	8.0	7.6	7.7	8.1	8.3
	Total area swept (nm^2).	7,493	**2,687**	**2,472**	**2,630**	**3,098**	**2,730**	**2,516**	**2,589**	**2,912**	**2,812**	**2,562**	**2,740**	**3,189**
Status quo	Landings (million lbs.).	52.6	42.4	41.4	37.1	19.3	47.7	51.6	46.5	43.3	49.8	55.7	46.3	45.9
	Revenue (million 1996)	$168.4	$157.9	$155.9	$148.4	$ 98.9	$164.7	$168.3	$163.1	$ 159.0	$166.6	$171.0	$162.4	$ 162.1
	Average fishing mortality	0.27	0.20	0.20	0.20	0.14	0.20	0.20	0.20	0.20	0.21	0.22	0.21	0.17
	Target day-at-sea use	30,483	22,481	26,086	30,288	38,009	22,229	22,654	23,219	24,913	28,203	30,367	52,276	30,985
	Estimated full-time DAS allocation	120	93	107	125	**> 150**	96	96	99	103	**121**	128	**> 150**	128
	Landings per day-at-sea used (lb.)	1,721	1,892	1,610	1,236	**510**	2,150	2,283	2,004	1,740	1,759	1,850	**891**	1,504
	Producer surplus (million)	$134.4	$133.7	$127.3	$114.7	$ 55.5	$140.8	$143.9	$138.0	$ 132.0	$135.5	$137.1	$100.5	$ 127.1
	Total benefits (million)	$237.4	$205.6	$196.5	$172.4	$ 74.6	$228.3	$243.2	$221.7	$ 206.9	$229.1	$249.7	$183.8	$ 210.1
	Georges Bank biomass (kg/tow).	9.9	11.2	12.3	13.3	14.0	10.8	11.1	11.4	11.5	10.9	11.3	11.8	11.7
	Mid-Atlantic biomass (kg/tow)	4.8	4.1	3.4	2.6	2.2	4.3	4.0	3.8	3.7	4.1	3.5	2.9	2.7
	Combined biomass (kg/tow)	7.2	7.4	7.5	7.6	7.7	7.3	7.3	7.3	7.3	7.2	7.1	7.0	6.9
	Total area swept (nm^2).	7,493	5,256	7,496	10,089	15,291	4,358	3,838	5,296	6,332	7,460	7,440	18,759	8,870

Maximum fishing mortality threshold (MSY)	**0.24**
Target fishing mortality (OY)	**0.20**
Target biomass (kg/tow) - Georges Bank	**5.30**
Target biomass (kg/tow) - Mid-Atlantic	**6.26**

Table 163. Comparison of overfishing definition performance with and without area rotation and Georges Bank area access, using 4-inch ring assumptions and a 12-day/ 18,000 lb. tradeoff, compared to baseline conditions without area rotation or access using 3½-inch rings.

		No Area Rotation No Access to Closed Areas					4" rings Area Rotation No Access to Closed Areas				4" rings Area Rotation Access to Closed Areas			
Hudson Canyon Area fishing mortality target		0.32	0.40	0.48 (2005)	Open	Open	0.40	0.48 (2005)	Open	Open	0.40	0.48 (2005)	Open	Open
Closed Area I & NLSA fishing mortality target		Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	0.40	Closed	0.40	0.40
Closed Area II target fishing mortality		Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	0.20	Closed	0.20
Controlled access scallop possession limit		21,000	21,000	21,000	#N/A	#N/A	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000
DAS tradeoff		9	9	9	#N/A	#N/A	12	12	12	12	12	12	12	12
Overfishing definition	**Data**	**2003**	**2004**	**2005-2007**	**2008**	**Long-term average**	**2004**	**2005-2007**	**2008**	**Long-term average**	**2004**	**2005-2007**	**2008**	**Long-term average**
Proposed	Landings (million lbs.).	52.6	29.1	27.1	32.9	36.3								
	Revenue (million 1996)	$168.4	$132.0	$125.6	$141.2	$ 148.1								
	Average fishing mortality	0.27	0.13	0.10	0.10	0.09								
	Target day-at-sea use	30,483	13,482	12,360	14,559	15,901								
	Estimated full-time DAS allocation	120	**56**	**54**	**60**	**65**								
	Landings per day-at-sea used (lb.)	1,721	**2,145**	**2,184**	**2,245**	**2,260**								
	Producer surplus (million)	$134.4	$118.3	$113.1	$126.3	$ 131.7								
	Total benefits (million)	$237.4	$155.7	$146.7	$172.6	$ 186.2								
	Georges Bank biomass (kg/tow).	9.9	11.5	13.1	14.6	15.7								
	Mid-Atlantic biomass (kg/tow)	4.8	4.6	4.3	4.5	4.6								
	Combined biomass (kg/tow)	7.2	7.8	8.4	9.2	9.7								
	Total area swept (nm^2).	7,493	**2,687**	**2,472**	**2,630**	**3,098**								
Status quo	Landings (million lbs.).	52.6	42.4	41.4	37.1	19.3	42.6	35.0	24.6	33.3	50.0	52.5	47.4	46.8
	Revenue (million 1996)	$168.4	$157.9	$155.9	$148.4	$ 98.9	$158.1	$143.2	$119.2	$ 141.0	$167.1	$168.8	$164.4	$ 162.5
	Average fishing mortality	0.27	0.20	0.20	0.20	0.14	0.20	0.16	0.09	0.11	0.20	0.20	0.19	0.18
	Target day-at-sea use	30,483	22,481	26,086	30,288	38,009	24,315	37,428	37,610	37,536	23,108	26,286	38,126	37,299
	Estimated full-time DAS allocation	120	93	107	125	**> 150**	110	150	152	152	126	119	183	180
	Landings per day-at-sea used (lb.)	1,721	1,892	1,610	1,236	**510**	1,747	957	794	1,012	2,157	1,999	1,260	1,338
	Producer surplus (million)	$134.4	$133.7	$127.3	$114.7	$ 55.5	$131.7	$100.5	$ 76.2	$ 98.0	$142.1	$140.0	$120.7	$ 119.9
	Total benefits (million)	$237.4	$205.6	$196.5	$172.4	$ 74.6	$204.2	$153.5	$104.3	$ 145.5	$236.5	$242.3	$207.2	$ 204.4
	Georges Bank biomass (kg/tow).	9.9	11.2	12.3	13.3	14.0	11.2	12.2	13.6	14.6	10.6	10.8	11.2	11.4
	Mid-Atlantic biomass (kg/tow)	4.8	4.1	3.4	2.6	2.2	4.2	3.8	3.0	3.0	4.4	4.2	3.8	3.6
	Combined biomass (kg/tow)	7.2	7.4	7.5	7.6	7.7	7.2	7.4	7.7	8.1	7.1	7.1	7.0	7.1
	Total area swept (nm^2).	7,493	5,256	7,496	10,089	15,291	5,402	12,041	12,068	11,817	3,901	5,076	10,849	10,137

Maximum fishing mortality threshold (MSY)	**0.24**
Target fishing mortality (OY)	**0.20**
Target biomass (kg/tow) - Georges Bank	**5.30**
Target biomass (kg/tow) - Mid-Atlantic	**6.26**

8.2.2.3.1 Trends in Target DAS Use

The DAS use targets are calculated before applying controlled access DAS tradeoffs or making allowances for DAS utilization by the fleet. These estimates are estimated to achieve the fishing mortality target appropriate to the overfishing definition

As would be expected, the target day-at-sea use is higher for the status quo overfishing definition. With area access but not rotation area management, the annual day-at-sea target averaged 19,398 vs. 24,874 days for the status quo overfishing definition (Figure 64). Area rotation increases the target day-at-sea estimates, but introduces variability, which is much greater for the status quo overfishing definition than for the proposed overfishing definition. Using the status quo overfishing definition with 4" rings reduces the DAS targets initially to 23,108 DAS in 2004, which gradually rises and hits the 38,000 DAS projection limit by 2008.

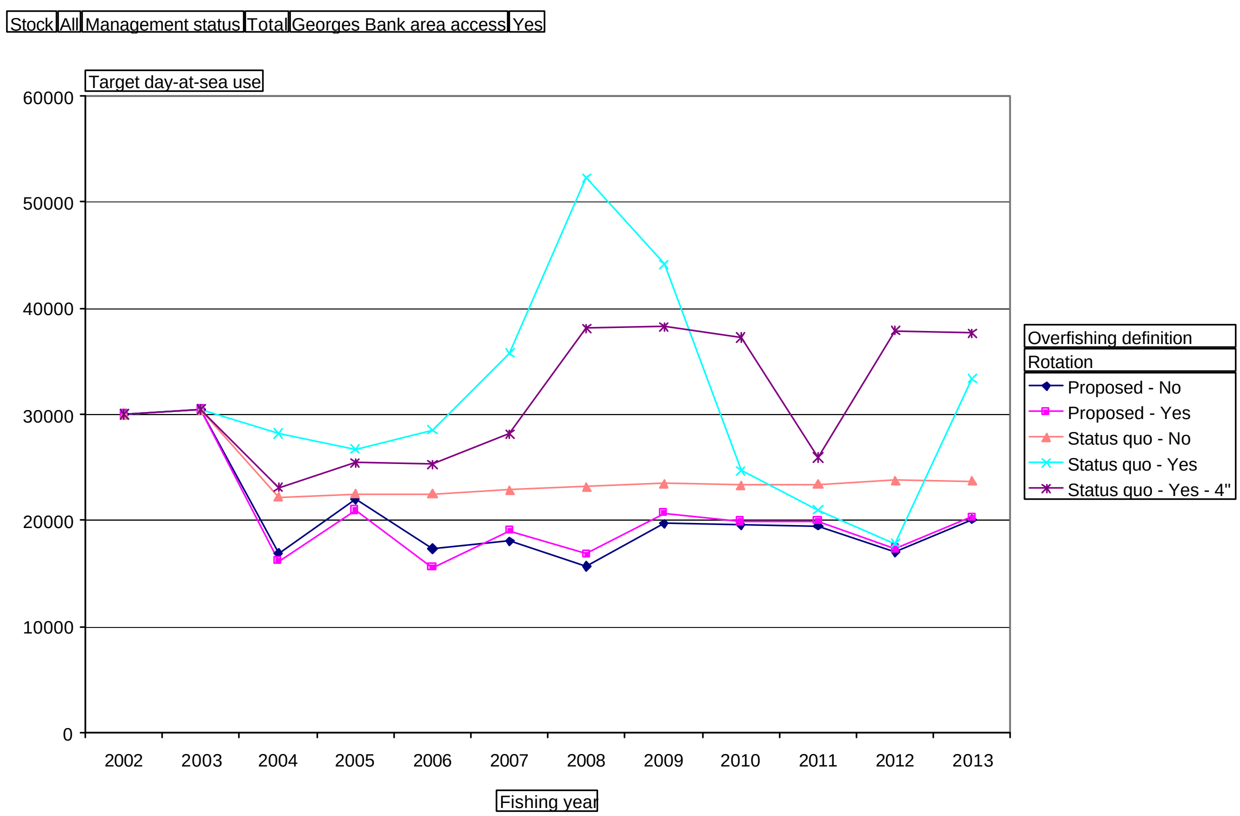


Figure 64. Comparison of overfishing definitions: Target DAS use by year with access to the Georges Bank closed areas

While the day-at-sea targets are stable for the proposed overfishing definition without access or rotation (although lower, reflecting the reduction in productivity without access), the projection for the status quo overfishing definition reaches the limit placed on the model by 2009[66] (Figure 65). Essentially

[66] Some iterations reach the limit earlier, due to variations in the projected biomass in closed areas vs. open areas.

without access, the status quo overfishing definition could allow an unlimited amount of days-at-sea without achieving the resource-wide 0.2 fishing mortality target. Using the status quo overfishing definition, other factors that define optimum yield would have to come into play to control mortality on scallops that are available to the fleet. Using 4” ring assumptions, the target DAS use would rise slightly to 24,315 DAS in 2004 and then reach the DAS limit by 2005 because of the high proportion of biomass in closed areas.

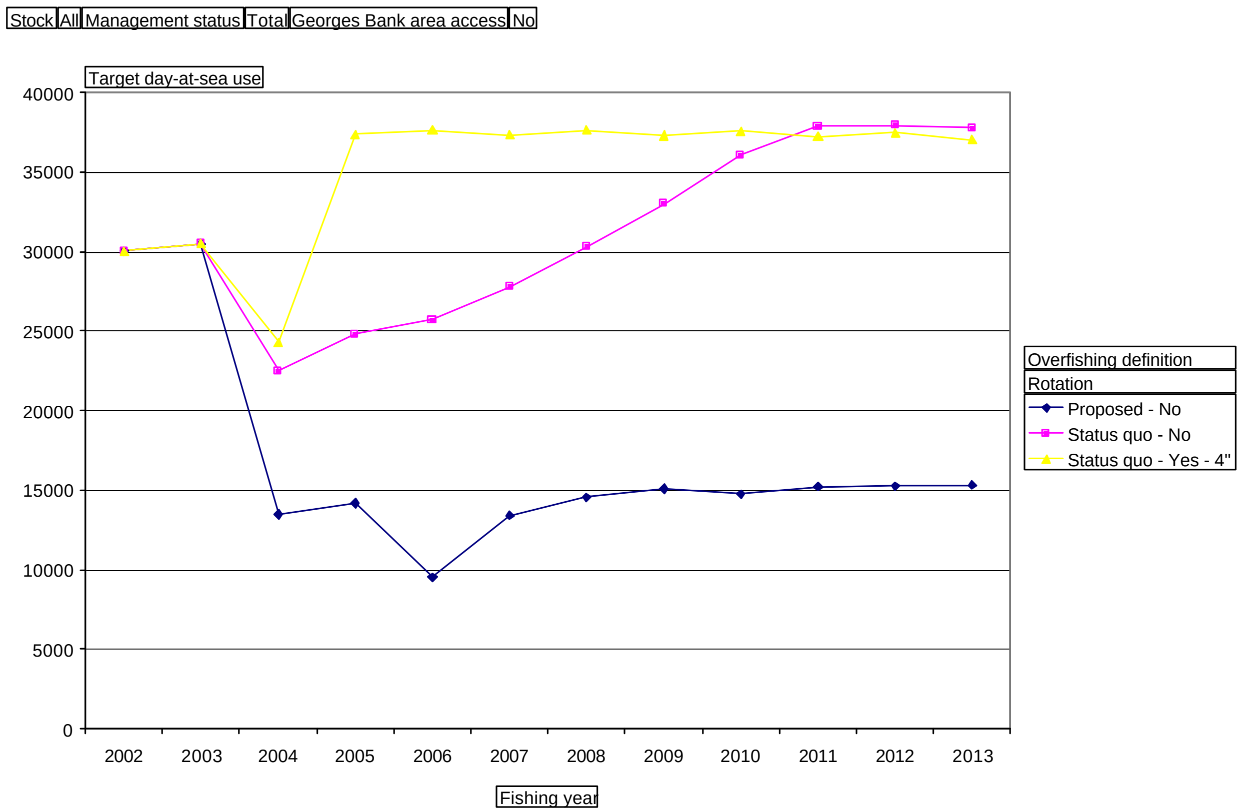


Figure 65. Comparison of overfishing definitions: Target DAS use by year with no access to the Georges Bank closed areas

8.2.2.3.2 DAS allocations

With access to the Georges Bank closed areas, the DAS allocations follow similar trends to the DAS use above. The DAS allocations with the status quo overfishing definition are higher than with the alternative proposed overfishing definition (Figure 66), the latter averaging about 70 to 80 DAS in the short- and long-term. The status quo overfishing definition with the lower DAS tradeoff and 3½ inch rings would allow a 121 DAS allocation in 2004, rising to at least 150 DAS in 2008, with a long term average of 128 DAS. Application of 4-inch rings and the higher controlled access DAS tradeoff (final alternative) allows higher DAS allocations in 2004 (126 DAS), 2008 (183), and in the long-term (180), but has a slightly lower average for 2005-2007 (119 DAS).

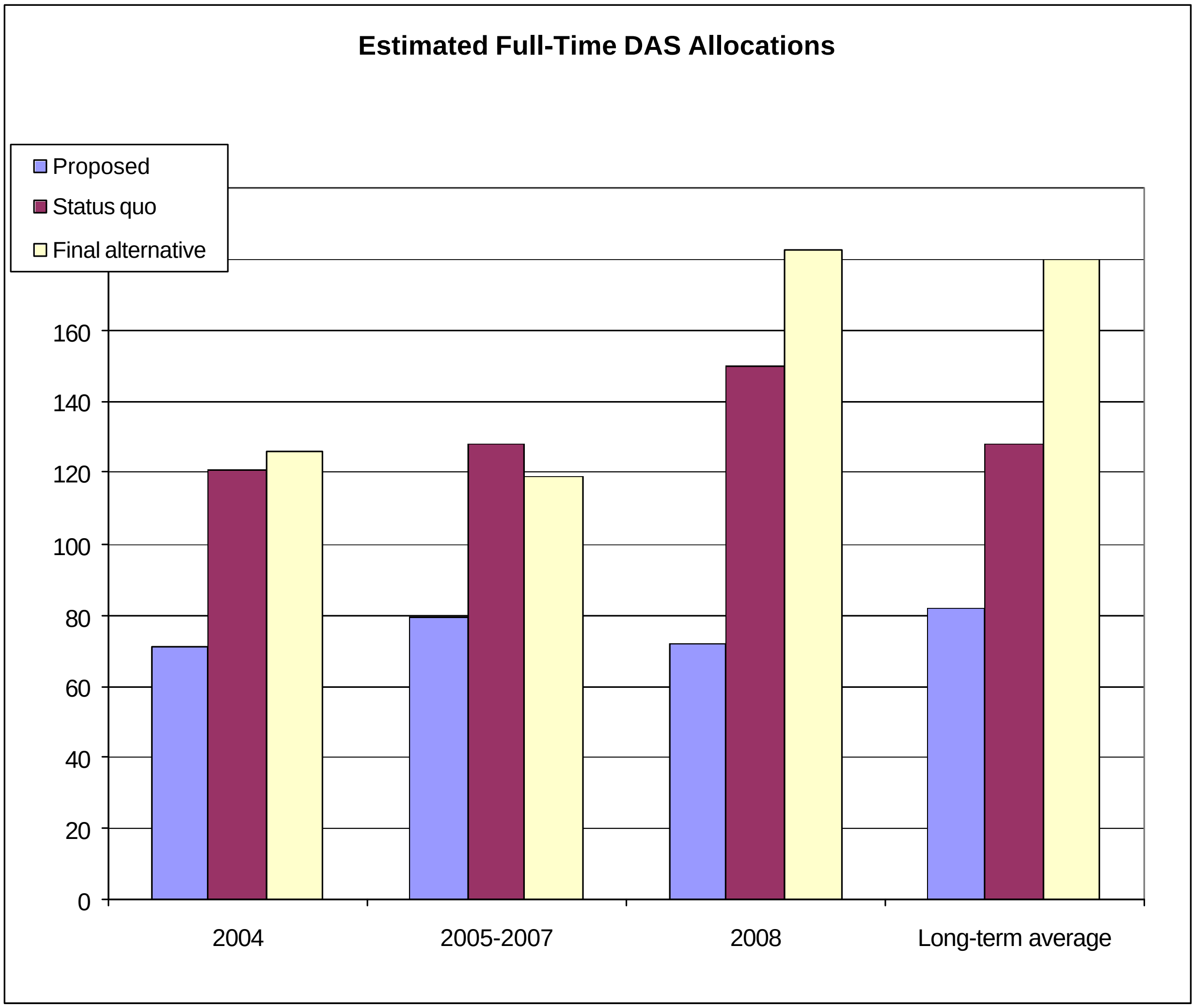


Figure 66. With Georges Bank access: Estimated full-time DAS allocations after accounting for DAS utilization in 2002 and DAS tradeoffs. The DAS tradeoffs are 9 days/21,000 lbs. for the "Proposed" and "Status quo" scenarios, and 12 days/18,000 lbs. for the "Final alternative" scenario.

Without access to the Georges Bank closed areas, the DAS allocations follow similar trends to the DAS use above. The DAS allocations with the status quo overfishing definition are higher than with the alternative proposed overfishing definition (Figure 67), the latter averaging ranging between 54 and 65 DAS in the short- and long-term. The status quo overfishing definition with the lower DAS tradeoff and 3½ inch rings would allow a 93 DAS allocation in 2004, rising to 125 DAS in 2008, with a long term average of at least 150 DAS. Application of 4-inch rings and the higher controlled access DAS tradeoff (final alternative) allows higher DAS allocations in all cases: 2004 (110 DAS), 2005-2007 (150), 2008 (152), and in the long-term (152).

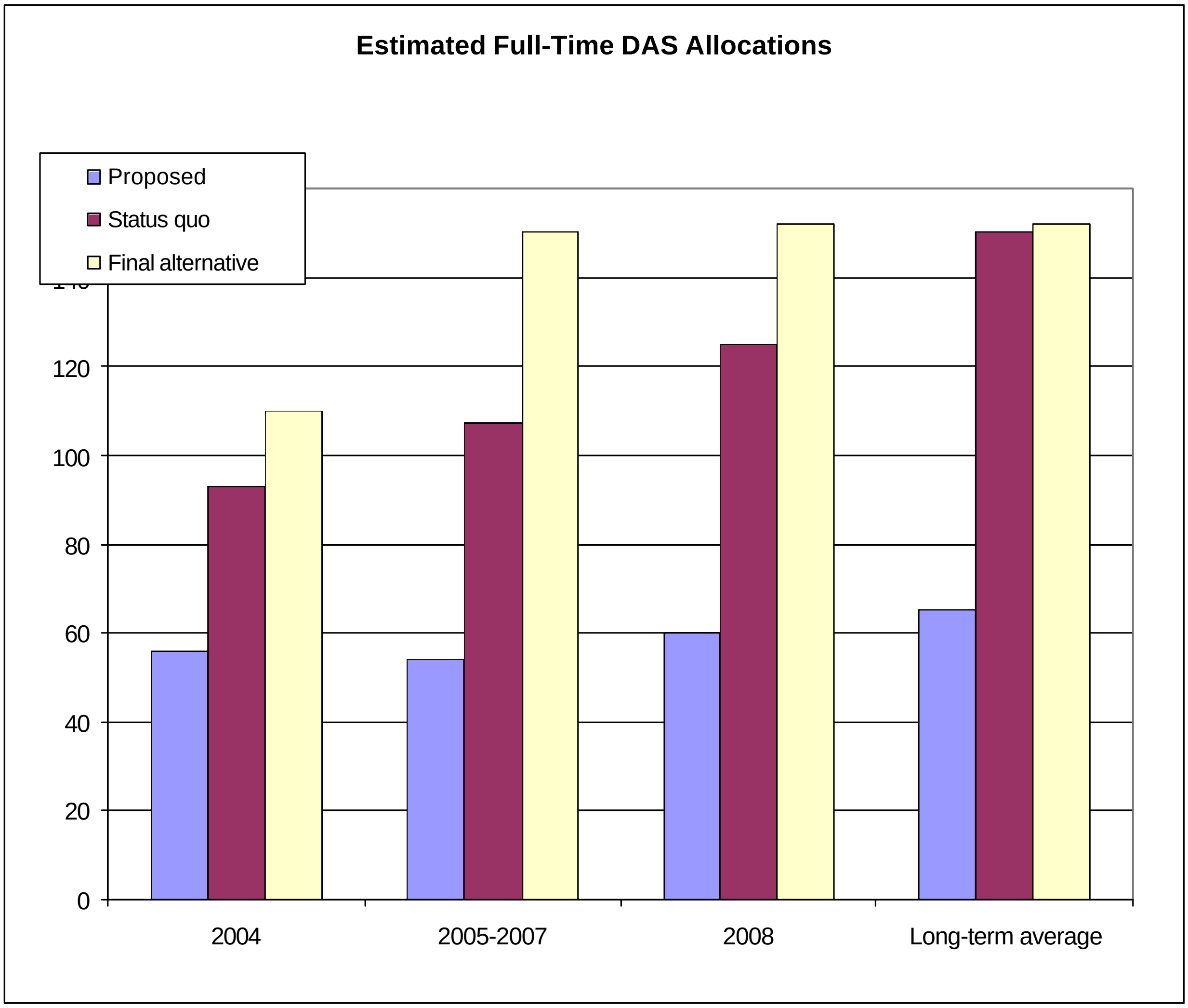


Figure 67. With no Georges Bank access: Estimated full-time DAS allocations after accounting for DAS utilization in 2002 and DAS tradeoffs. The DAS tradeoffs are 9 days/21,000 lbs. for the "Proposed" and "Status quo" scenarios, and 12 days/18,000 lbs. for the "Final alternative" scenario.

8.2.2.3.3 Trends in Fishing Mortality

The projected annual fishing mortality rates are a result of applying the overfishing definition target, combined with area rotation policy having areas open to fishing with elevated local fishing mortality targets. For re-opened areas, the fishing mortality rate is locally higher than the target – which in the short-term applies to the controlled access programs for the Hudson Canyon Area, the Nantucket Lightship Area, Closed Area I and Closed Area II. When the proposed "Elephant Trunk" area re-opens to scallop fishing (2007 assumed), the fishing mortality rate there was modeled on the basis of time-averaged, ramped mortality where the six year average from 2004 – 2010 is equal to 0.20.

The status quo and the alternative proposed overfishing definition apply the targets in different ways, however. For the status quo overfishing definition, the projections model the fishing mortality rate in the open areas so that the resource wide average is 0.20 if it can be produced with less than 38,000 days-at-sea. The peculiar aspect of this is that as more areas close to scallop fishing, the target allows higher and higher fishing mortality to be applied in the open fishing areas. This is why the PDT advice is that the status quo overfishing definition does not by itself work well with rotation area management. As more areas close, it requires more effort in the remaining open areas, potentially reducing yield-per-recruit and catch per DAS.

According to the status quo overfishing definition, the annual fishing mortality target is F = 0.2, applied to all resource areas regardless of their availability to the commercial fishery. Thus, without rotation the status quo overfishing definition projects fishing mortality declining from 0.27 in 2003 to 0.20 in 2004 and then remaining flat (Figure 68). In this case, the projections were run without constraining the DAS allocations. Other projections using the status quo overfishing definition with area rotation and access to Georges Bank areas indicate that fishing mortality for the resource would decline and then vary between 0.15 and 0.23. The use of 4" rings ("Status quo – Yes – 4"), which is the most relevant to the final alternative, reduces fishing mortality on the resource relative to 3 ½ rings where the status quo overfishing definition is applied.

In contrast, the alternative proposed overfishing definition applies a fishing mortality target to areas open to fishing to achieve maximum yield-per-recruit from the scallops that occur there. Thus, the fishing mortality rate in open fishing areas remains at 0.20, regardless of what other areas are close or are under controlled access. Time-averaged mortality rules apply to areas that re-open to fishing and the fishing mortality can vary because of that management strategy. On the other hand, the closed areas (both long and short-term) bring the overall resource fishing mortality rate down below 0.20.

For the proposed overfishing definition with access to Georges Bank areas, fishing mortality is projected to decline from 0.27 in 2003 to 0.15 in 2004, and then vary between 0.13 to 0.19 (Figure 68). It is less than 0.20 because of the zero fishing mortality in areas that never open to fishing (in this case parts of the Georges Bank groundfish closed areas). Area rotation ("Proposed – Yes") is projected to reduce overall fishing mortality slightly.

The overall fishing mortality is not that meaningful, however, to yield and the economy because it averages in zero fishing mortality in closed areas which do not contribute to landings. Fishing mortality in open areas is expected to be higher than the 0.20 MSY target, potentially reducing yield-per-recruit and catch per DAS. Obviously other management objectives will need to come into play in future framework adjustments to set annual mortality targets and produce optimum yield in the long-term.

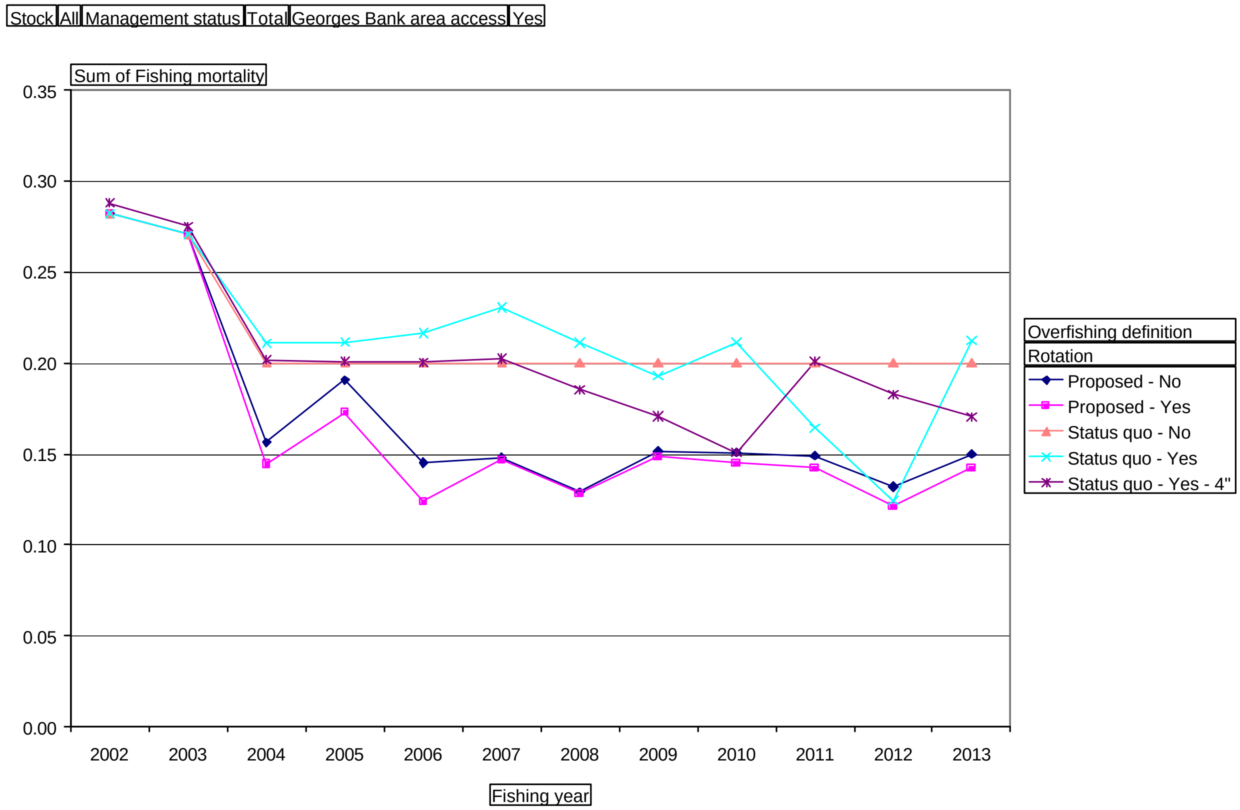


Figure 68. With Georges Bank access: Projected annual fishing mortality rates for the total resource area.

Without access to the Georges Bank closed areas, the status quo overfishing definition will allow higher fishing mortality rates than the proposed overfishing definition, even with 4" rings ("Status quo – Yes – 4"; Figure 69). Fishing mortality is projected to decline from 0.27 in 2003 to 0.20 in 2004, and then decline through 2009. For the proposed overfishing definition, fishing mortality is projected to decline to 0.13 in 2004, and then vary around 0.10 overall, reflecting the averaging of zero fishing mortality in closed areas.

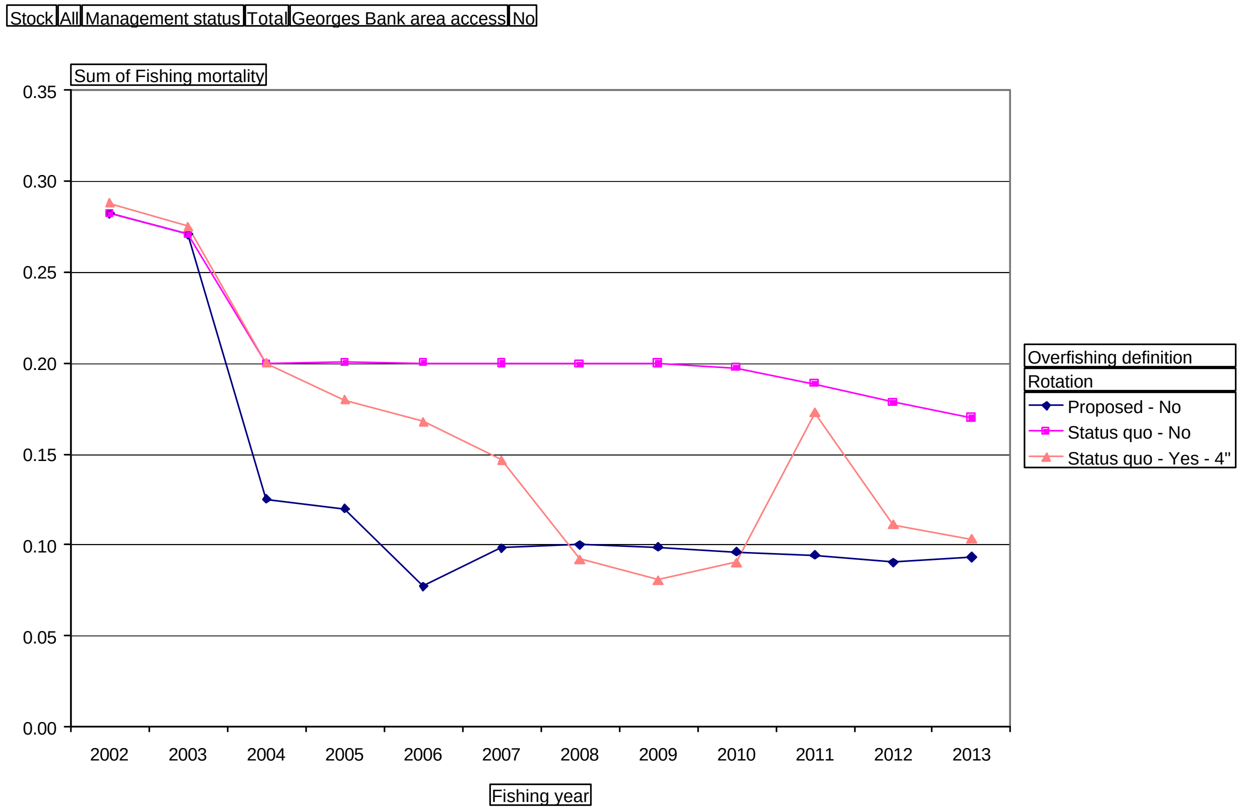


Figure 69. With no Georges Bank access: Projected annual fishing mortality rates for the total resource area.

Fishing mortality in the open fishing areas where scallops contribute to yield is much higher, however. In the open areas of Georges Bank (this excludes the controlled access areas), the status quo overfishing definition without rotation ("Status quo – No"), fishing mortality is projected to decline from 0.57 in 2003 to 0.21 in 2004, then begin climbing in 2006, reaching more than 0.30 in 2012 (Figure 70).

With rotation, the fishing mortality rate in the open areas of Georges Bank becomes more variable. In the short term, fishing mortality in the open areas of Georges Bank is expected to decline to 0.27 in 2004 and 2005, then bounce around between 0.13 and 0.40, depending on the year and rotation areas in place at the time.

Fishing mortality using the proposed overfishing definition is projected to decline more steeply to 0.07 with rotation in 2004, then stabilize around 0.18 beginning in 2007.

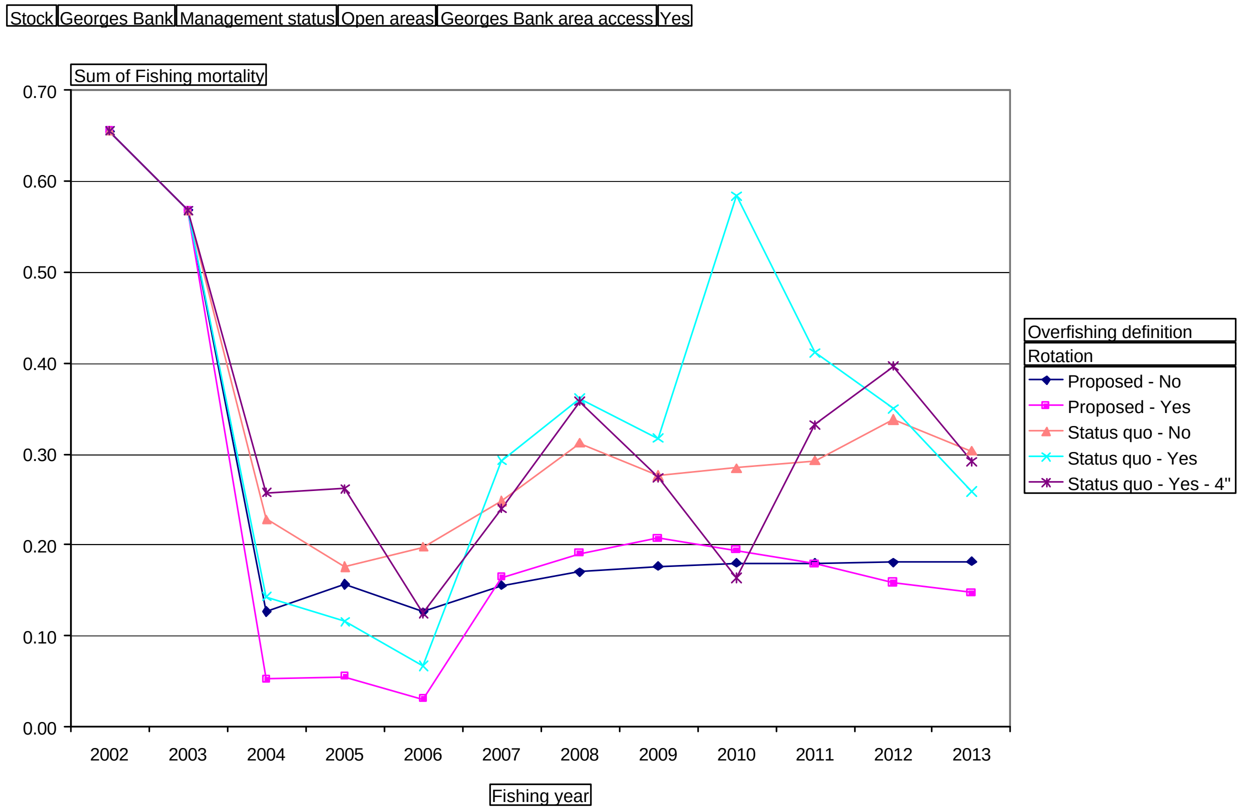


Figure 70. With Georges Bank access: Projected annual fishing mortality rates for open fishing areas for the Georges Bank scallop resource (excludes controlled access fishing in the Georges Bank groundfish closed areas).

For scallops in the Georges Bank area access mechanical rotation program, fishing mortality (the target is established independently of the overfishing definition) is expected to increase to 0.06 in 2004, 0.10 in 2005, then gradually decline through 2013 (Figure 71). Slight increases in fishing mortality are expected with 4" rings ("Status quo – Yes – 4"), but this will be offset by better size selection and increased dredge efficiency.

Although the fishing mortality targets for the individual areas are higher, all three Georges Bank areas are not open in the same year. These projections also are estimating the average fishing mortality rate for scallops in all of the Georges Bank closed areas, and large portions are classified as a habitat closure area. Thus, the overall average for the Georges Bank groundfish areas is considerably less than 0.20.

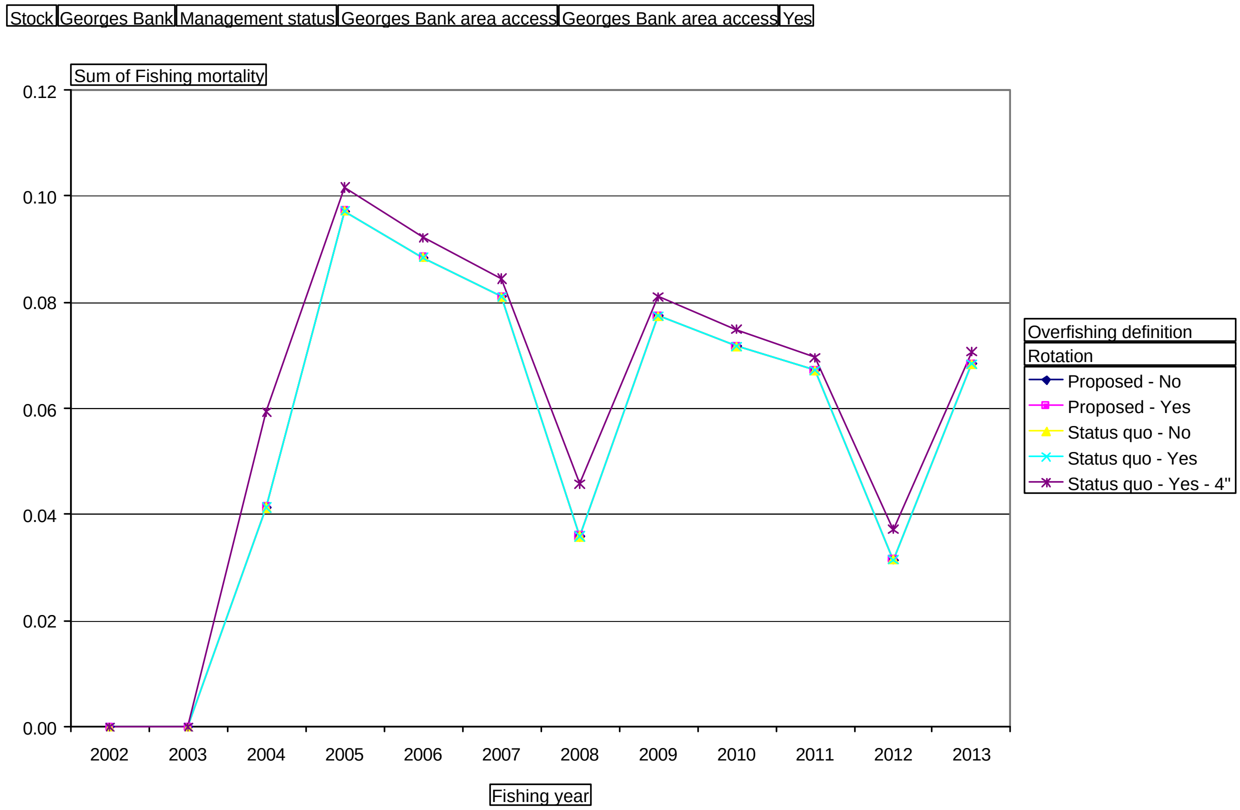


Figure 71. With Georges Bank access: Projected annual average fishing mortality rates for the Georges Bank controlled access areas (Framework 13 portions of the Nantucket Lightship Area, Closed Area I, and Closed Area II).

The projected fishing mortality rate in the Mid-Atlantic is expected to be higher than 0.20, partly due to the effects of the status quo overfishing definition on local mortality rates and partly due to the lower fishing costs associated with fishing in the Mid-Atlantic compared to Georges Bank.

For the status quo overfishing definition with rotation and 4” rings (“Status quo – Yes – 4”; Figure 72), fishing mortality is projected to decline from 0.55 in 2003 to 0.45 in 2004, 0.41 in 2005, increase to 0.58 in 2006, then vary between 0.20 and 0.41. All are well above F_{max} (F= 0.24). Without area rotation, fishing mortality is projected to climb will above 1.0.

Applying the alternative proposed overfishing definition, the Mid-Atlantic fishing mortality rate is projected to decline to 0.32-0.33 in 2004 and 2005, then decline and remain constant around 0.22 (by definition). Area rotation is projected to cause slight decreases in Mid-Atlantic fishing mortality.

Figure 72. With Georges Bank access: Projected annual fishing mortality rates for the Mid-Atlantic scallop resource.

8.2.2.3.4 Trends and Distribution of Total Area Swept

Area swept is an important element to understanding ancillary impacts, especially those on finfish bycatch and on habitat. The amount of fishing time and area swept is estimated in this section, while the distribution of the fishing time and area swept relative to areas, substrates, and EFH designations is analyzed and discussed in Sections 8.5.4.14.1and 8.5.4.14.2. In addition to analyzing the trends and distributions of historic limited access effort, Section 8.5.7.2.1.1 goes a step further and analyzes the probable distribution of scallop fishing effort under area rotation, by applying the rotation management area swept area estimates to the VMS effort distributions within each rotation management area

Total area swept is calculated from the total projected DAS use and the amount of fishing time per DAS, multiplied by the dredge width. For purposes of analytic comparisons, the projections assume that the total width of a vessel’s dredges is 30 feet, even though some vessels use smaller dredges (sometimes to qualify for a higher DAS allocation category) or trawls.

The projection estimates also assume no overlap of any tow during the year and is therefore an overestimate of the total area swept one or more times in the year. An analogy is the amount of highway area needed if each car has its own traffic lane and gets a new, unused traffic lane each day. Nonetheless total area swept is a useful measure as an index of fishing effects assuming that the concentration of fishing effort is fairly constant.

In general, the alternative proposed overfishing definition minimizes bottom contact time and area swept, through the combined effects of lower DAS use and higher LPUE[67]. The use of 4" rings is projected to reduce total area swept when using the status quo overfishing definition as the basis for annual mortality targets. This result occurs because of the combined effects of higher dredge efficiency for large scallops and higher LPUE from the effects of using 4" rings.

With access and mechanical rotation of the Georges Bank closed areas, the final alternative ("Status quo – Yes – 4"; Figure 73) is projected to reduce area swept from 7,493 nm2 in 2003 to 3,901 nm2 in 2004, average 5,076 nm2 in 2005-2007, then increase to around 10,000 nm2 after the first rotation of Georges Bank closed area access. Total area swept of 10,000 nm2 is approximately the area swept when the fleet uses 38,000 DAS continuously.

Without rotation, the area swept by applying the status quo overfishing definition is about the same as with rotation in 2004-2006, but then remains low with a long-term average of 6,332 nm2. The al proposed overfishing definition total area swept is projected to be lower, declining to 2,812 nm2 in 2004, then fluctuating between 2,000 to 3,500 nm2, with a long-term average of 3,098 nm2 without rotation and 3,189 nm2 with rotation. The total area swept is sometimes higher with rotation than without because area rotation is projected to increase productivity by 5 to 15 percent and it takes slightly more fishing to capture the benefits of area rotation while achieving the fishing mortality objectives.

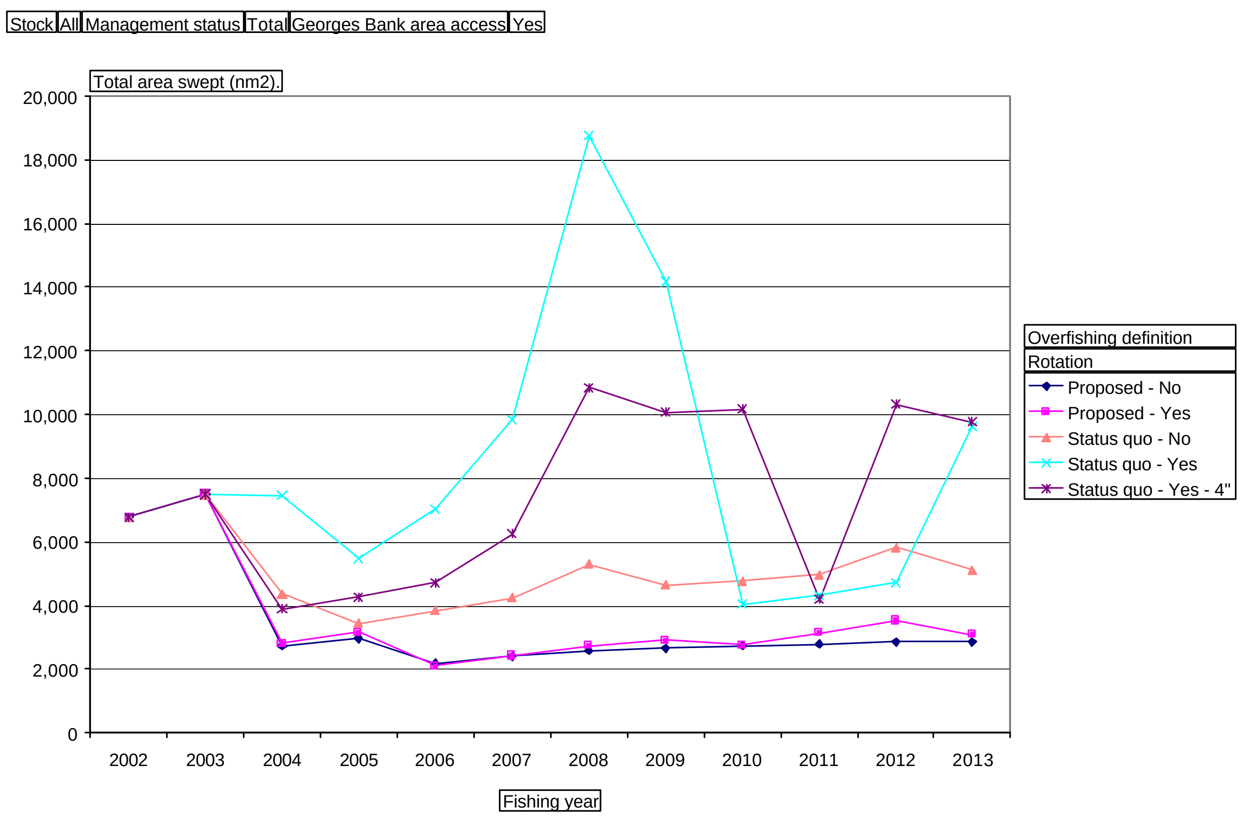


Figure 73. With Georges Bank access: Average projected total annual area swept by scallop fishing.

[67] CPUE, or catch per unit effort, is estimated in the projections as landings per DAS. Dead scallop discards are a small fraction of the total catch and are taken into account by the projection model assumptions.

Without access to the Georges Bank closed areas, the area swept differences between the application of the two alternative overfishing definitions is greater, particularly from the interaction between large area closures and the status quo overfishing definition. For the final alternative ("Status quo – Yes – 4"; Figure 74), area swept is projected to decline to 5,402 nm2 in 2004, the increase to around 12,000 nm2. Without rotation or access ("Status quo – No"), the projected area swept drops to about the same level as with area rotation, the gradually rises to the long-term average, 15,291 nm2. In contrast, the alternative proposed overfishing definition is projected to reduce area swept even without access to the Georges Bank closed areas, declining to 2,687 nm2 in 2004 with a gradual rise to the long-term average, 3,098 nm2.

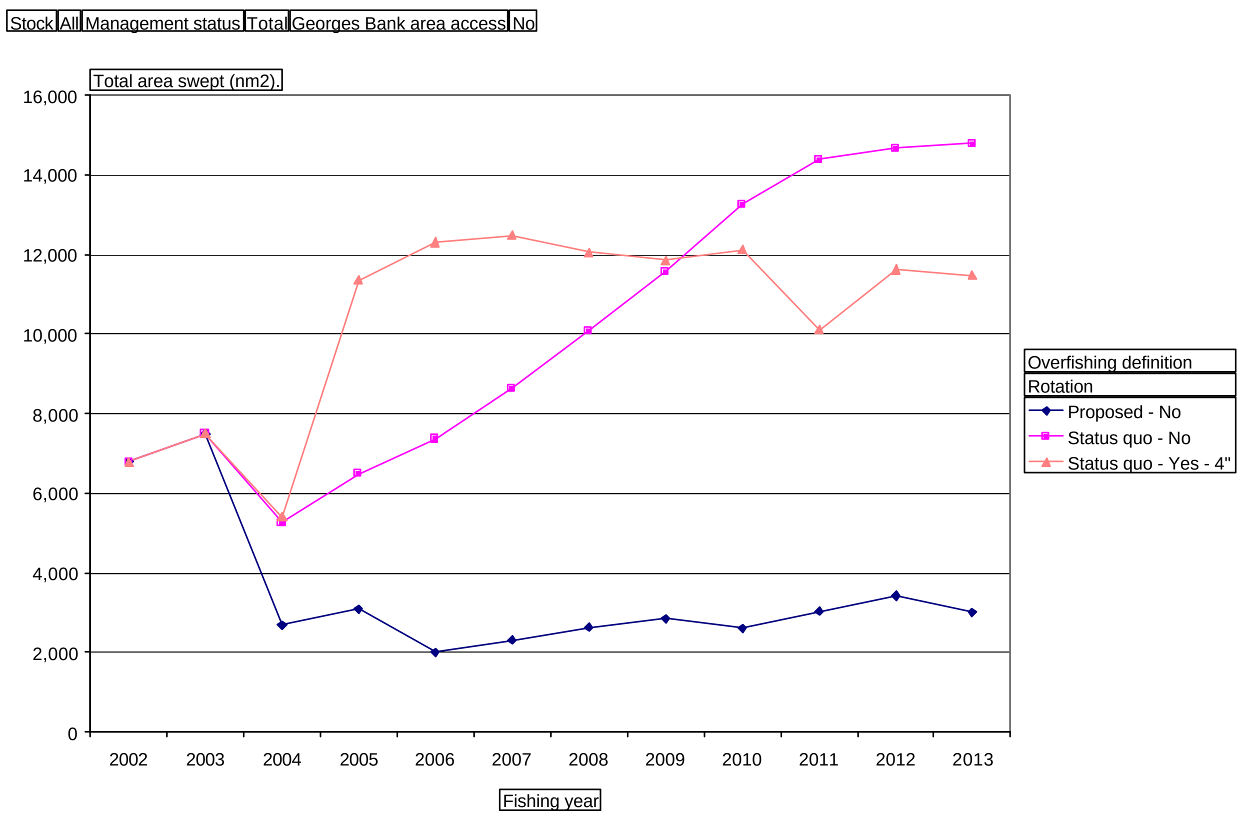


Figure 74. With no Georges Bank access: Average projected total annual area swept by scallop fishing.

The projection for the final alternative was summarized in greater detail to provide some geographical distribution data. All variables, including catch and biomass, were computed, but the geographical distribution of a variable of particular interest is area swept, because it has bearing on how area rotation and access could affect finfish bycatch and habitat.

In 2004 (Figure 75), 74% of the projected area swept is expected in the Mid-Atlantic region (MA1 to MA9). Over half of the bottom contact time and area swept in the Mid-Atlantic is projected to occur in two rotation management areas, MA7 and MA8, which are located in the NY Bight, north of the Hudson Canyon Area. Part of MA7 overlaps the Hudson Canyon Area, which will continue under controlled access through 2005.

In contrast, effort and total area swept is projected to remain relatively low in the Georges Bank region, in spite of controlled access to the Georges Bank closed areas. Although substantial catches from

Nantucket Lightship Area and Closed Area I are expected, the high daily catch rates combined with the crew shucking capacity will keep the area swept in GB12 and GB09 around only 7 percent of the total.

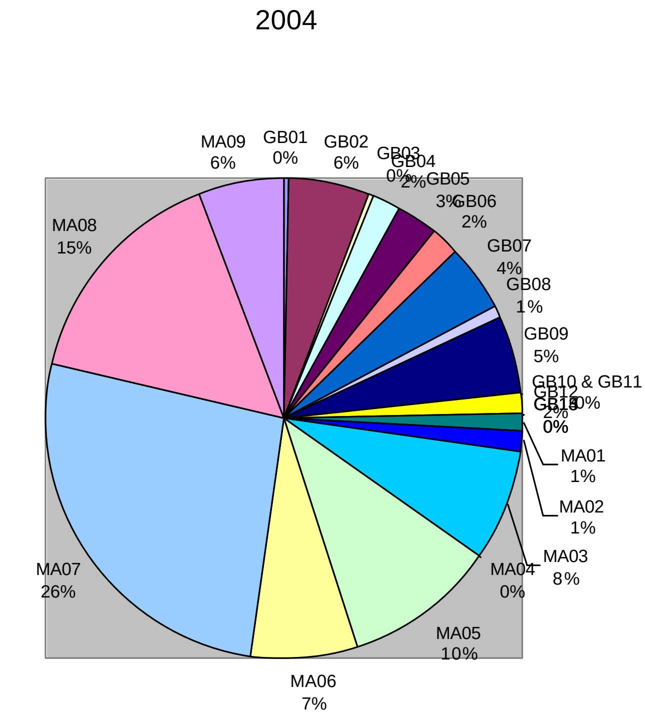
In 2005, the outlook is similar but there is a slight increase in the percent of total fishing time and area swept in the Georges Bank region (Figure 75), increasing from 24 percent in 2004 to 31 percent in 2005. Even with controlled access to Closed Area II (i.e. GB14), the bottom time and area swept is projected to be only 5 percent of the total.

The situation changes markedly in 2006, because Amendment 10 contemplates that the Hudson Canyon Area would no longer be regulated as a controlled access area. Due to high catch rates coupled with open access, MA05 and MA06 which overlap the Hudson Canyon Area is projected to attract fishing effort and contribute to 65 percent of the bottom contact time and area swept (Figure 76). The Closed Area II controlled access area is projected to continue to have a very low bottom contact time and area swept, only 5 percent of the total, despite the substantial catches anticipated.

This projected outlook continues in 2007 (Figure 76), but the bottom contact time and area swept for the MA05 and MA06 areas that overlap the Hudson Canyon Area would decline to 39 percent of the total. If the "Elephant Trunk" area re-opens under controlled access regulation[68], like the Georges Bank closed area access, the area swept is expected to be low and contribute only 2 percent of the total despite relatively large DAS allocations and catches in the re-opened area.

Over the long term, the total area swept for Georges Bank is projected to be a much greater share of the total, reflecting a return to average recruitment conditions. Since 1997, recruitment has been well above average in the Mid-Atlantic region and the current DAS use and area swept distribution reflect that temporary imbalance in resource productivity. Under average conditions, the projections indicate that 53 percent of the bottom contact time and area swept would occur in the Georges Bank region (Figure 77), but that 49 percent would occur in the open areas of Georges Bank, assuming that the Georges Bank closed areas continue under a mechanical rotation of controlled access.

[68] The area would not open in three years by default, but could re-open in 2007 (or earlier or later) by framework action, depending on resource conditions and anticipated future rotation management.



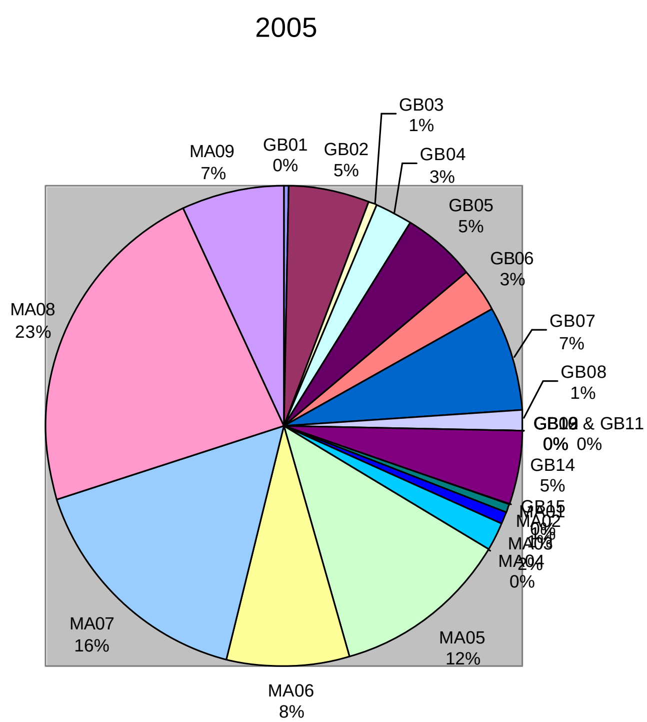
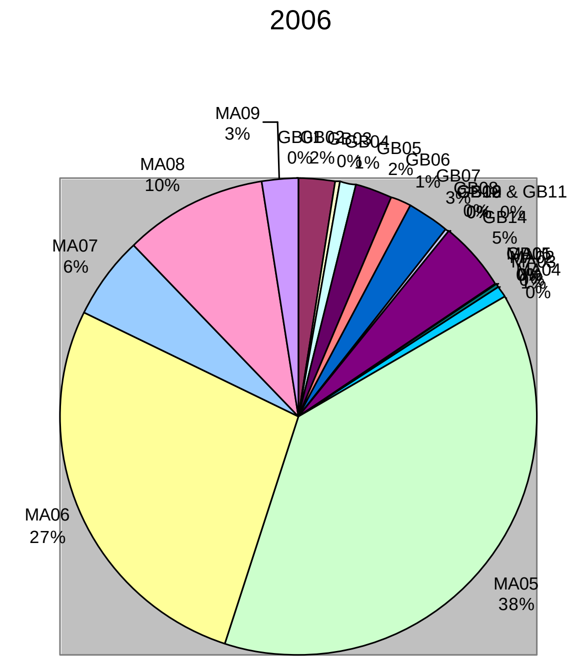


Figure 75. With Georges Bank access: Average distribution of area swept by rotation management area, for 2004 – 2005. See Map 7 for key



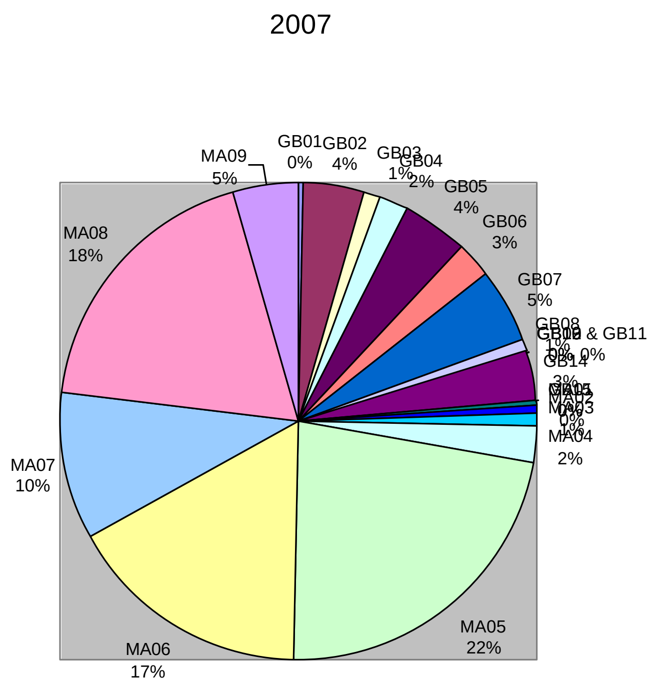


Figure 76. With Georges Bank access: Average distribution of area swept by rotation management area, for 2006 – 2007. See Map 7 for key.

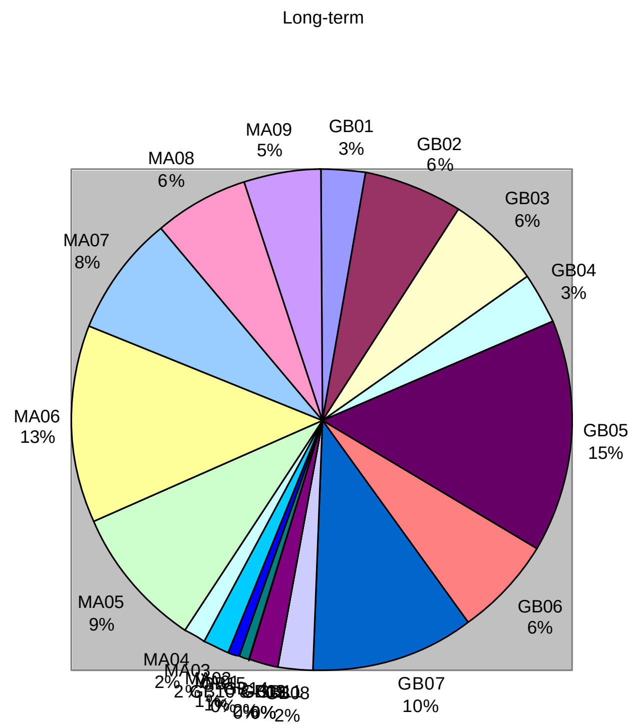


Figure 77. With Georges Bank access: Average distribution of area swept by rotation management area, summed for long-term. See Map 7 for key.

8.2.2.3.5 Trends in Total biomass

The survey total biomass index is used to compare with appropriate biological reference points to determine whether the scallop stock is overfished, i.e. below ½B_{MSY}, or near the target. This biological reference point (B_{max}) is derived from the expected biomass index if the stock is continuously fished at F_{max}, or the mortality rate that is calculated to produce maximum yield-per-recruit. The current estimate of B_{max} is 5.60 kg/tow, or 5,600 gtow.

With the status quo overfishing definition, the total biomass is projected to gradually increase to 7.1 kg/tow in 2004 to 7.5 kg/tow by 2012 (Figure 78), near the long-term average of 7.7 kg/tow. Differences between the projected biomass on a region-wide basis are insignificant with regard to area rotation and 4” rings. Area rotation with the status quo overfishing definition, however, is projected to have slightly lower total biomass than without rotation, due to the higher fishing mortality rates applied in open areas when a greater share of the resource area is closed. Requiring 4” rings helps to make up the difference.

Projections for the alternative proposed overfishing definition, on the other hand, show a gradual and continuing increase in total biomass from 7.6 kg/tow in 2004 to nearly 9.0 kg/tow by 2012, before leveling off around the 9.5 – 9.7 kg/tow long-term average. With the proposed overfishing definition, the biomass is projected to be higher with area rotation than without, unlike the situation with the status quo overfishing definition.

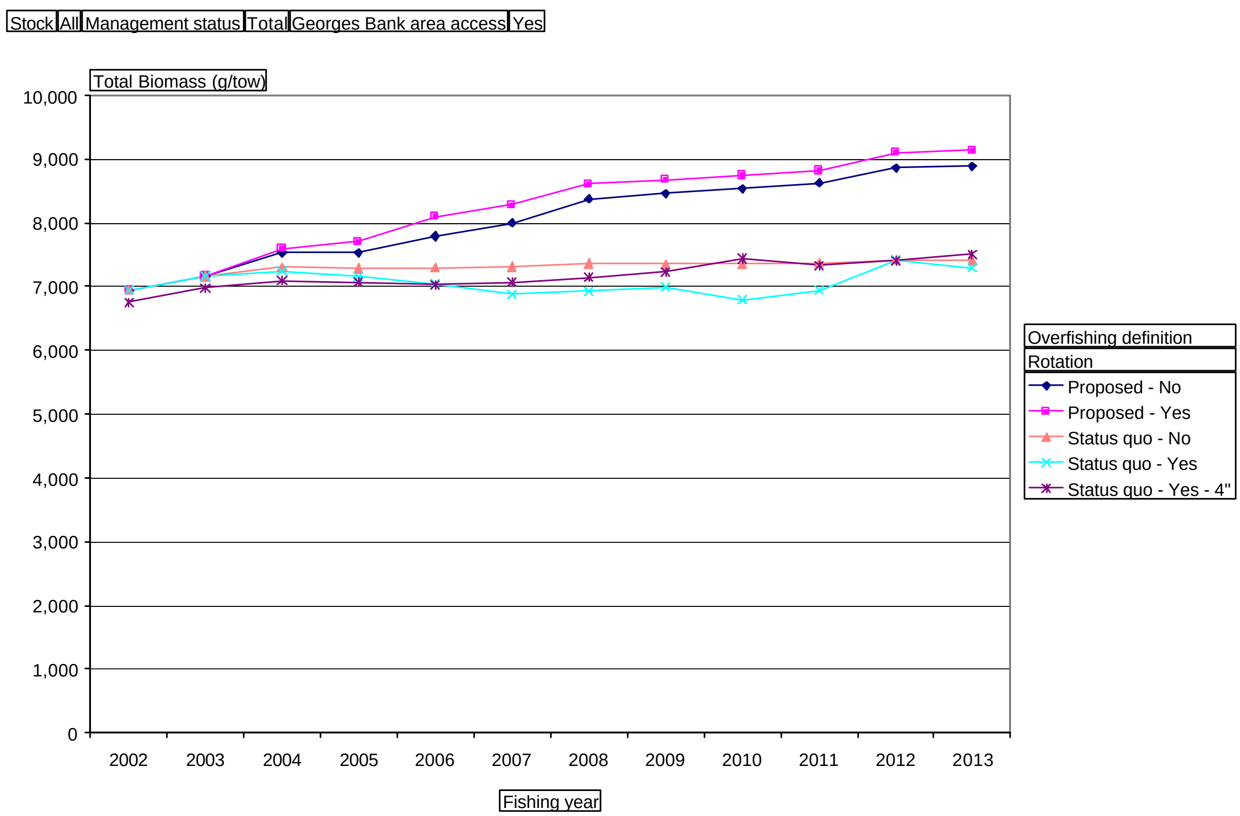


Figure 78. With Georges Bank access: Annual projected trends in total biomass of scallops in the Mid-Atlantic and Georges Bank regions.

Over the long-term, the effects of the current scallop distributions and recent management practices level out and the biomass is a reflection of the results of area rotation, gear requirements, and the application of the target fishing mortality rates for the two overfishing definitions. The table below shows the projected long-term average biomass for each management scenario and management area. The effect of area access is observable, where biomass without access is projected to increase to 43 kg/tow, but stabilize around 24 kg/tow with access. In the Georges Bank open areas and in the Mid-Atlantic region, the differences arise mainly from the application of the target fishing mortality rate for each overfishing definition. The alternative proposed overfishing definition is projected to give a total scallop biomass of 6.6 to 7.0 kg/tow in Georges Bank open areas and 4.9 kg/tow in the Mid-Atlantic region. In contrast, the final alternative ("Status quo – Yes – 4") is projected to produce an average long-term biomass of 3.5 – 3.7 kg/tow in the Georges Bank open areas and 3.2 – 3.3 kg/tow in the Mid-Atlantic region. The status quo management with no rotation and 3 ½ rings is projected to produce an average scallop biomass of 2.6 kg/tow in the Georges Bank open areas and 3.2 – 3.3 kg/tow in the Mid-Atlantic region, with access to the Georges Bank areas. Without access, the average scallop biomass is projected to be only 0.9 kg/tow in the Georges Bank open areas and 1.1 kg/tow in the Mid-Atlantic region.

Table 164. Comparison of long-term projected total scallop biomass by management area for various scallop management alternatives. The final alternative is the status quo overfishing definition, with rotation and 4" rings ("Yes – 4").

Total biomass (kg/tow).

			Stock / Management status				
			Mid-Atlantic	Georges Bank			All
Georges Bank area access	Overfishing definition	Rotation	Total	Georges Bank area access	Total	Open areas	Total
No	Proposed	No	4.9	43.4	23.7	6.8	13.6
	Status quo	No	0.9	43.4	20.7	1.1	10.1
		Yes - 4"	3.2	43.1	21.9	3.7	11.9
Yes	Proposed	No	4.9	24.4	14.8	6.6	9.5
		Yes	5.0	24.4	15.1	7.0	9.7
	Status quo	No	2.6	24.4	13.3	3.8	7.6
		Yes	3.4	24.4	13.3	3.7	8.0
		Yes - 4"	3.3	23.9	12.9	3.5	7.7

The trends in biomass for the Georges Bank region are projected to show a similar pattern, but at a higher level due to the existence of large closed areas that were not open to fishing during 2000 by Framework Adjustment 13. Total biomass is projected to rise from 10.6 to 11.4 kg/tow in 2004 to 11.6 to 13.7 kg/tow by 2012 (Figure 79). Generally, the Georges Bank total biomass index is projected to be lower when using the status quo overfishing definition than when using the alternative proposed overfishing definition especially after 2008, but all are expected to be well above the biomass that would achieve MSY from scallops in the Georges Bank region.

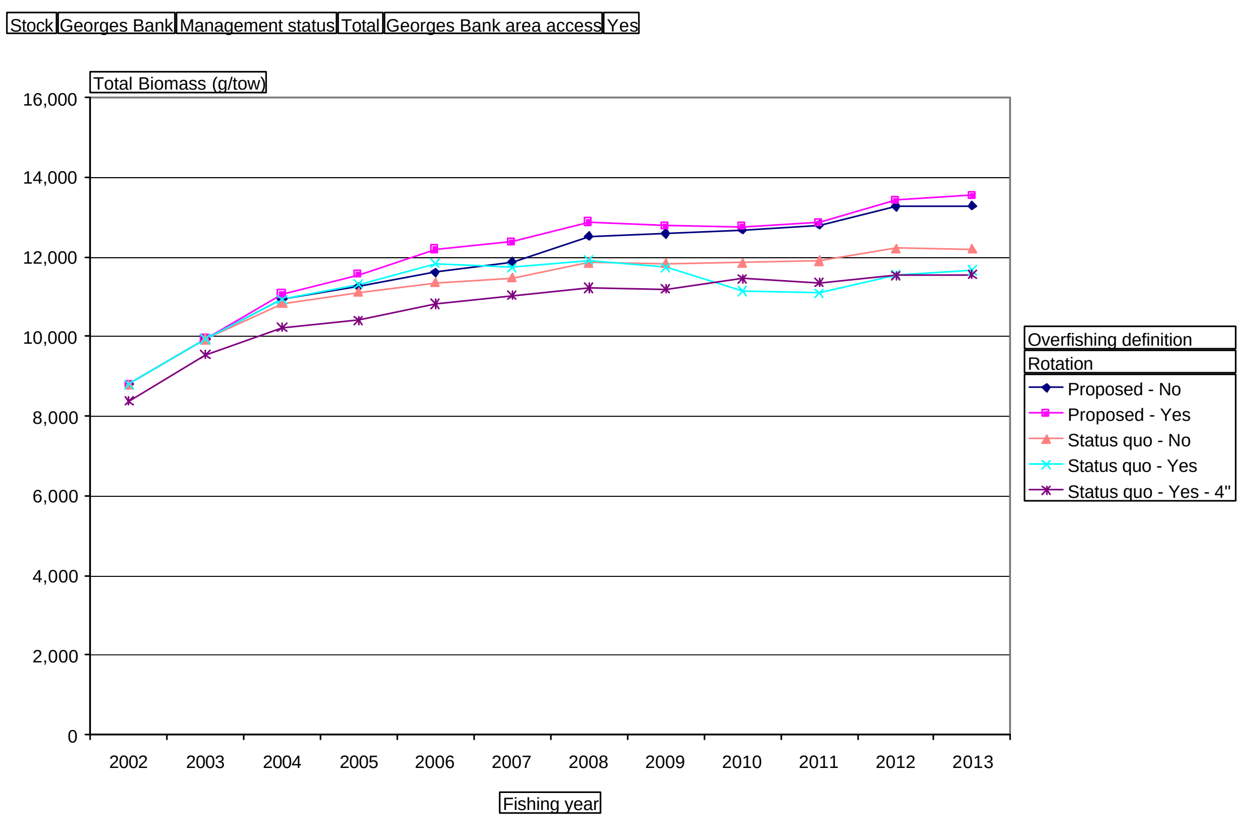


Figure 79. With Georges Bank access: Annual projected trends in total biomass of scallops in the Georges Bank region.

With access to the Georges Bank closed areas, most of the differences in total biomass for scallops in the Georges Bank region occur in the open fishing areas (Figure 80). Total biomass is expected to rise from 2.1 kg/tow in the open areas of the Georges Bank region during 2003 to 4.0 to 5.6 kg/tow by 2006. After that the projected biomass levels off around 4.0 to 4.5 kg/tow when using the status quo overfishing definition. The status quo overfishing definition scenario projected biomass declines with area rotation and 3½" rings in 2010 to around 3.0 kg/tow, presumably due to the higher fishing mortality associated with the open areas under the status quo overfishing definition. Requiring 4" rings (the final alternative) seems to compensate for this effect. Using the alternative proposed overfishing definition, the open area total biomass for the Georges Bank region is projected to continue a gradual increase to 6.4 to 6.8 kg/tow by 2013.

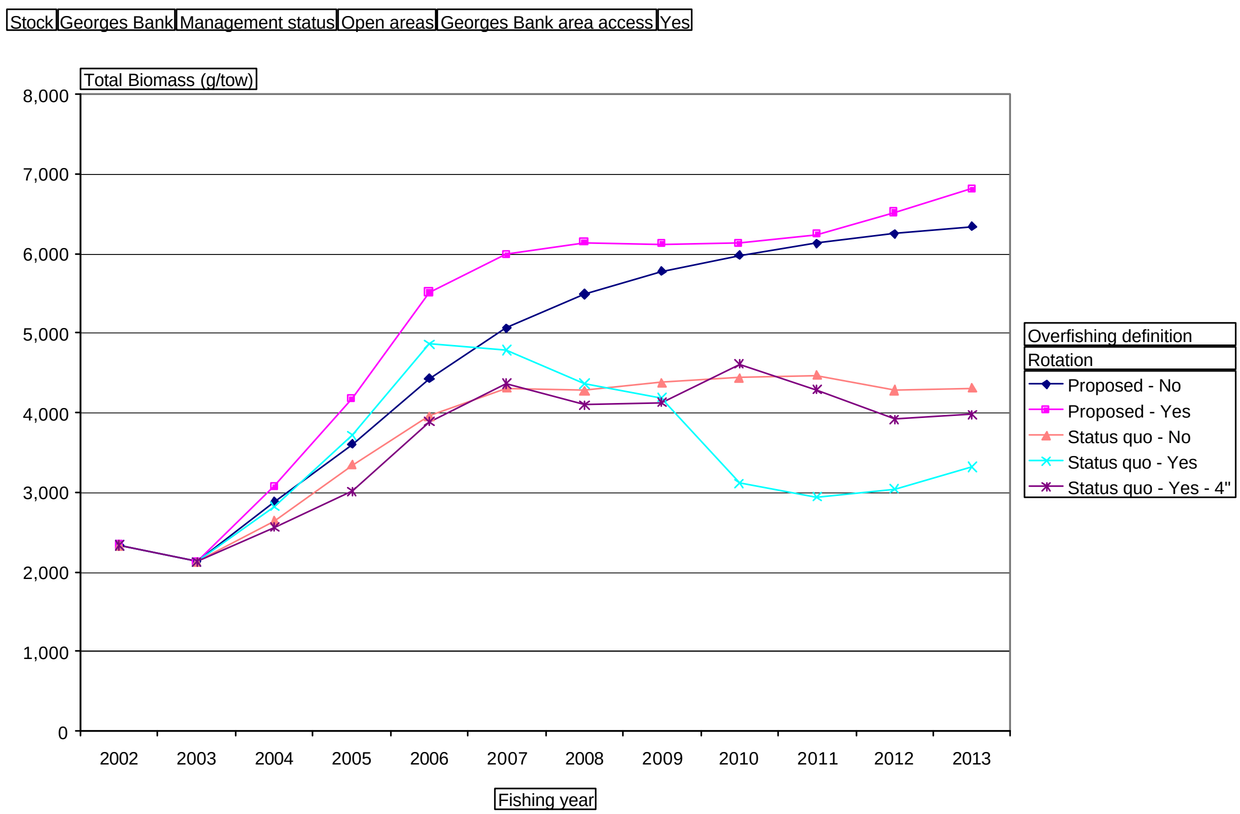


Figure 80. With Georges Bank access: Annual projected trends in total biomass of scallops in the open areas of the Georges Bank region.

Within the Georges Bank closed areas, assuming access to the areas fished in 2000, beginning in 2003, the total biomass is expected to remain relatively stable at about 20.0 kg/tow throughout the time series (Figure 81). This occurs because the fishing mortality targets and TACs for mechanical rotation of the Georges Bank controlled access areas operates independent of the application of the overfishing definition or area rotation elsewhere. Total biomass is projected to be slightly lower if 4" rings are required.

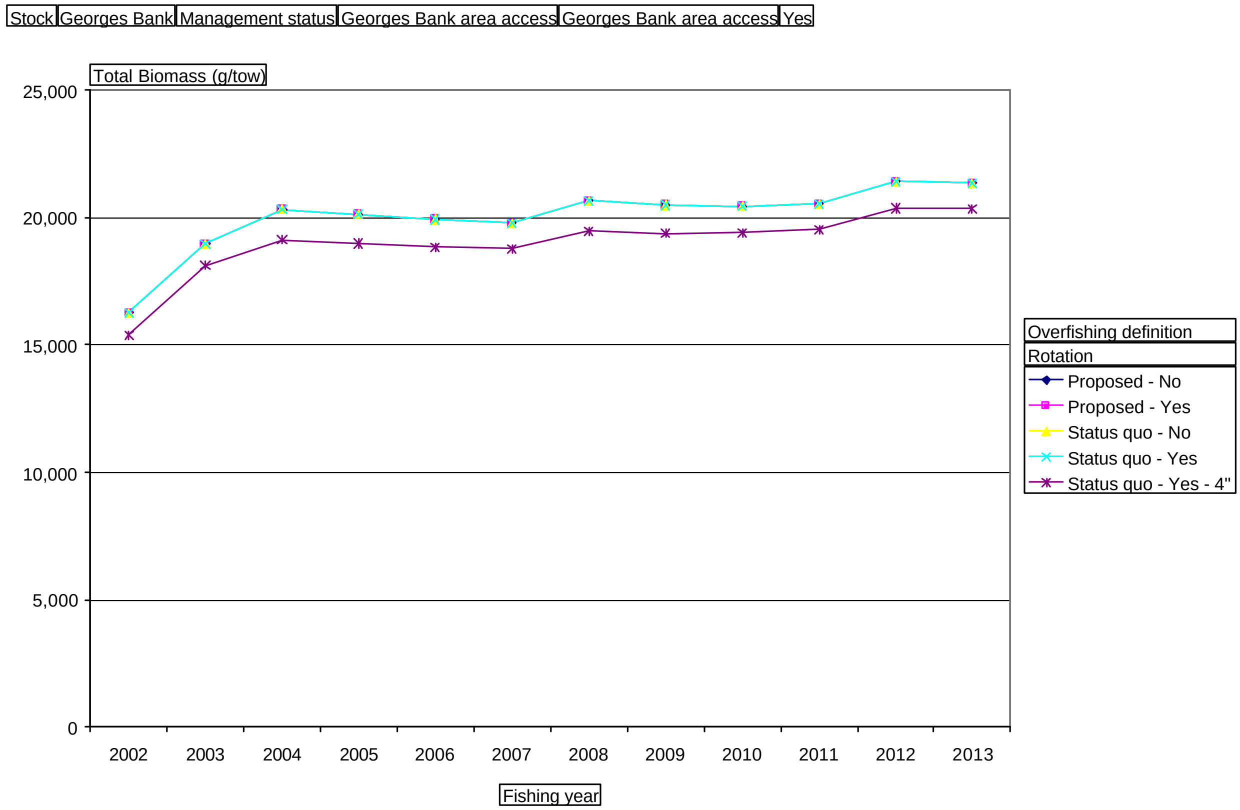


Figure 81. With Georges Bank access: Annual projected trends in total biomass of scallops in the Georges Bank groundfish closed areas (including areas under controlled access regulations).

Biomass trends in the Mid-Atlantic region follow the projected pattern in open areas of Georges Bank, except that with the status quo overfishing definition, the projected biomass declines from current levels. With rotation and 3 ½ " rings ("Status quo – Yes";), the Mid-Atlantic region biomass is projected to decline from 4.8 kg/tow in 2003 to 2.6 kg/tow by 2008.

The biomass decline is less steep when 4" rings are required ("Status quo – Yes – 4"), consistent with the final alternative. Total biomass is projected to decline to 3.6 kg/tow by 2006 and then gradually increase to 4.0 kg/tow by 2013. The long-term projected biomass average is 3.6 kg/tow. Beginning in 2008, the Mid-Atlantic region biomass level is expected to be higher under the final alternative using 4" rings than without area rotation. Area rotation with 3.5" rings is projected to result in the steepest decline in Mid-Atlantic scallop biomass.

With the alternative proposed overfishing definition, total biomass is projected to decline to 4.4 kg/tow by 2005, then gradually increase to 5.1 to 5.3 kg/tow by 2013. The long-term projected biomass is 4.7 kg/tow with the alternative proposed overfishing definition. Area rotation is expected to increase the total biomass level compared to that expected without area rotation.

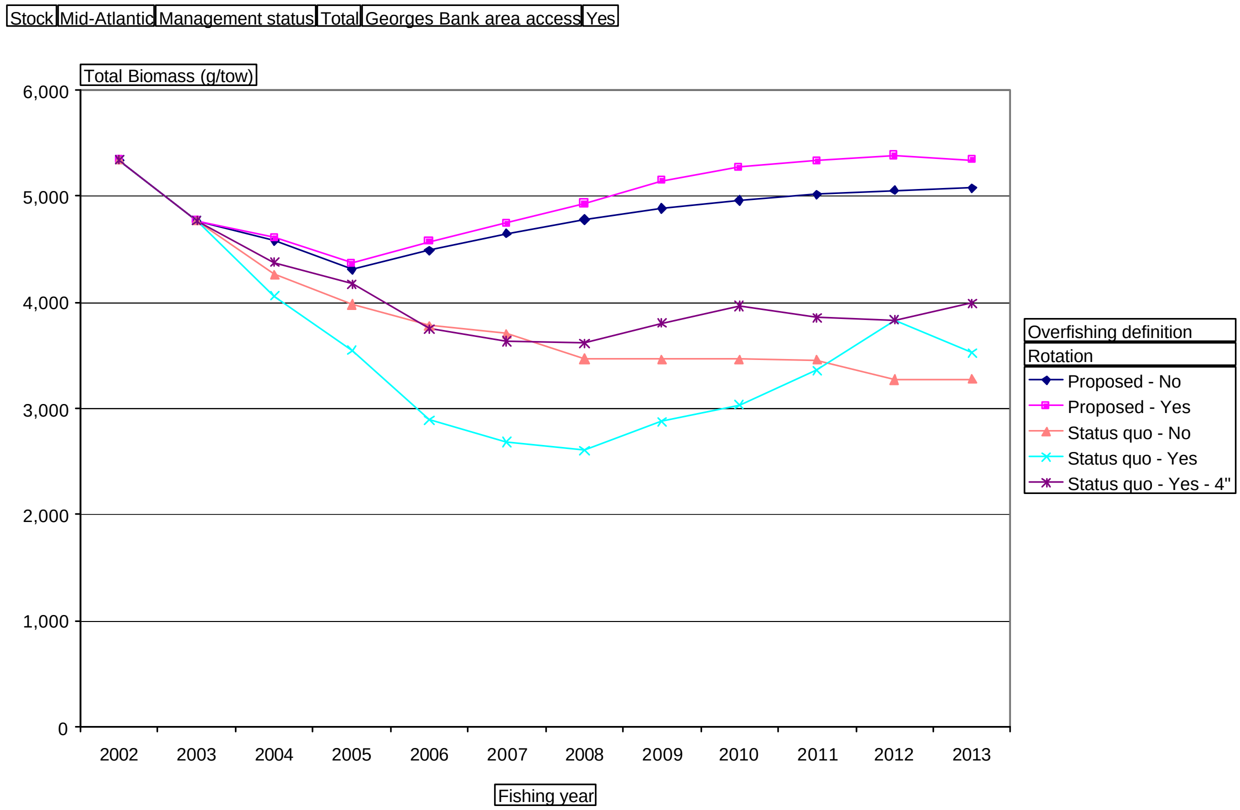


Figure 82. With Georges Bank access: Annual projected trends in total biomass of scallops in the Mid-Atlantic region.

Without access to the Georges Bank closed areas, the total biomass is expected to climb much higher with the alternative proposed overfishing definition, because the average fishing mortality across all areas are lower. In addition to the near-zero fishing mortality in closed areas, the proposed overfishing definition fishing mortality target is 0.2 in open fishing area, maximizing yield from the scallops available to the fishery. In other words, without access, the trend in biomass in the Georges Bank closed area is exactly the same, and the higher fishing mortality in open fishing areas under the status quo overfishing definition (i.e. applying its fishing mortality target to the entire resource instead of only areas open to fishing).

Although large scallop resource areas would remain closed without access, total scallop biomass for the status quo overfishing definition is projected to rise from 7.0 kg/tow in 2003 to 8.3 kg/tow in 2013 with 3.5" rings and no area rotation (Figure 83). With 4" rings and area rotation [final alternative ("Status quo – Yes – 4"], total scallop biomass is expected to rise faster, particularly after 2006, rising to 10.3 kg/tow by 2013. With the alternative proposed overfishing definition and 3½" rings, total stock biomass is expected to rise more and more quickly, reaching 11.8 kg/tow by 2013.

Without access, all projections indicate that stock biomass will remain well above the resource-wide B_{max} target, irregardless of which overfishing definition is in use or whether area rotation is implemented.

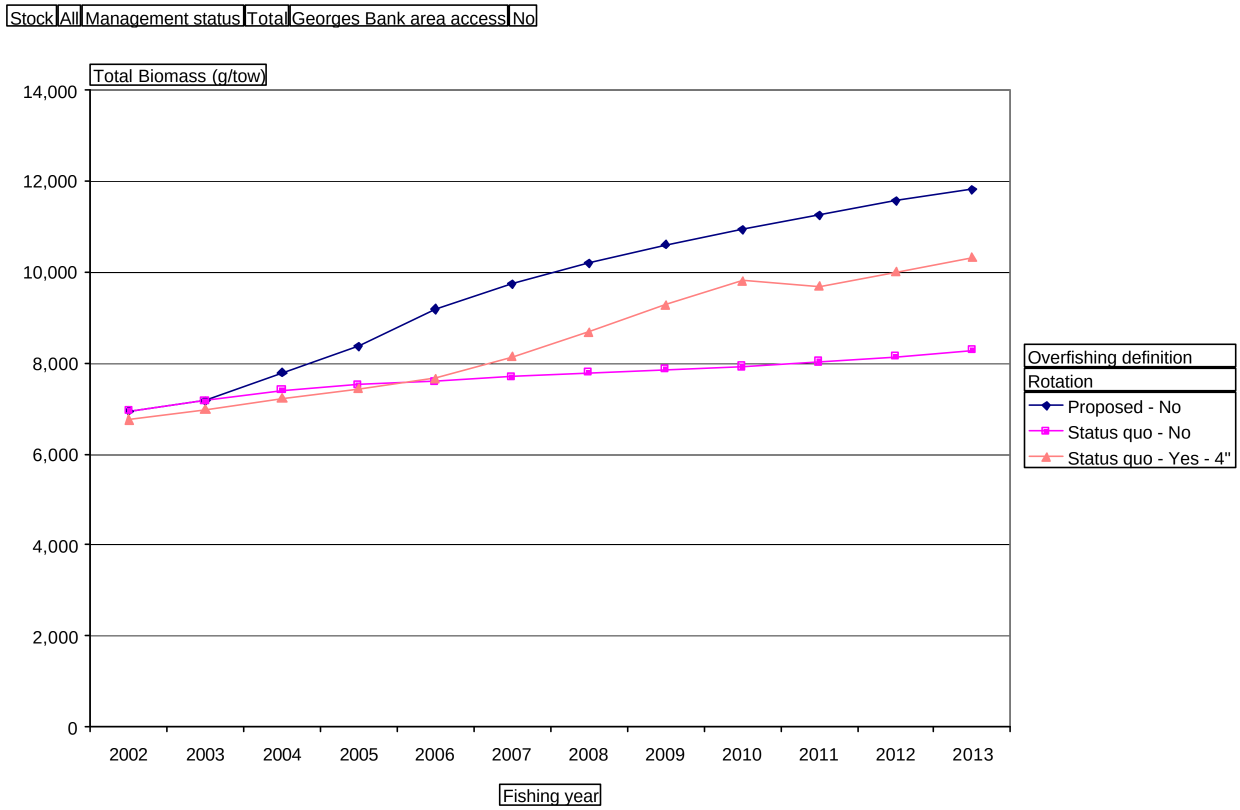


Figure 83. With no Georges Bank access: Annual projected trends in total biomass of scallops in the Mid-Atlantic and Georges Bank regions.

Stock biomass trends in open fishing areas, however, reveal greater disparities between the alternatives. For the final alternative ("Status quo – Yes – 4"; Figure 84), scallop biomass in the open areas of the Georges Bank region is projected to nearly double over the current value. Initially, biomass is projected to increase from 2.1 kg/tow in 2003 to 2.2-2.3 kg/tow in 2004-2005, then begin rising to 4.5 kg/tow in 2010 before falling off to 3.6-4.0 kg/tow, with a long-term average biomass of 3.7 kg/tow.

Applying the status quo overfishing definition with 3 ½ " rings but without area rotation ("Status quo – No") is expected to cause declines in open area Georges Bank biomass. Initially, biomass is projected to increase to 3.0 kg/tow in 2006 and then begin declining to 1.3 kg/tow by 2013. The long-term average biomass for this alternative is 1.1 kg/tow.

Applying the alternative proposed overfishing definition and area rotation produces radically different results, however, even when 3 ½ " rings are used ("Proposed – No"). Biomass in the Georges Bank open areas is projected to rise steeply to 6.0 kg/tow in 2007, before leveling off. A slight rise in biomass is projected in 2012 and 2013. The long-term average biomass for the Georges Bank areas is 6.8 kg/tow.

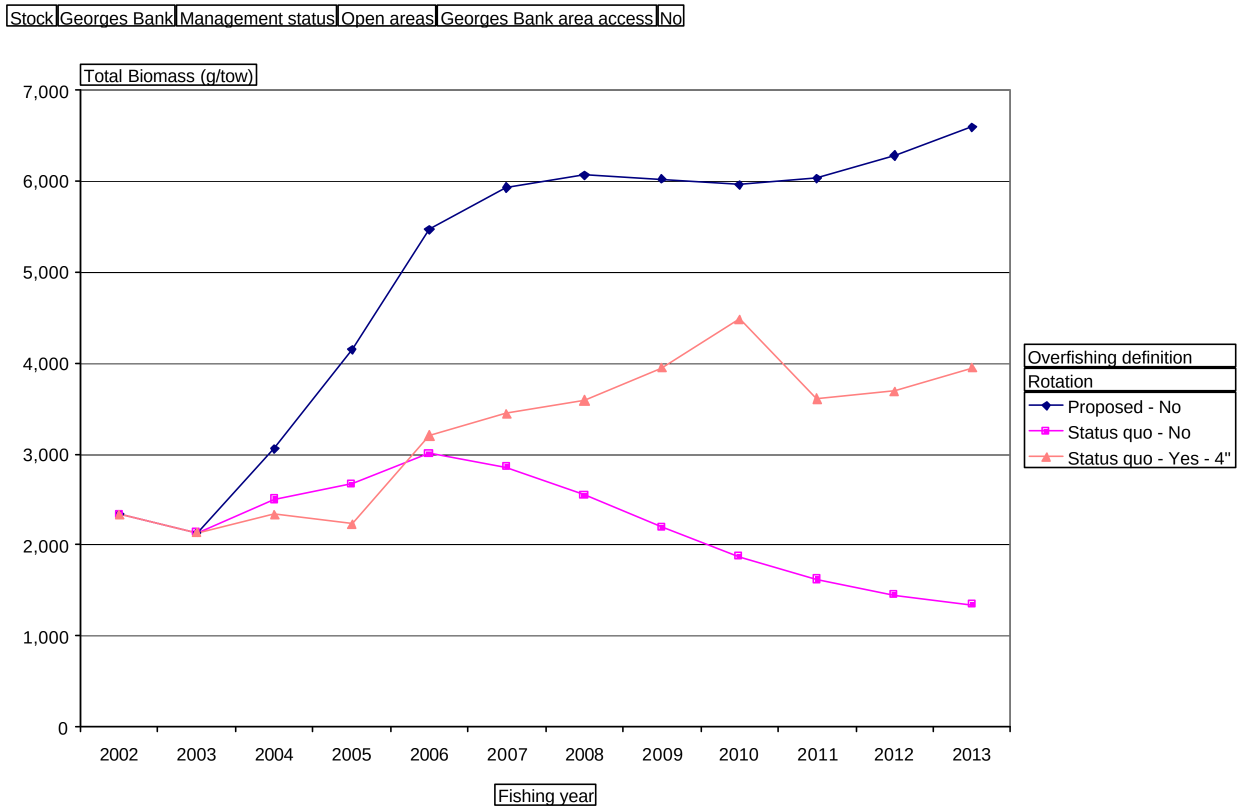


Figure 84. With no Georges Bank access: Annual projected trends in total biomass of scallops in the open areas of the Georges Bank region.

The biomass trends in the Mid-Atlantic region without access are similar to those above for the open areas of the Georges Bank region, but at a lower level compared to current conditions partly due to the assumption that recruitment will return to the time-series average[69] and an assumption based on empirical data that the fleet favors fishing in the Mid-Atlantic due to lower fishing costs and proximity to the major Mid-Atlantic ports.

For the final alternative ("Status quo – Yes – 4"; Figure 85), scallop biomass in the Mid-Atlantic is projected to decline from 4.8 kg/tow in 2003 to 3.0 kg/tow by 2006, before increasing again to 3.9 kg/tow in 2010. The long-term average is 3.2 kg/tow.

Total biomass is projected to decline much more under the status quo overfishing definition with 3½" rings, but without rotation ("Status quo – No"). Total biomass is projected to steadily decline to 1.0 kg/tow by 2013, near the long-term average of 0.9 kg/tow. The target fishing mortality rate for the alternative proposed overfishing definition, on the other hand, keeps biomass at much higher levels, declining only to 4.3 kg/tow in 2005 before increasing to 5.2 kg/tow in 2013, slightly above the long-term average of 4.9 kg/tow.

[69] Although the recruitment was assumed to return to average conditions, the projections were run over a wide range of recruitment ranges that were represented by the historic distribution of annual recruitment levels. The projection results are presented as the average of these stochastic simulations.

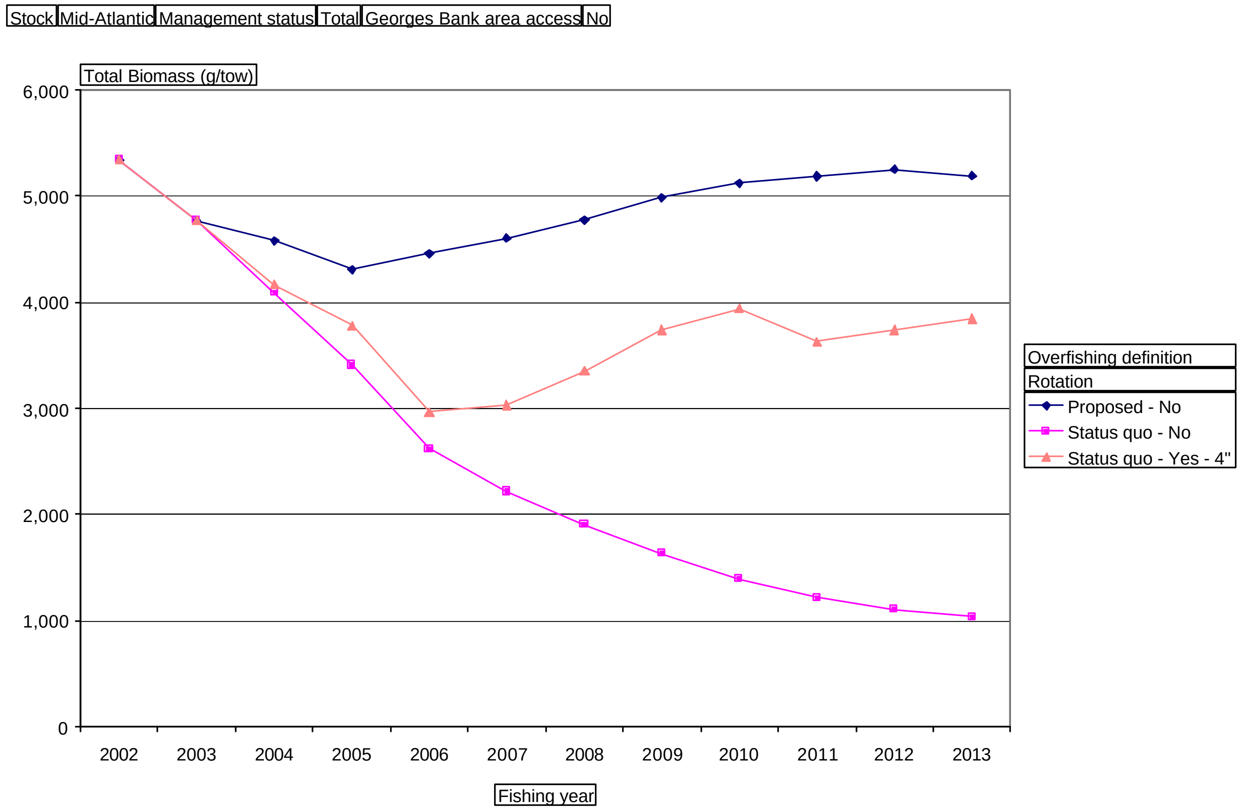


Figure 85. With no Georges Bank access: Annual projected trends in total biomass of scallops in the Mid-Atlantic region.

8.2.2.3.6 Trends in Landings and Daily Catches (LPUE)

Projected landings are more affected by whether or not there is controlled access for the Georges Bank closed areas than by which overfishing definition is in place. Long-term average annual landings are shown in Table 165 for comparison across overfishing definition alternatives, scallop management alternatives, and management areas. Without access, however, area rotation and 4" rings make a substantial difference (32.7 million pounds vs. 19.0 million pounds with 3 ½ " rings and no rotation). On the other hand, without access, application of the aternative proposed overfishing definition alone actually surpasses the landings with rotation and 4" rings (35.0 million pounds vs. 32.7 million pounds). Without access, about 2/3rd of the landings (20.7 out of 32.7 million pounds) are projected to originate from the Mid-Atlantic region.

With access, long-term average annual landings increase to 43.2 to 48.6 million pounds, with the landings for the alternative proposed overfishing definition exceeding those for the status quo overfishing definition, by about 10 percent. With access, only 40 percent of the long-term average landings are projected to originate from the Mid-Atlantic region and 60% from the Georges Bank region.

Table 165. Comparison of long-term projected total scallop landings [mt (top) and million lbs. (bottom)] by management area for various scallop management alternatives. The final alternative is the status quo overfishing definition, with rotation and 4” rings (“Yes – 4”).

Catch (mt)

			Stock	Management status			
			Mid-Atlantic	Georges Bank			All
Georges Bank area access	Overfishing definition	Rotation	Total	Georges Bank area access	Total	Open areas	Total
No	Proposed	No	9,618	0	6,479	6,479	16,097
	Status quo	No	5,413	0	3,205	3,205	8,618
		Yes - 4"	9,370	0	5,472	5,472	14,842
Yes	Proposed	No	9,421	6,183	12,398	6,215	21,819
		Yes	9,519	6,183	12,522	6,338	22,042
	Status quo	No	8,091	6,183	11,501	5,318	19,593
		Yes	8,420	6,183	11,893	5,710	20,314
		Yes - 4"	8,827	6,183	12,076	5,893	20,903

Catch (million lbs.)

			Stock	Management status			
			Mid-Atlantic	Georges Bank			All
Georges Bank area access	Overfishing definition	Rotation	Total	Georges Bank area access	Total	Open areas	Total
No	Proposed	No	21.2	0.0	14.3	14.3	35.5
	Status quo	No	11.9	0.0	7.1	7.1	19.0
		Yes - 4"	20.7	0.0	12.1	12.1	32.7
Yes	Proposed	No	20.8	13.6	27.3	13.7	48.1
		Yes	21.0	13.6	27.6	14.0	48.6
	Status quo	No	17.8	13.6	25.4	11.7	43.2
		Yes	18.6	13.6	26.2	12.6	44.8
		Yes - 4"	19.5	13.6	26.6	13.0	46.1

Under the final alternative (“Status quo – Yes – 4”, with access to the Georges Bank closed areas, projected landings are expected average about 20,000 mt (44.1 million pounds; Figure 86). U10[70] scallops are projected to increase to nearly 30 percent of the total and with 10-20 count scallops will comprise nearly 80 percent of the total. In 2004 and 2005, the majority of the projected scallop landings will be 10-20 count, but by 2006, the size composition of landings will be very close to the long-term conditions.

From only a biological yield point of view, landings of 20-30 and smaller scallops are undesirable, because the scallops are caught before reaching their optimum yield potential. Maximum yield potential occurs with scallop landings in the 10-20 category, but very little yield is lost due to natural mortality by landing U10 scallops (U5 or larger, being a different story).

[70] Scallop landings are classified or graded according to average size in approximately 40 lb. bags. The count is an average number of scallop meats per pound and are inversely related to size. Scallop yield for a given size shell also varies seasonally, but this could not be taken into account by the projection model.

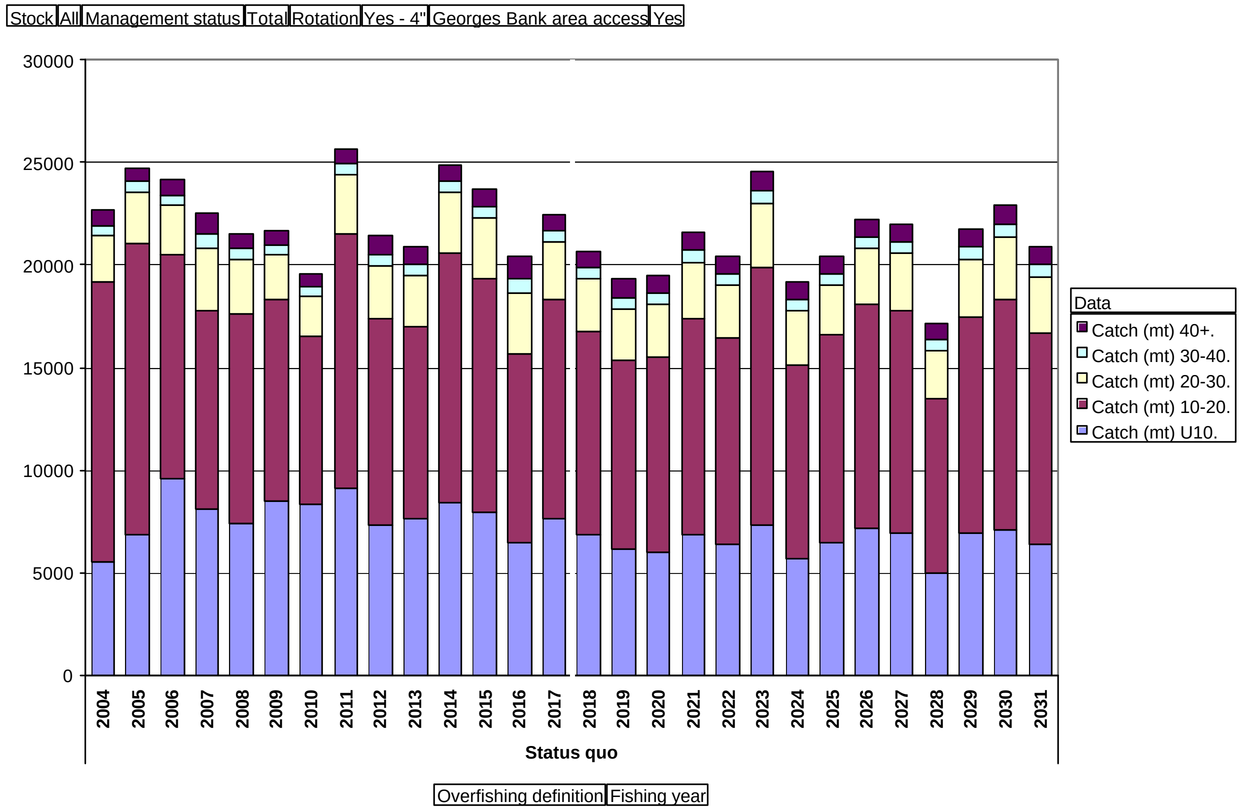


Figure 86. Projected landings (mt) by meat count for the final alternative ("Status quo – Yes – 4") with access to the Georges Bank closed areas. 20,000 mt is equivalent to 44.1 million lbs.

Without access to the Georges Bank closed areas, the projected landings for the final alternative are projected to be considerably more uneven. This choppy pattern comes from the controlled access management of the Hudson Canyon Area and from the application of area rotation in open fishing areas. The latter may be smoothed out by subsequent Council actions under future framework adjustments.

Total landings during 2004 – 2006 would be held up around 17,000 to 19,000 mt by the scallop biomass in the Hudson Canyon Area, followed by a drop to 11,000 to 13,000 mt from 2007 – 2010 (Figure 87). After that the projected landings gradually rise to 14,000 to 16,000 mt in the long-term, even under the status quo overfishing definition. Some of the downturn in landings from open fishing areas without access in 2007 – 2010 and then the gradual increase in landings is an outcome of using 4" rings in open fishing areas where scallops are presently smaller than found in the controlled access areas.

Without access, about 25% of the scallop landings are projected to be classified as U10 and a greater share of the catch will be comprised of 10-20 and 20-30 scallops than with access.

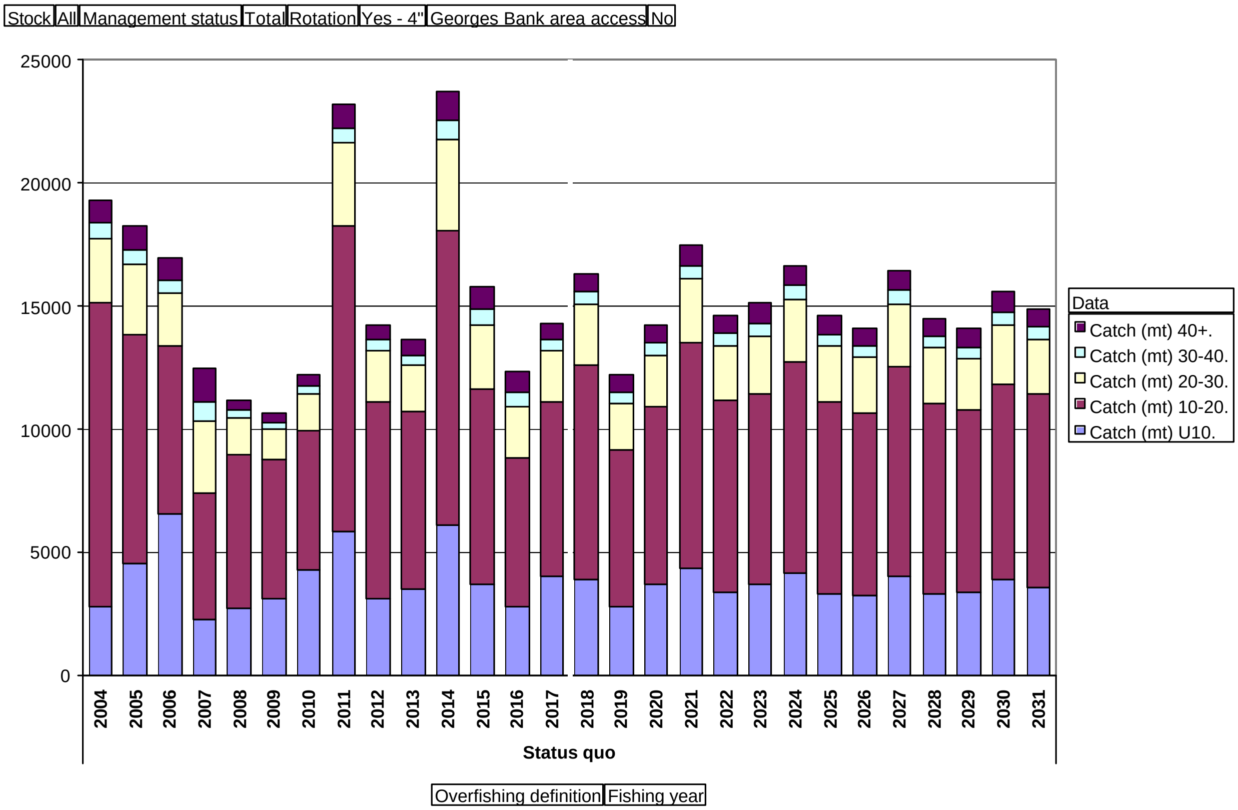


Figure 87. Projected landings (mt) by meat count for the final alternative ("Status quo – Yes – 4") <u>without access to the Georges Bank closed areas</u>. 20,000 mt is equivalent to 44.1 million lbs.

Projected scallop landings from Georges Bank controlled access areas are dominated by U10 and 10-20 scallops. Nearly half of the projected landings from the Nantucket Lightship Area and Closed Area I (2004, 2008, 2012, etc.) are expected to be U10 scallops (Figure 88). According to the final projections, landings from the Nantucket Lightship Area and Closed Area I with a 0.4 fishing mortality target would produce about 5,900 mt, declining to about 3,600 mt in 2012. This decline in landings is desirable, because nearly all of the scallops are U10 and 10-20, larger than that which produces maximum yield-per-recruit.

Applying a fishing mortality target of 0.2 in Closed Area II (2005-2007, 2009-2011, etc.), projected landings would initially be about 9,500 mt (20.9 million pounds), and gradually decline to 6,000 to 7,000 mt per year. About 30% of the total landings from the Georges Bank controlled access areas is projected to be U10, increasing to 45% over the long-term. With U10's, scallops of 10-20 count will make up about 90-95% of the landings through the projected time series.

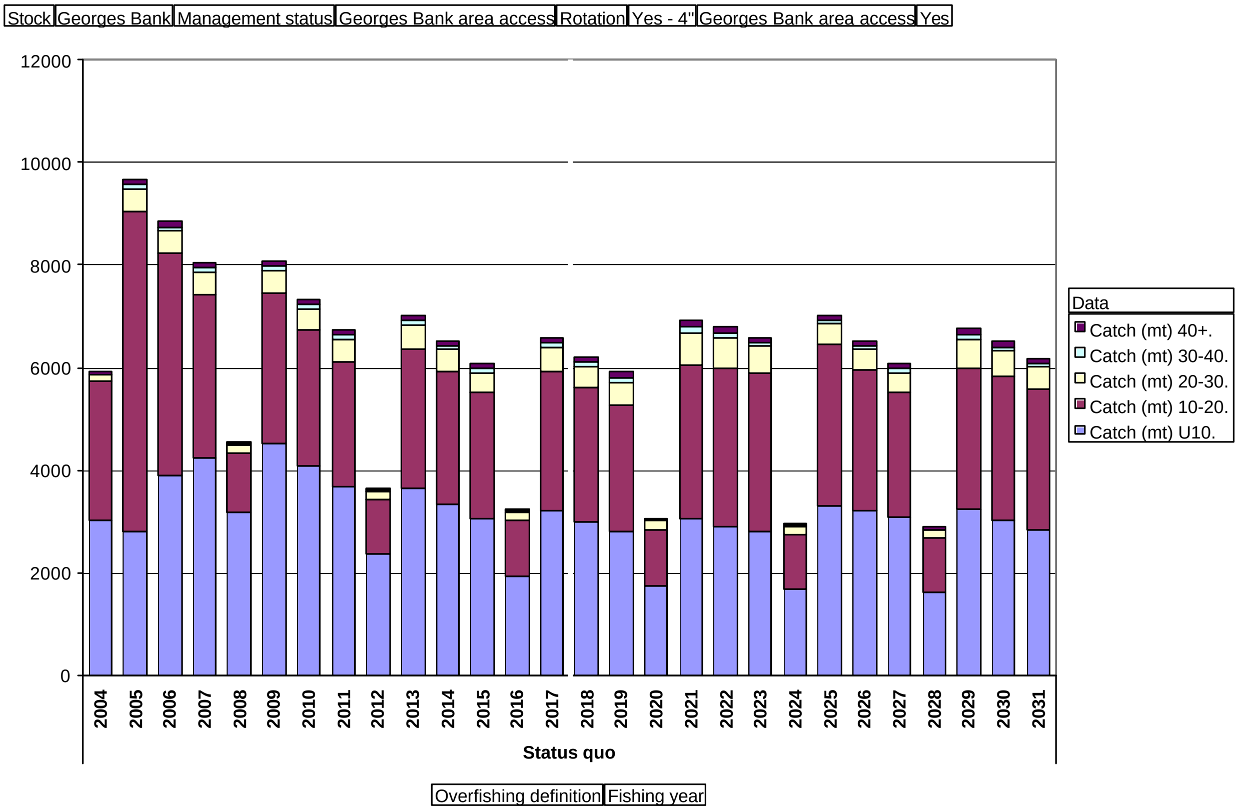


Figure 88. Projected landings (mt) from the Georges Bank closed area access program by meat count. 20,000 mt is equivalent to 44.1 million lbs.

With access, area rotation, and 3 ½ " rings, the projected landings under both overfishing definition alternatives are nearly identical, averaging about 19,000 and 21,000 mt for the status quo and alternative proposed overfishing definitions, respectively (Figure 89).

The size composition of the projected landings are, however, different. With the status quo overfishing definition, about 30% of the projected landings are U10s, 50 percent are 10-20, and 12 percent are 20-30. In contrast, the projected landings for the alternative proposed overfishing definition are 40% U10s, 45% 10-20, and 10% 20-30, favoring landings of larger scallops.

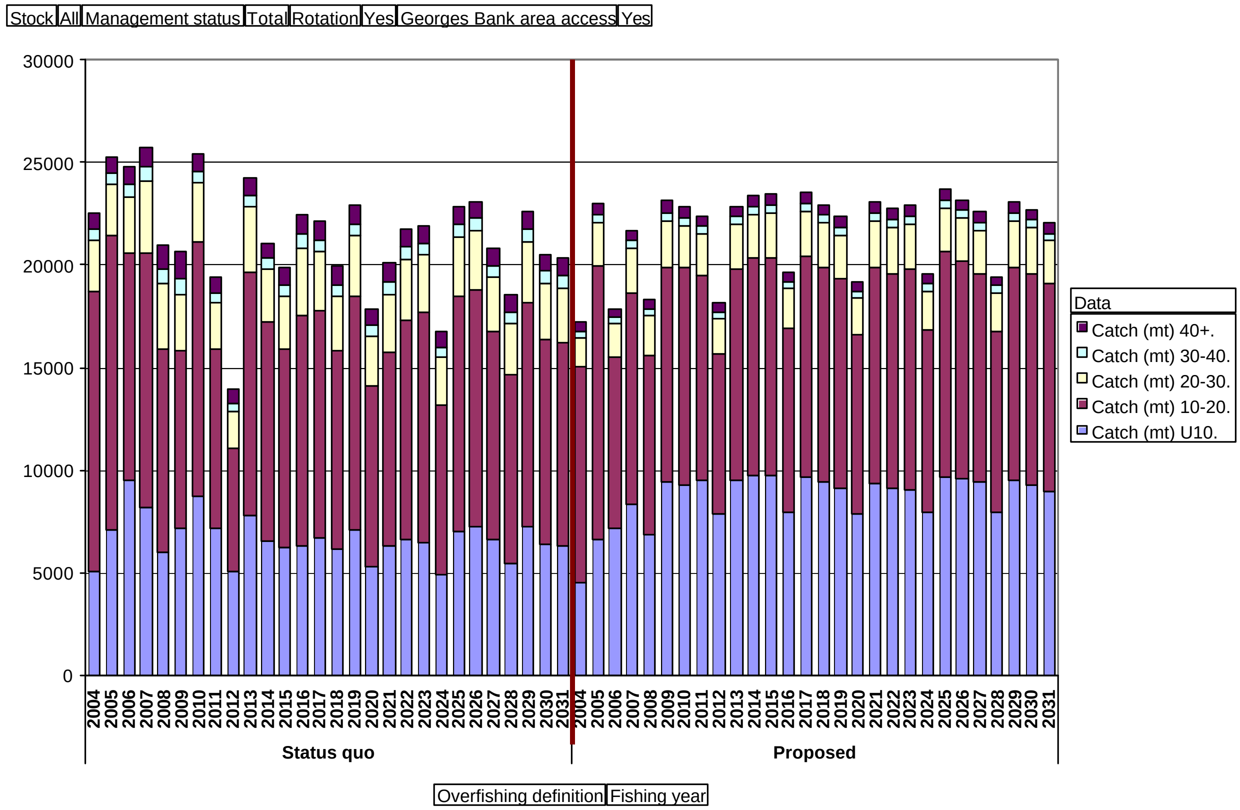


Figure 89. Projected landings (mt) by meat count for the status quo and alternative proposed overfishing definition, with rotation and access, and 3 ½ " rings. 20,000 mt is equivalent to 44.1 million lbs.

The difference in size composition and DAS use between the overfishing definition alternatives is borne out in the catch per DAS (LPUE) estimates (Figure 90). For the final alternative ("Status quo – Yes – 4"), catch rates are projected to increase from 1,721 lbs./day in 2003 to 2,157 lbs./day in 2004 with access. The average catch rate is projected to remain above 2,100 lbs./day through 2006 and then decline to 1,260 lbs./day by 2008.

With 3 ½ " rings and the status quo overfishing definition, catch rates are initially lower around 1,759 to 2,065 lbs./day in 2004 – 2006, falling to as low as 891 lbs./day in 2008. With access, the daily catches are actually higher without area rotation and using 3 ½ " rings. Daily catches are projected to increase to 2,150 to 2,359 lbs./day in 2004-2006 then decline only to 1,725 to 2,120 lbs./day.

In contrast, the daily catches with the alternative proposed overfishing definition are much higher, resulting from the catches derived from higher biomass, larger scallop size, and fewer DAS. Projected daily catches rise from 1,721 lbs./day in 2003 to 2,300 to 2,500 lbs./day throughout the projected time series.

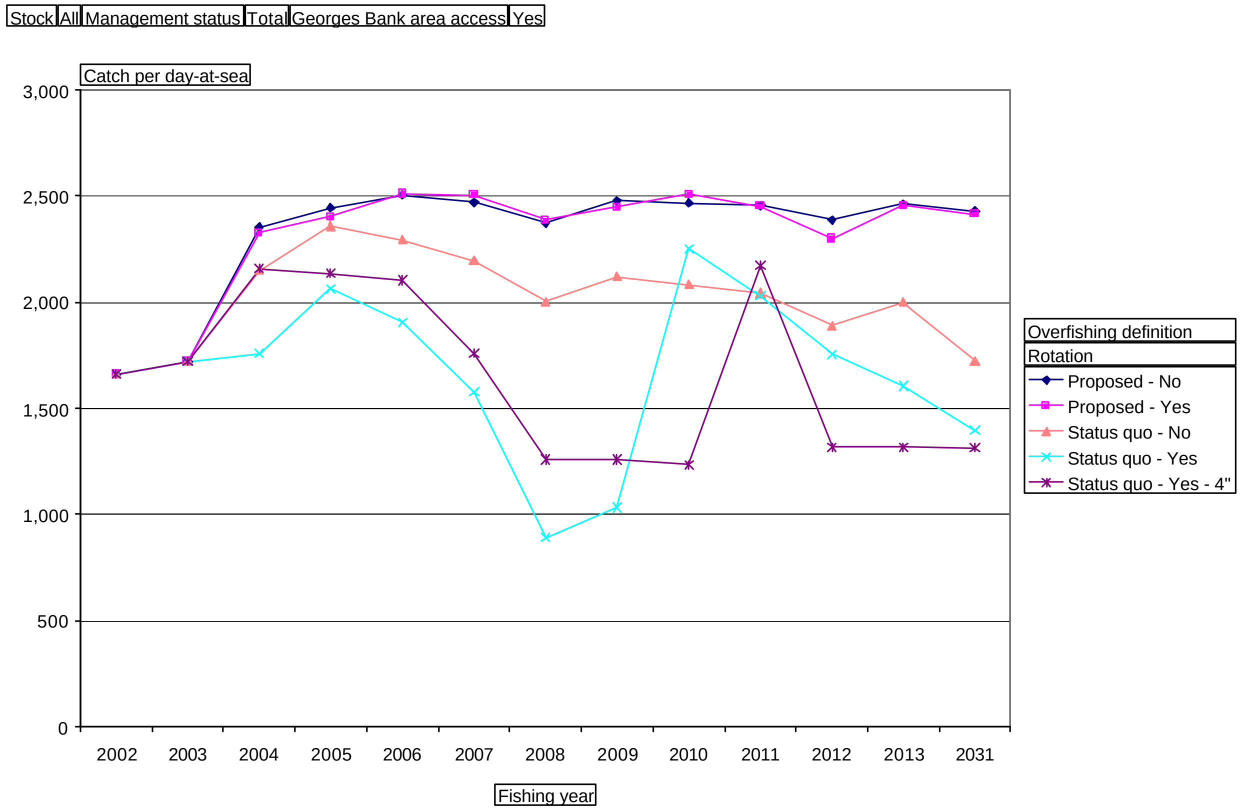


Figure 90. Trends in average catch rates (lbs./DAS) for limited access scallop vessels assuming access to the Georges Bank closed areas.

The projected landings for the two overfishing definition alternatives are much different from one another without access or area rotation, primarily due to the application of a resource-wide fishing mortality target by the status quo overfishing definition.

With the status quo overfishing definition, projected landings average around 19,000 mt (41.9 million pounds) per year from 2004-2006 (Figure 91). After that the projections indicate that average annual landings would decline precipitously to 8,600 mt (19.0 million pounds). Landings of U10 and 10-20 count scallops would decline from 75% of the total to only 30%.

In contrast, projected landings for the alternative proposed overfishing definition with no access or rotation would start around 13,000 mt (28.7 million pounds) in 2004 and with the exception of 2006, gradually increase to about 16,000 mt (35.3 million pounds). Because this overfishing definition applies the Fmax target to the available scallops, the size frequency distribution of landed scallops would be similar to that associated with the size structure expected when achieving maximum yield-per-recruit. The proportion of U10 landings to the total would increase from 15 percent in 2004 to the long-term average of about 35% by 2011. U10 and 10-20 count scallops combined would contribute to about 85% of total landings throughout the projection time series.

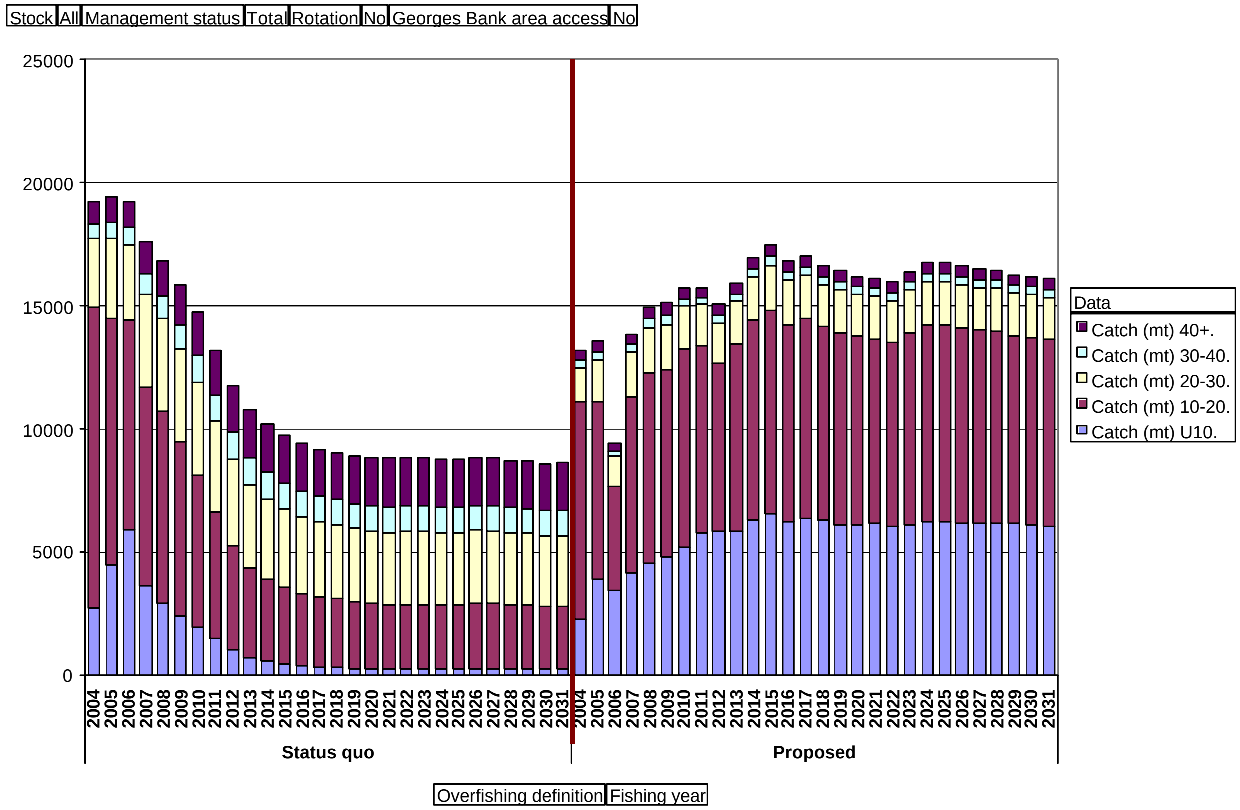


Figure 91. Projected landings (mt) for the status quo and alternative proposed overfishing definition, <u>without rotation or access</u>, and 3 ½ " rings. 20,000 mt is equivalent to 44.1 million lbs.

The final alternative ("Status quo – Yes – 4") with area rotation, but no Georges Bank access, the daily catches (LPUE) in open fishing areas are projected to decline from 1,721 – 1,747 lbs./day in 2003 and 2004 to less than 1,100 lbs./day beginning in 2005 (). Actually, without access, no rotation and 3 ½ " rings actually produces higher LPUE through 2009 than the final alternative. Projected LPUE is 1,679 to 1,892 lbs./day during 2004-2006, then declines to 1,066 lbs./day by 2009. After that, the final alternative ("Status quo – Yes – 4") is projected to produce higher LPUE.

The alternative proposed overfishing definition, in contrast, produces nearly the same catch rates as with access. Projected LPUE increases from 1,721 lbs./day in 2003 to around 2,300 lbs./day by 2007, even without access. Compared to the average LPUE with access, these projected catch rates are only slightly lower, reflecting the slightly lower productivity of areas outside of the Georges Bank closed areas.

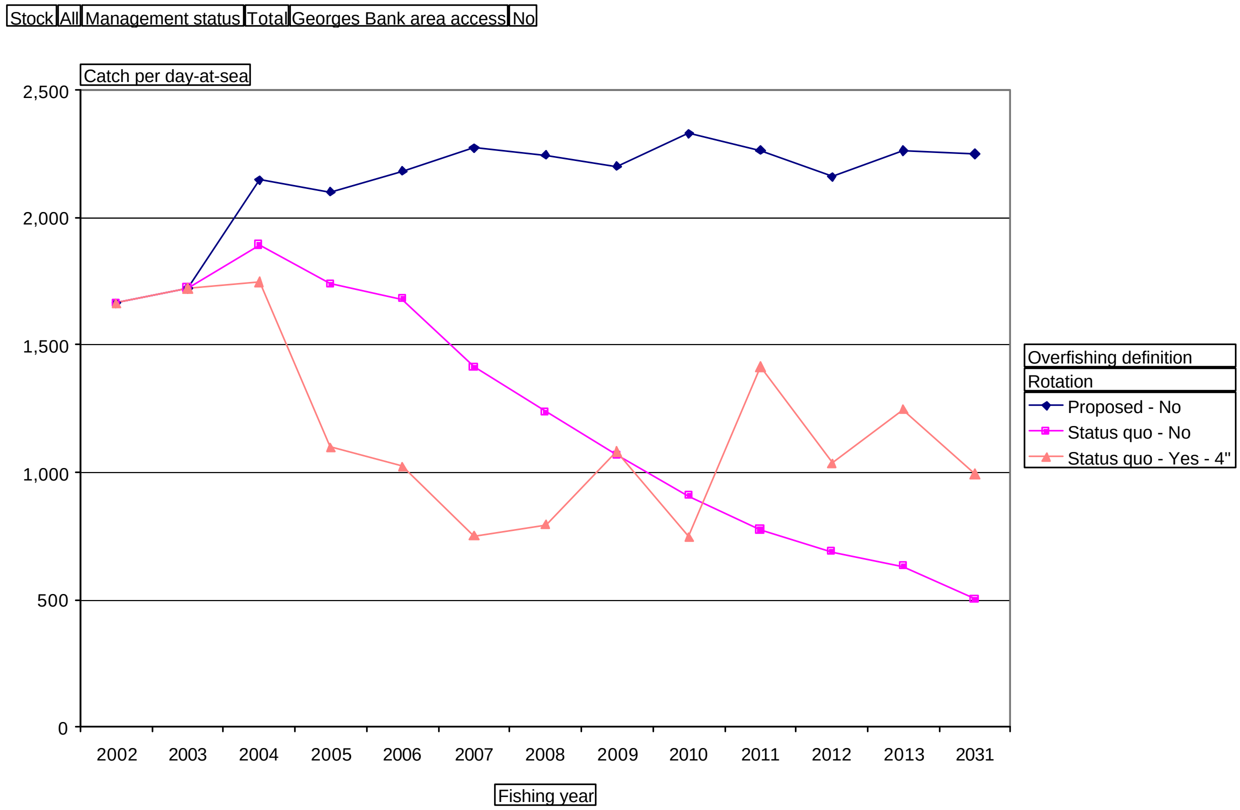


Figure 92. Trends in average catch rates (lbs./DAS) for limited access scallop vessels assuming no access to the Georges Bank closed areas.

8.2.3 Area-specific DAS and trip allocations

8.2.3.1 DAS allocations for open fishing areas

DAS allocations for open fishing areas were derived separately from those in controlled access areas, but treated similar to the DAS allocation procedures that have been applied since at least Amendment 7 for the 1998 fishing year. This procedure takes into account the number of vessels using days in the previous fishing year and the proportion of days allocated that they actually use. Since publication of the DSEIS, these data were updated for the VMS reports in the 2002 fishing year which were not yet available at that time. During 2002, active limited access scallop vessels, i.e. those using a scallop day-at-sea, were charged 85.3 percent of their annual day-at-sea allocations, assuming that they carried forward 10 days from the 2001 fishing year[71].

To evaluate how many DAS should be allocated to achieve a different DAS use target than was achieved in 2002, it was assumed that a limited access scallop vessel would use the number of days it was charged in 2002, unless the allocation to its permit class was less than the number of days used in 2002. In that case, it was assumed that the vessel would use all of its allocation. For potential full-time allocations more than 120, it was assumed that the DAS for that vessel would increase in the same

[71] According to law enforcement DAS data, the vast majority of limited access scallop vessels carry forward the maximum amount into the next fishing year.

proportion as the percent of days used in 2002 by that vessel. In other words, a vessel using 80 percent of 120 days allocated would use 80 percent of 135 days, or 108 days. In accordance with past Scallop FMP policies with regard to limited access DAS allocations, part-time scallop vessels receive 40 percent of the full-time DAS allocation and occasional vessels receive 1/12th of the full-time DAS allocation, both rounded to the nearest integer.

The final projection results by rotation management area, described above, were adjusted to take into account the overlap between the rotation management areas and controlled access areas, the latter having the DAS allocations adjusted for the 12 DAS/18,000 lb. tradeoff. The proposed rotation area management closure in the Mid-Atlantic (Section 5.1.3.3) has considerable overlap with rotation area management "MA4", which was assumed to have no fishing activity during 2004 – 2006. Rotation management areas "MA5" and "MA6" in the projections were assumed to overlap and account for the effort and landings from the Hudson Canyon Area, where a tradeoff would apply and the DAS allocations were handled through the procedure described in the section below.

The remaining day-at-sea estimates from the final projections in Section 8.2.2.3 were summed and the equivalent full-time, part-time, and occasional DAS allocations were calculated using the procedure described above in this section. The 2004 – 2006 results are shown in Table 166. The projected allowable DAS use values were adjusted by deducting a three percent set-aside to account for the program to fund at-sea observers, scallop research, and cooperative industry surveys. For example, in the open fishing areas, the 2004 target DAS use was 11,657 days which was reduced by 350 fishing days for the set-asides.

Using the relationship between days allocated to active fishing vessels and their actual DAS use, shown in Figure 93, the equivalent allocation for 11,307 days was 42 full-time, 17 part-time, and 4 occasional DAS. Similar calculations gave the results for 2005 and 2006, with and without access to the Georges Bank groundfish closed areas. As explained in the final projection summaries, the allowable DAS use in the open areas is higher than with access, because it takes more effort in the open areas to achieve a resource-wide F = 0.2 target when large areas are closed to fishing.

Table 166. Allowable open area DAS use to achieve the resource-wide target fishing mortality rates (F = 0.2), without and with access to Framework 13 parts of the Georges Bank closed areas.

	2004	2005	2006
DAS use without access	17,130	30,359	37,594
Less 3% set-aside	16,616	29,448	36,466
Full-time DAS allocation	62	117	152
Part-time DAS allocation	25	47	61
Occasional DAS allocation	5	10	13
DAS use with access	11,657	11,134	18,660
Less 3% set-aside	11,307	10,800	18,100
Full-time DAS allocation	42	40	67
Part-time DAS allocation	17	16	27
Occasional DAS allocation	4	3	6

8.2.3.2 Area-specific DAS allocations for controlled access fishing areas

Unlike the allowable DAS estimates for open areas which are a function of the catch that would achieve the annual target fishing mortality rate and the estimated landings per day-at-sea[72], the DAS allocations for controlled access areas were calculated directly from the estimated TACs. Swept-area biomass estimates were derived from the NMFS R/V Albatross survey data, which were often supplemented with additional tows in the controlled access areas to increase the precision of these estimates. Where appropriate, the SMAST video survey data were also used to estimate the TAC. Due to questions and concerns about some of the data, the PDT agreed that the best treatment of all data was to apply the size frequency information from the Albatross survey to the density estimates for both surveys, until the video survey size frequency data were peer reviewed by the SARC. The PDT furthermore decided that the SARC-reviewed, shell-height/meat-weight relationships should be used.

The total potential number of allocated trips was calculated by dividing the scallop possession limits into the TACs (after deducting a 3 percent set-aside to provide funds for scallop research, observers, and the cooperative industry survey), then allocating these trips to full-time, part-time, and occasional categories. The Council agreed that the policy that should apply to the three permit categories were that part-time vessels should be allocated 40 percent of the number of trips assigned to full-time vessels and occasional vessels should be allocated 1/12th the number of trips assigned to full-time vessels, both rounded down to the nearest integer number of trips as long as vessels received at least one trip per vessel. The Council also decided that the best approach would be to allocate a pool of controlled access trips and DAS that vessels may take to any controlled access area, but that there would be a maximum number of trips that a limited access scallop vessel may take for each area.

[72] Commercial landings per DAS were modeled using the historic relationship between survey abundance and commercial LPUE, as modified by a cap on landings per day-at-sea imposed by the crew size restriction. This cap varies with the expected average scallop size, but is roughly 50,000 scallops per vessel-day.

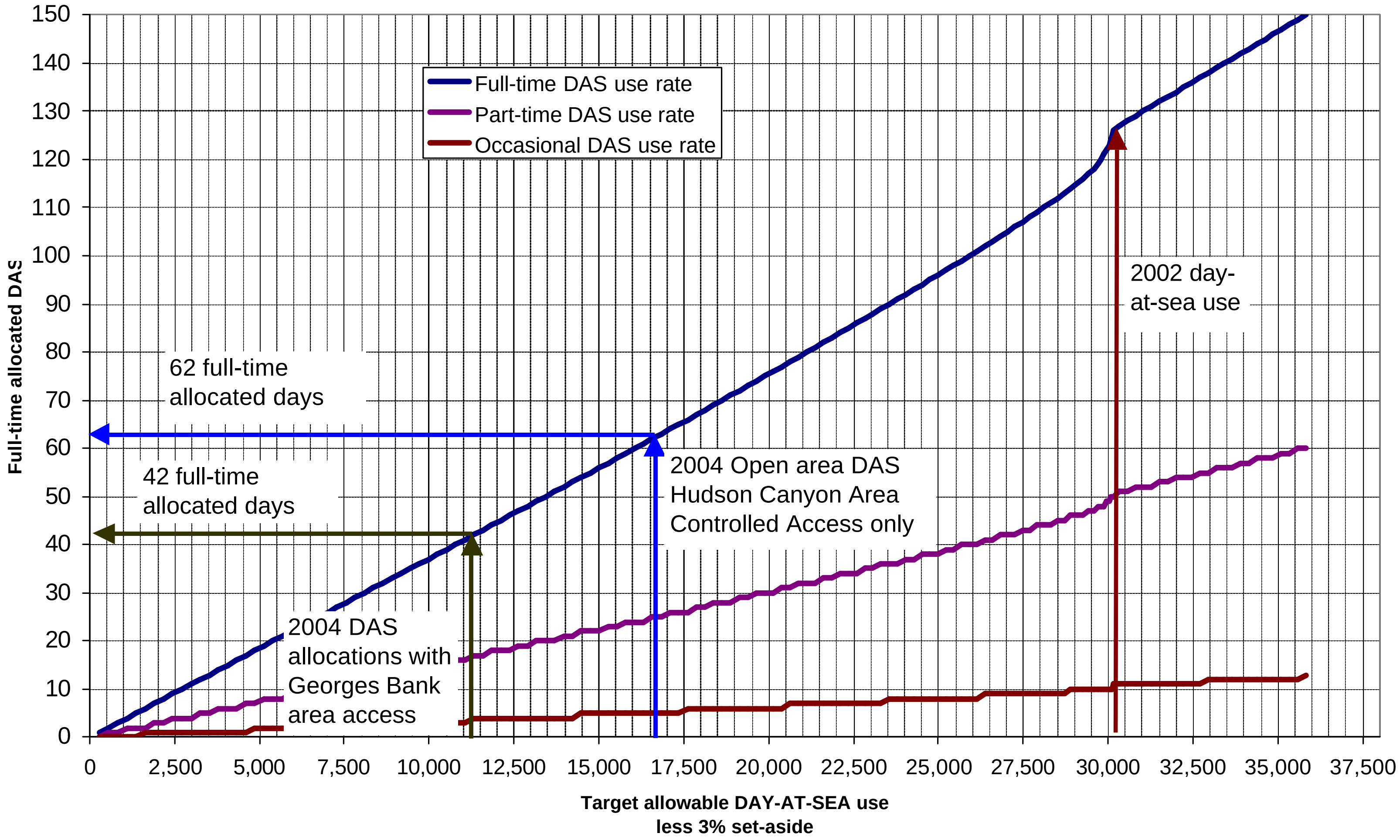


Figure 93. Calculation of limited access day-at-sea allocations from 2002 baseline day-at-sea estimates, applied to open area DAS use targets to achieve target fishing mortality rate.

This approach to allocating controlled access DAS and trips would avoid several potential problems. First, it would avoid allocating an unfairly large share of trips to part-time and occasional vessels if they were to receive no less than one trip in each area. In some cases, a full-time vessel might receive one or two trips, making the part-time and occasional allocation equal to 100 or 50 percent of the full-time allocation. Alternatively, this pooling procedure would avoid a potential regulatory burden of NMFS determining which area to allocate a trip or two to each part-time or occasional vessel, depending on its stated preference, possibly during the annual permit application process. Lastly, the pooled approach potentially reduces the need for part-time and occasional vessels to exchange trips with other vessels – they simply take the number of trips allocated provided that the total number of trips taken for a vessel does not exceed the number of allowable trips for each area.

Based on public testimony and advice, the Council also chose to apply a 1,500 lb/DAS tradeoff which was a 23 to 50 percent reduction compared to the expected LPUE in each controlled access area (see below). The length of the trip was evaluated with respect to this tradeoff and the one that gave the most profits per vessel was chosen (see Section 8.7.4.9). There were no biological implications of the tradeoff or the length of the trip, other than that associated with the proportion of the TAC that could be taken. Obviously, scallop fishing mortality, finfish bycatch, and bottom contact time all vary in direct proportion with the amount of the TAC that will be taken with the allocated trips.

In essence, the DAS tradeoff allows the plan to allocate more DAS than will actually be fished and unlike previous management the DAS cannot be fished outside of the controlled access areas. This procedure allows the FMP to allocate more DAS on paper than will actually be fished. Limited access scallop vessels will be allocated extra DAS in the controlled access areas and may fish at a more leisurely pace than when fishing elsewhere, because each trip will "burn" 12 DAS even though the trip will probably be much shorter if the crew and vessel were operating at capacity around the clock, like vessels do when fishing normally.

Using the average projected landing per day (LPUE) estimates for the controlled access areas and applying a 12 DAS/18,000 lbs. tradeoff implies that the average trip will last 7.2 days to land 18,000 lbs., a value that varies with the catch rates and crew's shucking capacity between areas, seasons, and vessels. In 2005 with controlled access for the Hudson Canyon Area and Closed Area II, the average trip length is expected to be 8.2 days to landing 18,000 lbs. of scallop meats.

The Council also decided based on public input that controlled access DAS should be allocated in trip-length blocks and unlike previous policy the controlled access DAS could not be used to fish in fully-open fishing areas. Even if limited access vessels take fewer controlled access trips than they are allocated, this decision will have a substantial conservation effect in open fishing areas and reduce scallop fishing mortality, which has been problematically high especially in the Mid-Atlantic region (Figure 94).

Applying the above formulation to the estimated TACs for controlled access areas (see below), the DAS allocations for the Hudson Canyon Area, which will remain under controlled access rules during 2004-2005, will be 48 days for full-time, 12 days for part-time, and 12 days for occasional vessels, equivalent to 4, 1, and 1 allocated trips respectively. This will decline to 36 DAS/3 trips for full-time and 12 DAS/1 trip for part-time and occasional vessels in 2005, because although the target fishing mortality will increase from 0.4 to 0.48, the TAC is estimated to decline from 18.8 million lbs. (8,523 mt) to 15.0 million lbs. (6,784 mt).

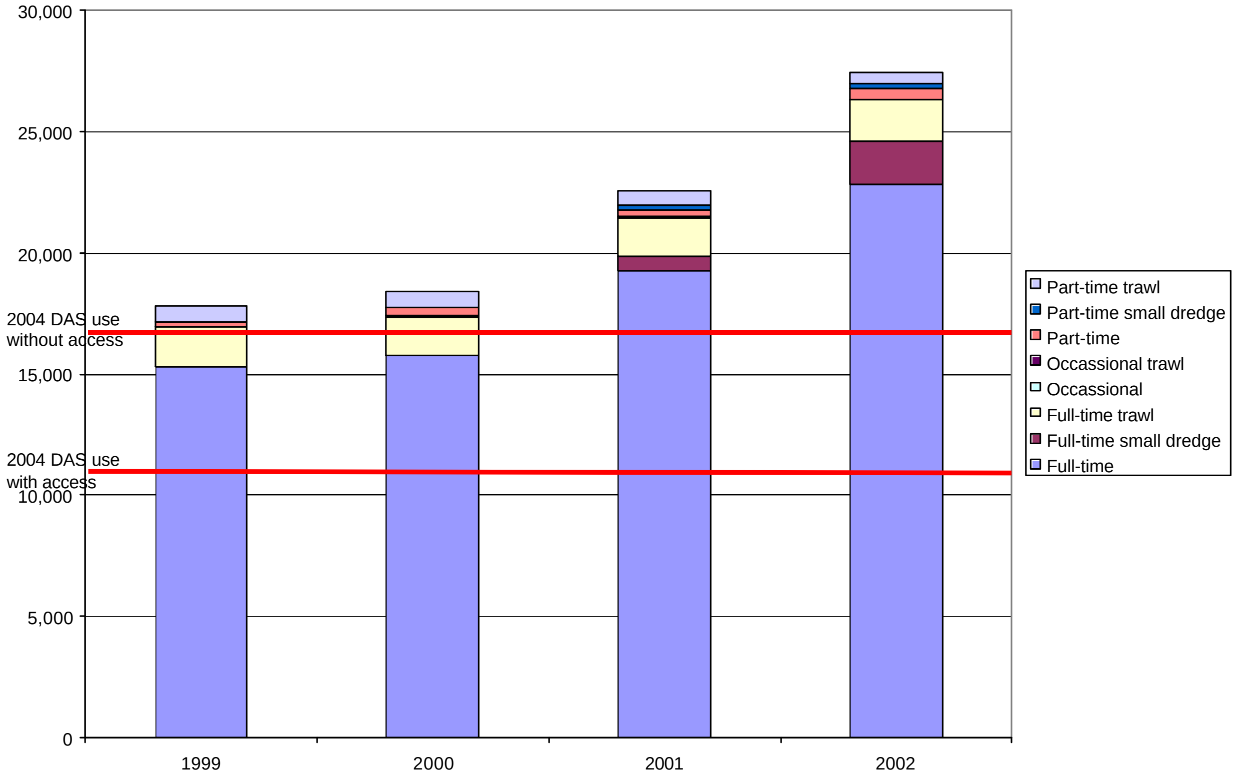


Figure 94. 1999 – 2000 DAS use by limited access vessels using VMS compared to total allowable DAS use for 2004 associated with 62 full-time DAS allocations without Georges Bank access and 42 full-time DAS allocations with Georges Bank access.

If Framework Adjustment 16/39 allows access to the groundfish closed areas in 2004 and beyond, the controlled access trips would increase from to seven trips, or 84 DAS in both 2004 and 2005, equivalent to 84 DAS. Part-time vessels would receive an increase from one to two trips, or 24 DAS, which may be fished in any open controlled access area as long as the trips taken do not exceed the maximum number of trips for each area.

During 2004, the maximum number of trips for limited access vessels to take will be 4 in the Hudson Canyon Area, and 2 trips in the Nantucket Lightship Area and 1 trip in Closed Area I pending approval of Framework Adjustment 16/39. In 2005, limited access vessels would be allowed to take a maximum of 3 trips in the Hudson Canyon Area and 4 trips in Closed Area II, the latter pending approval of Framework Adjustment 16/39. The Hudson Canyon Area is expected to convert to a fully-open status in 2006, making Closed Area II the only controlled access area for those years. Estimates based on the 2002 survey indicate that 4 trips and 48 DAS may be allowed during 2006 and 3 trips and 36 DAS during 2007 for full-time vessels. When the Mid-Atlantic “Elephant Trunk Area” will be ready for re-opening is uncertain, but generally the projection analyses in Section 8.2.1.3 suggest that a three-year closure provides satisfactory results in terms of optimizing yield-per-recruit. On the other hand, the Council may vary the time when closed rotation management areas re-open under controlled access rules, depending on actual resource conditions and rotation management outlook.

Table 167. Maximum number of limited access trips by controlled access area and number of allocated trips and DAS by permit category, assuming approval of Framework Adjustment 16/39 to allow access to the Georges Bank groundfish closed areas.

	2004		2005		2006		2007	
	Trips	DAS	Trips	DAS	Trips	DAS	Trips	DAS
Hudson Canyon Area	4		3		NA		NA	
Nantucket Lightship Area	2		Closed		Closed		Closed	
Closed Area I	1		Closed		Closed		Closed	
Closed Area II	Closed		4		4		3	
Full-time	7	84	7	84	4	48	3	36
Part-time	2	24	2	24	1	12	1	12
Occasional	1	12	1	12	1	12	1	12

8.2.3.3 TAC estimates from R/V Albatross dredge survey and video survey data

The Scallop PDT reviewed and compared the video survey with the dredge survey data. One conspicuous difference was first identified in the size frequency data for the Nantucket Lightship Area. It was observed that the video survey data had measurements of scallops that did not appear in the dredge survey data, the former observing scallops between 180 and 205 mm. Also, it appeared that the video survey year class peaks were not well correlated with those observed in the dredge survey.

Despite a more thorough validation by Dr. Stokesbury and SMAST, the cause of these differences could not be explained and were found to be even more wide-spread when comparing the size frequency distributions for other areas and years. This latter effort compared the size frequency distributions for the Albatross tow stations that coincided with the boundaries of the SMAST video surveys that were also in the Framework Adjustment 13 area access boundaries.

The PDT recommended that the video survey abundance densities be merged (i.e. a weighted average) with the Albatross densities to estimate area access TACs. This was done for the 2002 data for the Nantucket Lightship Area, but not for other areas with surveys in 2001 or earlier. The PDT also recommended using the SAW 29 shell height meat weight relationships.

In addition, the biomass and TAC estimates using the SMAST video survey length frequencies, applying a commercial ogive from SAW 20 and the SAW 29 shell height meat weight relationships were estimated for comparison. While the video-survey based estimates were higher for the Nantucket Lightship Area and Closed Area II, in the end it really didn’t make a difference (see Table 170) as the increased TAC did not allow for allocations of more trips for area access.

Nonetheless, the video survey estimates improve the precision of the estimate because many more samples are taken. Furthermore, the video survey can be very helpful in distinguishing the boundaries of beds of similar size or small scallops, as was done to evaluate the proposed Mid-Atlantic rotation area management closure, above.

Three explanations remain that relate to the observed differences between the size frequencies for the two surveys:

The video size frequency data is smoothed and affected by random and systematic sampling error. The random error was estimated by SMAST to be about 5 percent. A systematic error results from the step function assumed to correct for lens diffraction in salt water. Photogrammetry methods might be explored to address both of these error sources.

Length frequency sampling error on the dredge survey has not been estimated, but may also apply.

The lined survey dredge and the commercial dredge may not catch the very large scallops that are observable in the video survey. Even though Dr. Stokesbury had samples of shells approaching 200 mm, these very large scallops have not been observed in the commercial dredge samples taken by Dr. DuPaul and have not been observed in the dredge survey. This possibility, by the way, suggests a dome shaped partial recruitment curve if very large scallops are not available to the fishery.

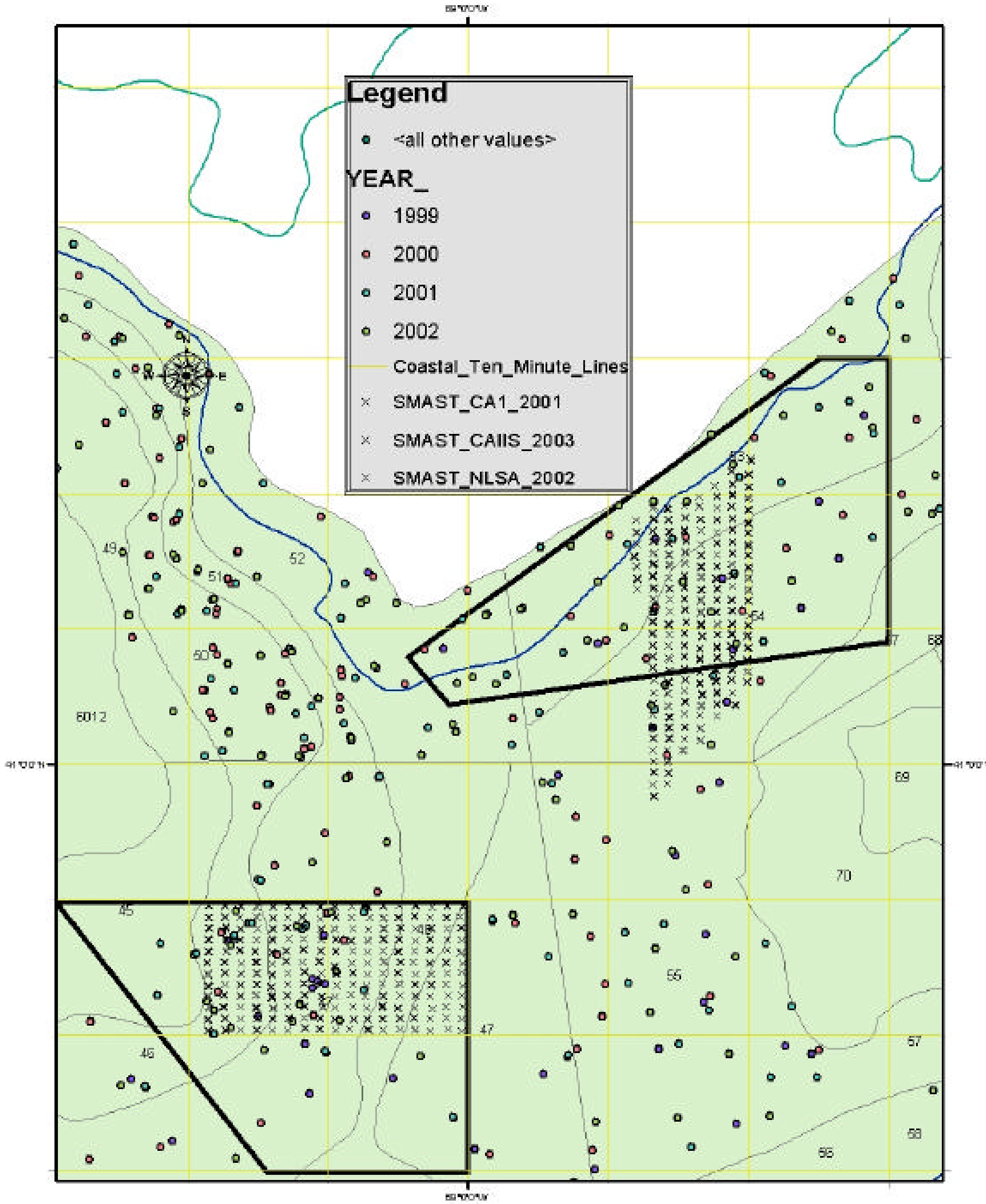


Figure 95. Comparison of SMAST video survey stations with NMFS R/V Albatross scallop survey tow locations and proposed area access boundaries for Closed Area I and Nantucket Lightship Area.

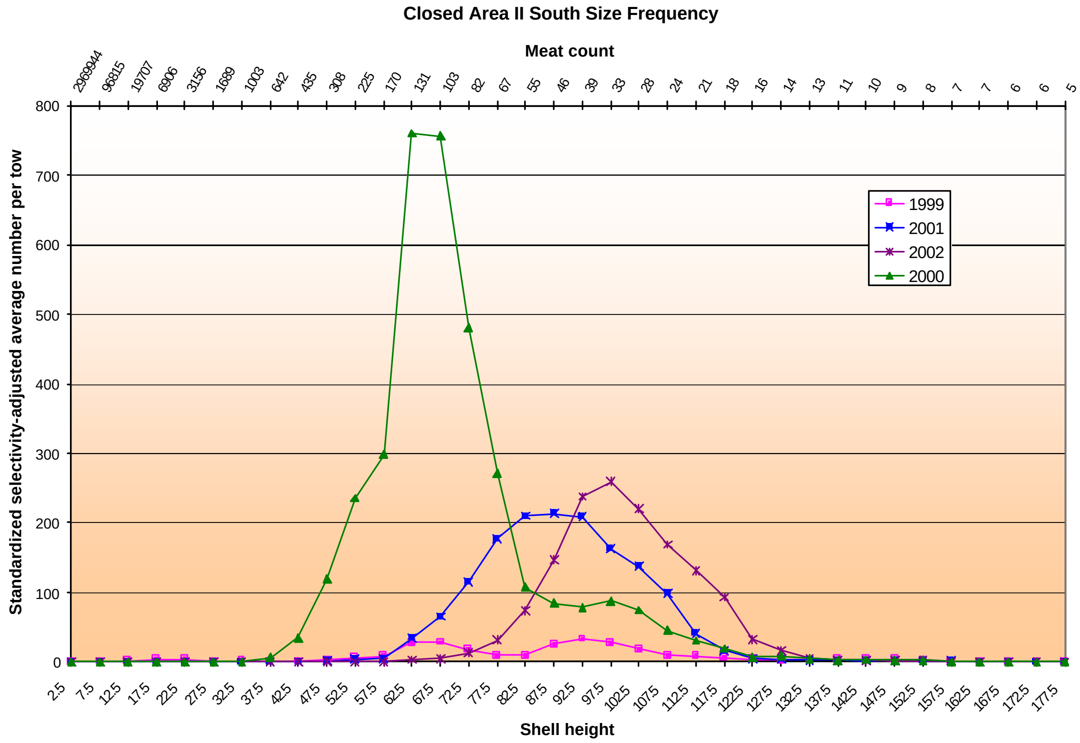


Figure 96. Shell height and meat count size frequency distribution of R/V Albatross scallop survey tows in Closed Area II South (GB14).

Table 168. Video survey based TAC estimates with a 0.2 fishing mortality target.

Video survey estimate	Selectivity / Year		*NLSA02*	*CA12001*	*CA2S2001*
Average MEAT WEIGHT	All		36.91	26.00	11.30
	90+		40.17	27.60	14.55
	Full recruits		39.46	27.20	12.74
	Full & partial		38.24	26.65	11.36
	Full & partial < 180		36.39	26.42	11.36
Density	All		0.820	0.35	1.07
	90+		0.744	0.326	0.636
	Full recruits		0.761	0.000	0.000
	Full & partial		0.790	0.341	1.062
	Full & partial < 180		0.773	0.339	1.062
	Ratio of biomass density without < 180 mm		93%	99%	100%
Fishable area (km^2)			1,356	1,250	4,327
Fishable area (nm^2)			395	365	1,261
Surveyed area (km)			504	405	153
2001/2002 Baseline (mt):			4996	5256	31747
2004 Baseline (mt):			10277	4671	49729
Exploitable biomass change to 2004		2004	103.2%	111.8%	167.0%
Projected change in exploitable biomas		2005	84.6%	86.7%	97.2%
		2006	72.5%	76.9%	90.8%
		2007	63.2%	69.8%	84.1%
Target F = 0.2					
Estimated exploitable biomass		2004	15,724	4,110	58,444
TAC estimates (mt)		2004	2,818	752	11,217
		2005	2,383	652	10,904
		2006	2,042	578	10,189
		2007	1,782	525	9,438

The biomass estimates and associated TACs above are based on the video survey size frequencies for the Nantucket Lightship Area in 2002 and in Closed Area I in 2001. Both exploitable biomass estimates are projected forward by applying the ratio of exploitable biomass estimates for the projections to 2004 to 2007. The biomass estimates for Closed Area II were based on the R/V Albatross mean catch per tow in 5 mm increments. This estimate, however, is probably an overestimate of the true value – either in 2001 or projected forward into 2004. During the 2001 video survey, SMAST sampled a subsection of Closed Area II South – the part that had the high concentrations of sea scallops. In comparison, the SMAST data for Closed Area II South in 2003 measured 0.2 scallops per m2, which using the SMAST estimates equates to only 21,980 mt, compared with the 61,153 mt of biomass estimated here from the 2001 video survey densities. During the surveys, SMAST also observed an elevated clapper ratio of about 14%.

For all three areas, the applicable shell height meat weight relationships from SAW 29 were applied and various selectivity ogives were applied to determine average meat weight and abundance density. The commercial cull ogive estimated by SAW 20 was also applied to estimate the total biomass of exploitable scallops and TACs were estimated by applying Baranov's catch equation (Baranov 1918).

To compare the effect that greater than 180 mm scallops (observed by the video survey, but not by the dredge survey or in the commercial catch), an ogive was applied that assumed no commercial catches of scallops greater than 180 mm. Doing so for the Nantucket Lightship Area reduced the abundance density by 7 percent and would have reduced the biomass estimate and TAC by 11 percent (because the average meat weight of the catch is smaller). This effect was smaller in the Closed Area I, because the video survey observed a smaller fraction of the catch above 180 mm.

Table 169. Video survey based TAC estimates with a 0.4 fishing mortality target.

Video survey estimate	Selectivity / Year	*NLSA02*	*CA12001*	*CA2S2001*
Average MEAT WEIGHT	All	36.91	26.00	11.30
	90+	40.17	27.60	14.55
	Full recruits	39.46	27.20	12.74
	Full & partial	38.24	26.65	11.36
	Full & partial < 180	36.39	26.42	11.36
Density	All	0.820	0.35	1.07
	90+	0.744	0.326	0.636
	Full recruits	0.761	0.000	0.000
	Full & partial	0.790	0.341	1.062
	Full & partial < 180	0.773	0.339	1.062
	Ratio of biomass density without < 180 mm	93%	99%	100%
Fishable area (km^2)		1,356	1,250	4,327
Fishable area (nm^2)		395	365	1,261
Surveyed area (km)		504	405	153
2001/2002 Baseline (mt):		4996	5256	31747
2004 Baseline (mt):		10277	4671	49729
Exploitable biomass change to 2004	2004	103.2%	111.8%	167.0%
Projected change in exploitable biomas	2005	71.1%	73.0%	97.2%
	2006	75.2%	79.7%	90.8%
	2007	80.1%	87.8%	84.1%
Target F = 0.4				
Estimated exploitable biomass	2004	15,724	4,110	58,444
TAC estimates (mt)	2004	5,090	1,427	20,435
	2005	3,619	1,042	19,864
	2006	3,829	1,137	18,562
	2007	4,076	1,253	17,193

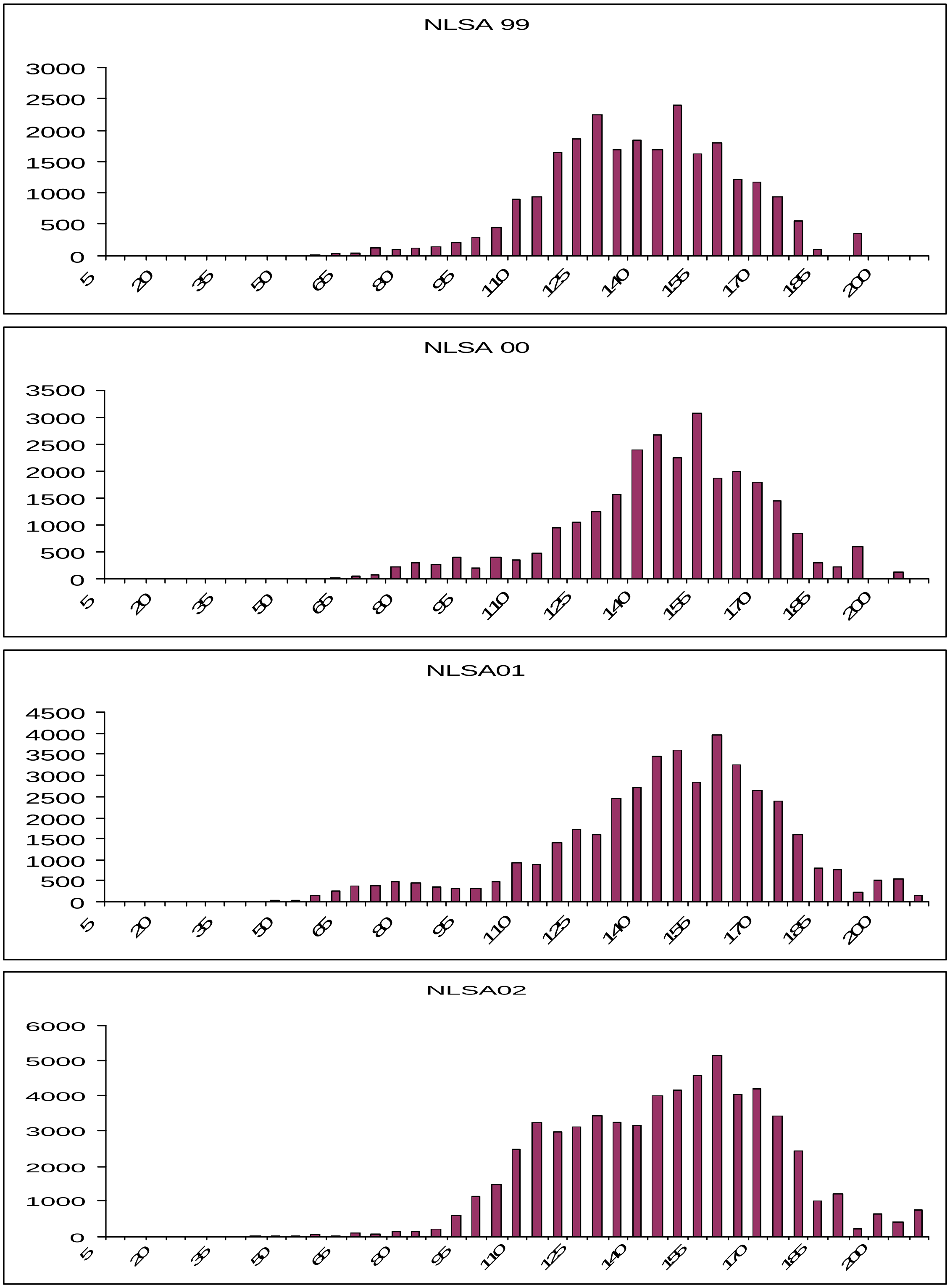


Figure 97. Total observed biomass size frequencies for Nantucket Lightship Area video surveys.

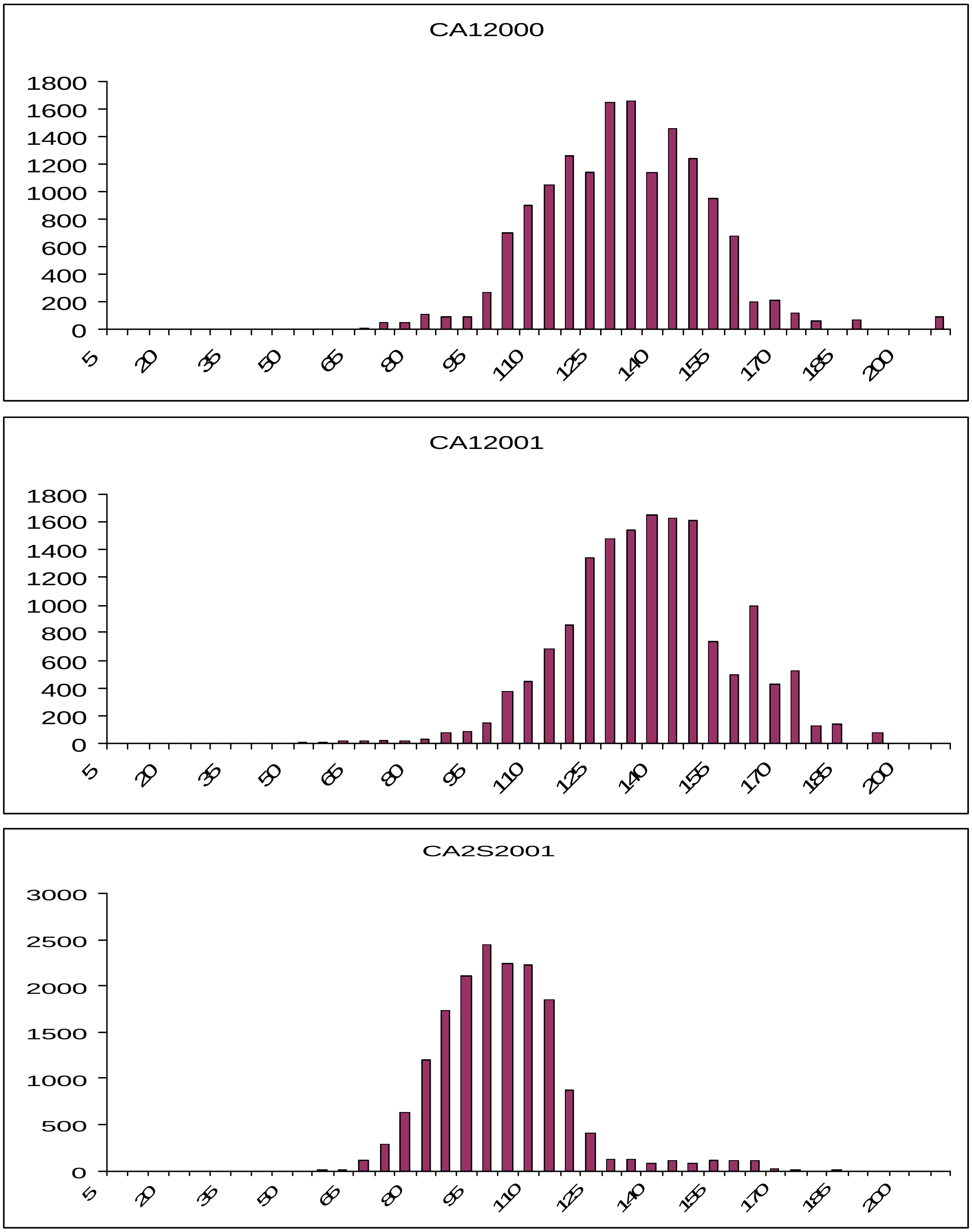


Figure 98. Total observed biomass size frequencies for Closed Area I and II video surveys. R/V Albatross scallop abundance size frequency was substituted for the video survey for Closed Area II, for estimating the TACs in this document.

Table 170. Biomass and TAC estimates by area and year for various fishing mortality targets. TACs for fishing mortality targets above 0.4, assumed that the area was fished at 0.4 in the previous years of the projection.

2004 TACs

	2004 projected biomass (mt)	Fishing mortality target 0.2	Video	0.4	Video	0.48	0.6	0.8
Hudson Canyon Area	21729	4,678		8,523		9,861	11,683	14,282
Closed Area I	4671	855	752	1,622	1,427	1,877	2,224	2,719
Closed Area II South	49729	9,545	11,217	16,615	20,435	19,238	22,814	27,934
Nantucket Lightship Area	10277	1,842	2,818	3,327	5,090	3,850	4,561	5,575

2005 TACs

Target F in 2004	2005 projected biomass (mt) Alternative 3: F=0.2	Alternative 1: F=0.4	Fishing mortality target 0.2	Video	0.4	Video	0.48	0.6	0.8
Hudson Canyon Area		17295	3,724		6,784		7,849	9,299	11,368
Closed Area I	4048	3410	741	652	1,406	1,042	1,627	1,927	2,356
Closed Area II South	48340		9,278	10,904	16,151	19,864	18,701	22,177	27,154
Nantucket Lightship Area	8691	7306	1,557	2,383	2,813	3,619	3,255	3,857	4,715

2006 TACs

Target F in 2004 - 2005	2006 projected biomass (mt) Alternative 3: F=0.2	Alternative 1: F=0.4	Fishing mortality target 0.2	Video	0.4	Video	0.48	0.6	0.8
Hudson Canyon Area		13776	2,966		5,403		6,252	7,407	9,054
Closed Area I	3591	3722	657	578	1,247	1,137	1,443	1,710	2,090
Closed Area II South	45171		8,670	10,189	15,093	18,562	17,475	20,723	25,374
Nantucket Lightship Area	7446	7731	1,334	2,042	2,410	3,829	2,789	3,304	4,039

2007 TACs

Target F in 2004 - 2006	2007 projected biomass (mt) Alternative 3: F=0.2	Alternative 1: F=0.4	Fishing mortality target 0.2	Video	0.4	Video	0.48	0.6	0.8
Hudson Canyon Area		10352	2,229		4,060		4,698	5,566	6,804
Closed Area I	3259	4100	597	525	1,132	1,253	1,310	1,552	1,897
Closed Area II South	41839		8,030	9,438	13,979	17,193	16,186	19,194	23,502
Nantucket Lightship Area	6500	8229	1,165	1,782	2,104	4,076	2,435	2,885	3,526

The Nantucket Lightship Area projected TAC is a weighted average of the dredge survey and video survey estimates. Video survey TAC estimates were derived by applying the SAW 29 shell height meat weight relationships and a commercial cull ogive to the video survey size frequencies, except for Closed Area II where the R/V Albatross size frequencies were substituted.

Table 171. Projected biomasses and catches in controlled access areas by year.

2004 Projected Biomasses and Catches in Closed/Access Areas

Area	Fishing mortality	Exploitable biomass (mt)	Mean exploitable weight (g)	Landings (mt)	Landings, video adjusted (mt)	Catch per day used	Allowable days used	21000 310 Trips (21,000 lbs; 310 vessels)	Days accumulated	Area swept (nm^2)
Hudson Canyon Area	0.4	21729	21.7	8523	8523	2451	7,666	3	8,948	657
Closed Area I (GB9)	0.4	4671	30.8	1622	1622	2279	1,569	1	1,703	235
Nantucket Lightship Area (GB12)	0.4	10277	40.4	3327	3685	3024	2,687	1	3,869	75
Closed Area I (GB9)	0.2	4671	28.4	855	855	2398	786	0	898	117
Closed Area II (GB14)	0.2	49729	30.8	9545	9545	2666	7,893	3	10,021	292
Nantucket Lightship Area (GB12)	0.2	10277	40.4	1842	2040	3064	1,468	1	2,142	37
				GB9 & GB12	5307	2749	4,256	2	5,571	310

2004 Projected Biomasses and Catches in Closed/Access Areas based on video only

Area	Fishing mortality	Exploitable biomass (mt)	Mean exploitable weight (g) during survey	Landings (mt)	Landings, video adjusted (mt)	Catch per day used	Allowable days used	Trips (21,000 lbs; 310 vessels)	Days accumulated	Area swept (nm^2)
Hudson Canyon Area						2451				
Closed Area I (GB9)	0.4	4109	26.65	1622	1427	2279	1,380	0	1,498	
Nantucket Lightship Area (GB12)	0.4	14195	38.24	3327	5090	3024	3,711	2	5,344	
Closed Area I (GB9)	0.2	4108	26.65	855	752	2398	691	0	789	
Closed Area II (GB14)	0.2	58440	11.36	9545	11217	2666	9,276	4	11,776	
Nantucket Lightship Area (GB12)	0.2	14196	38.24	1842	2818	3064	2,028	1	2,958	
				GB9 & GB12	6517	2822	5,091	2	6,842	-

2005 Projected Biomasses and Catches in Closed/Access Areas

Area	Fishing mortality	Exploitable biomass (mt)	Mean exploitable weight (g)	Landings (mt)	Landings, video adjusted (mt)	Catch per day used	Allowable days used	21000 310 Trips (21,000 lbs; 310 vessels)	Days accumulated	Area swept (nm^2)
Hudson Canyon Area	0.48	17295		6784	6784	1951	7,666	2	7,122	
Closed Area I (GB9)	0.4	3410		1406	1406	1664	1,863	0	1,476	
Nantucket Lightship Area (GB12)	0.4	7306		2813	3116	2150	3,195	1	3,271	
Closed Area I (GB9)	0.2	4048		741	741	2078	786	0	778	
Closed Area II (GB14)	0.2	48340		9278	9278	2592	7,893	3	9,740	
Nantucket Lightship Area (GB12)	0.2	8691		1557	1724	2591	1,467	1	1,810	
				HCA & GB14	16062	2276	15,559	5	16,862	-

2006 Projected Biomasses and Catches in Closed/Access Areas

Area	Fishing mortality	Exploitable biomass (mt)	Mean exploitable weight (g)	Landings (mt)	Landings, video adjusted (mt)	Catch per day used	Allowable days used	21000 310 Trips (21,000 lbs; 310 vessels)	Days accumulated	Area swept (nm^2)
Hudson Canyon Area	0.48	13776		5403	5403	1554	7,666	2	5,672	
Closed Area I (GB9)	0.4	3722		1247	1247	1816	1,514	0	1,309	
Nantucket Lightship Area (GB12)	0.4	7731		2410	2669	2275	2,587	1	2,802	
Closed Area I (GB9)	0.2	3591		657	657	1844	786	0	690	
Closed Area II (GB14)	0.2	45171		8670	8670	2422	7,893	3	9,102	
Nantucket Lightship Area (GB12)	0.2	7446		1334	1477	2220	1,467	1	1,551	
				HCA & GB14	14073	1994	15,559	5	14,774	-

2007 Projected Biomasses and Catches in Closed/Access Areas

Area	Fishing mortality	Exploitable biomass (mt)	Mean exploitable weight (g)	Landings (mt)	Landings, video adjusted (mt)	Catch per day used	Allowable days used	21000 310 Trips (21,000 lbs; 310 vessels)	Days accumulated	Area swept (nm^2)
Hudson Canyon Area	0.48	10352		4060	4060	1168	7,665	1	4,262	
Closed Area I (GB9)	0.4	4100		1132	1132	2000	1,248	0	1,188	
Nantucket Lightship Area (GB12)	0.4	8229		2104	2330	2421	2,122	1	2,447	
Closed Area I (GB9)	0.2	3259		597	597	1673	787	0	627	
Closed Area II (GB14)	0.2	41839		8030	8030	2243	7,893	3	8,430	
Nantucket Lightship Area (GB12)	0.2	6500		1165	1290	1938	1,468	0	1,355	
				HCA & GB14	12090	1713	15,558	4	12,692	-

The second table above uses the biomass and TAC estimates derived from the video survey length frequencies for comparison. Although the TACs are slightly higher, the video survey would not increase the number of trips, except for Closed Area II, but that area would benefit from a revised size frequency estimate in 2002 or 2003.

The Scallop PDT numerically averaged the density estimates derived from the 2002 R/V Albatross and SMAST video survey to derive the TAC estimate for the Nantucket Lightship Area. Video survey data from 2001 and earlier were not used in the TAC estimation for any area due to potential resource changes during the interim. Using the SARC approved shell-height/meat weight relationships and the RV Albatross shell-height frequencies, the accepted TACs that apply to the final alternative for controlled access areas are shown in Table 172.

Table 172. Total allowable catches (TAC) and estimated average catch per DAS (LPUE) for 2004-2007 based on 2002 survey data within the proposed controlled access areas.

		2004	2005	2006	2007
Hudson Canyon Area	TAC (mt) TAC (million lbs.) LPUE (lbs.)	8,523 18.8 2,451	6,784 15.0 1,951	NA[73]	NA
Nantucket Lightship Area	TAC (mt) TAC (million lbs.) LPUE (lbs.)	3,685 8.1 3,024	Closed	Closed	Closed
Closed Area I	TAC (mt) TAC (million lbs.) LPUE (lbs.)	1,622 3.6 2,279	Closed	Closed	Closed
Closed Area II	TAC (mt) TAC (million lbs.) LPUE (lbs.)	Closed	9,278 20.5 2,592	8,670 19.1 2,422	8,030 17.7 2,243

8.2.3.4 Day-at-sea and trip allocations for both overfishing definitions, with and without access and area rotation

The estimates in the figures below, allow calculation of the trip and day-at-sea allocations for a variety of possession limit with a 10 DAS charge, while taking into account the number of permits and days-at-sea used by active vessels. In the first series of figures below (one for each year, plus alternative 3 in 2004), the number of trips and the effect of the day-at-sea tradeoff is calculated for scallop possession limits ranging from 15,000 to 26,000 lbs, assuming a 10 DAS charge for each controlled access trip.

Ultimately, the Council selected a 12 DAS charge and an 18,000 lbs. scallop possession limit based on public testimony and further economic analysis (Section 8.7.4.9). This analysis is presented here, however, to show the range of analyses that the Council considered in making its decision and the relative effect of tradeoffs other than 1,500 lbs./DAS, or 18,000 lbs. for 12 DAS.

As the possession limit increases, the number of allocable trips declines because the TAC is divided by a larger amount – i.e. the possession limit. The figures below show the number of trips for each area that could be allocated. This has included the PDT recommendation above that the number of trips be rounded up, not down, assuming the selection of DAS allocation alternative 2 (Section 5.3.3.2). In the end, however, the Council selected DAS allocation alternative 1, with area specific DAS allocations, obviating the need for hard TACs. As a result, the Council did not approve the rounding up policy recommended by the PDT when a hard TAC applied and instead approved the simple rounding procedure for determining the number of trips to be allocated to limited access vessels.

As the possession limit increases, the effect of the day-at-sea tradeoff declines – because it is expected to take longer for the average vessel to take a controlled access trip. This calculation is based on

[73] NA = Not applicable – are expected to convert to fully-open fishing area in 2006.

the estimated average LPUE from the projection model. If the possession limit is more than 10 times the daily LPUE, then the average trip will take longer than 10 days and there would be no tradeoff to add to the annual allocation. Alternatively, if vessels would be charged 10 days for a controlled access taking 12 days, for example, it could mean that the tradeoff is a subtraction from the annual allocation.

The above projections estimate a baseline total amount of days to be used by the fishery. To get to a day-at-sea allocation, days allocated to inactive vessels and to vessels that use less than 100 percent of their days are taken into account, following procedures the Council used in Frameworks 11 to 15. Lower scallop possession limits mean that the controlled access trips would be shorter, and vessels would be charged 10 days for a shorter trip. The projections estimate actual days used – not the tradeoff – so these extra days are added onto the annual allocation.

The figures below show the extra tradeoff days for each limited access permit and scallop possession limit, for each year in access alternative 1 and for alternative 3 in 2004. These days are added onto the annual allocation for that permit that is calculated directly from the estimated days used in the projections.

During 2004 to 2007, a 21,000 lb. scallop possession limit always creates a day-at-sea tradeoff, that can be added to the annual baseline allocation. It can be increased, but the day-at-sea tradeoff decreases and reduces the annual day-at-sea allocation, which is the sum of the baseline days used in open fishing areas and controlled access areas and the day-at-sea tradeoff, which is charged to the vessel, but not actually contributes to fishing time on controlled access trips.

A 24,000 lb. trip limit, for example reduces the full-time day-at-sea tradeoff from 11 to 4 days, thus reducing the annual allocation by seven days in 2004. In 2006 and 2007, on the other hand, the day-at-sea tradeoff would be zero or negative. Decreasing the scallop possession limit to add days would simply make it less attractive to fish in the controlled access program, compared to fishing in open fishing areas where the daily catches are higher.

Fortunately, while a 21,000 lb. scallop possession limit may not be sufficiently attractive in 2004, it becomes more attractive to fishermen after that when the daily catches in open areas is expected to decline. This effect is a very robust feature of the system, because it attracts more effort to re-opened areas as catch rates decline from high mortality rates elsewhere.

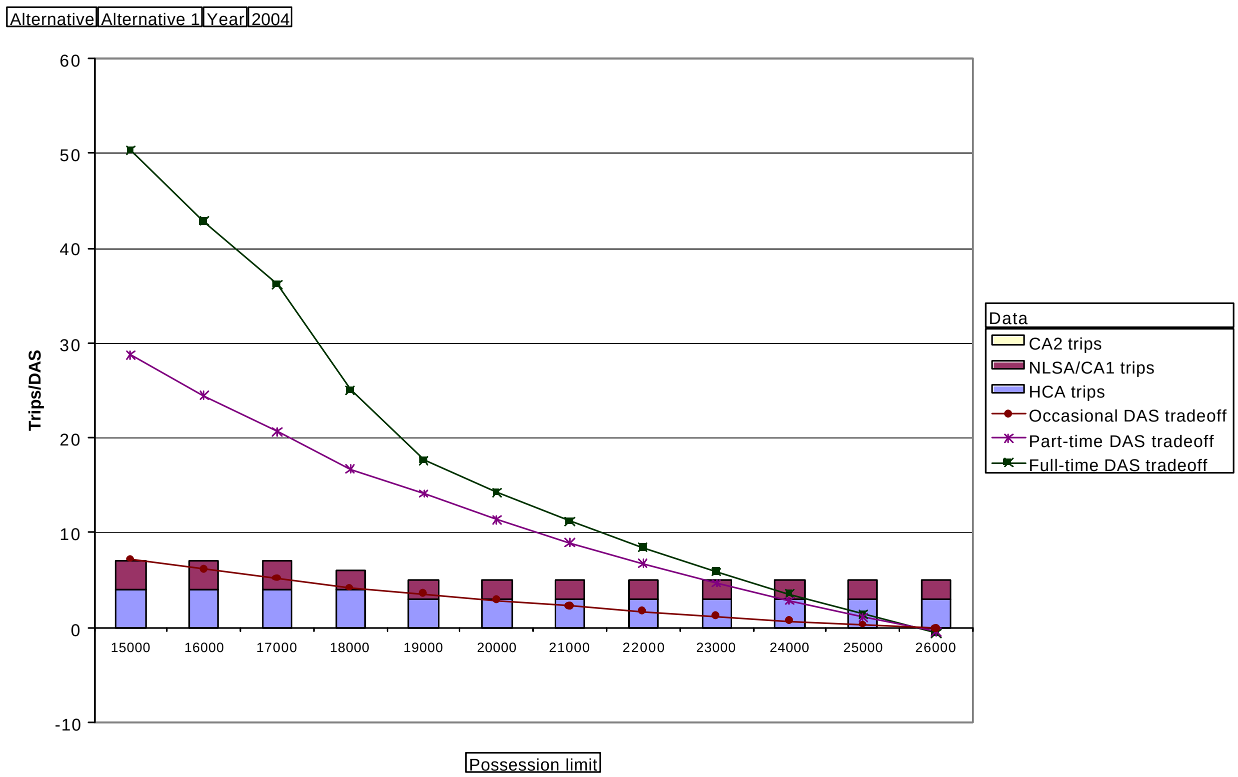


Figure 99. Trips and day-at-sea tradeoffs for 2004, area access alternative 1.

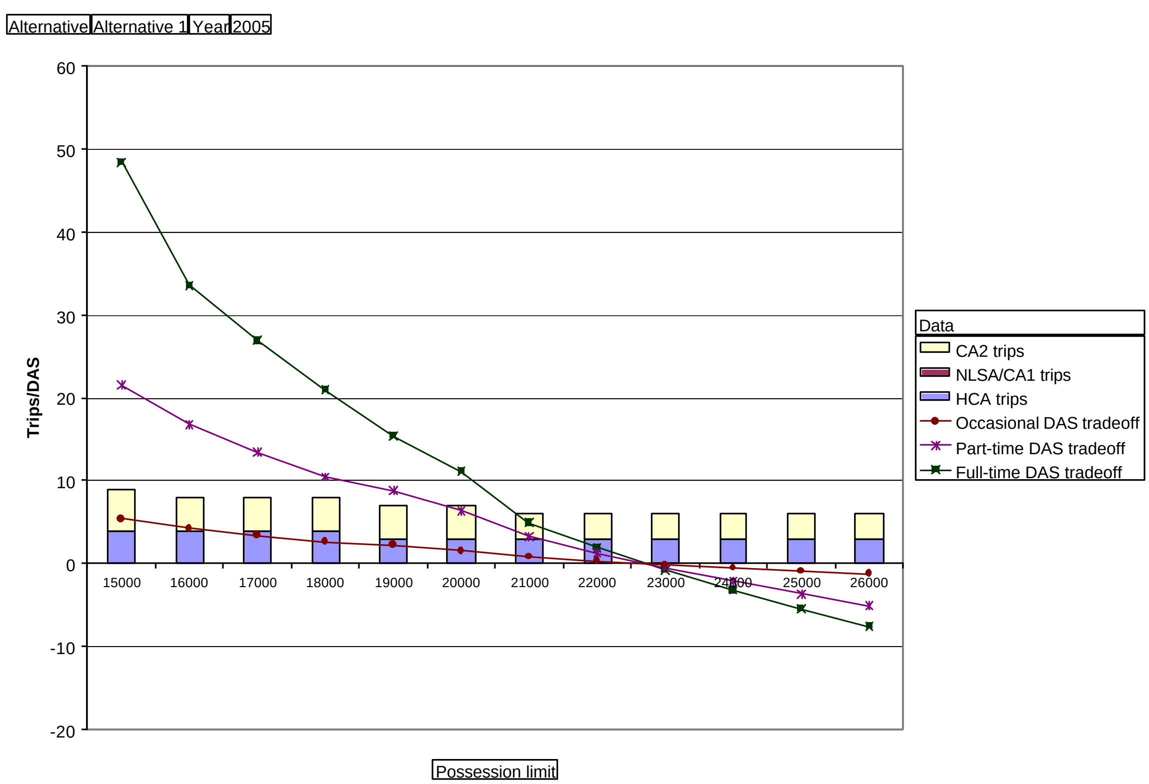


Figure 100. Trips and day-at-sea tradeoffs for 2005, area access alternative 1.

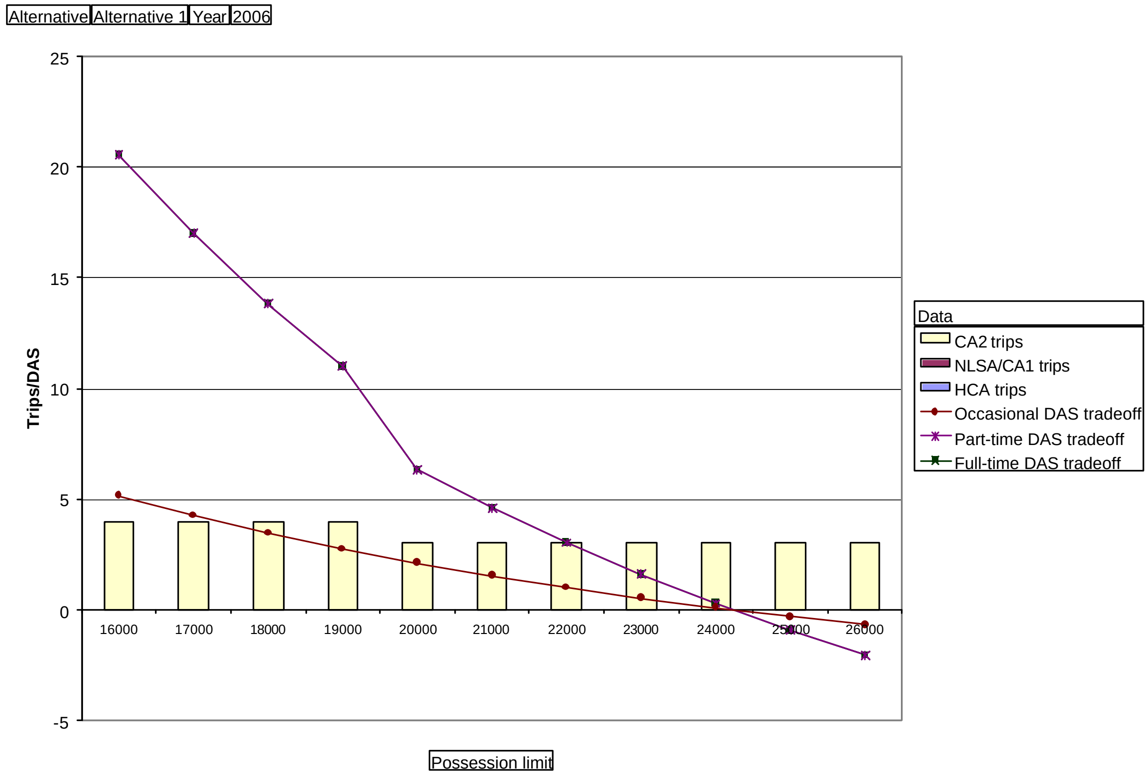


Figure 101. Trips and day-at-sea tradeoffs for 2006, area access alternative 1

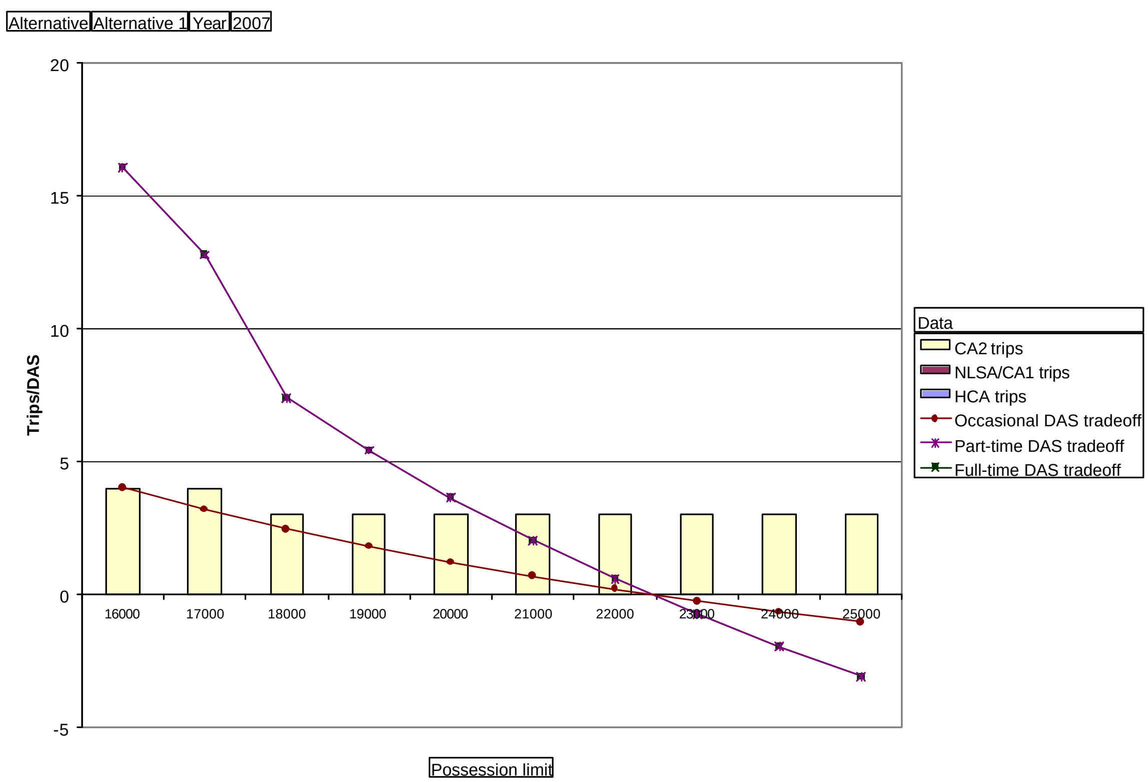


Figure 102. Trips and day-at-sea tradeoffs for 2007, area access alternative 1.

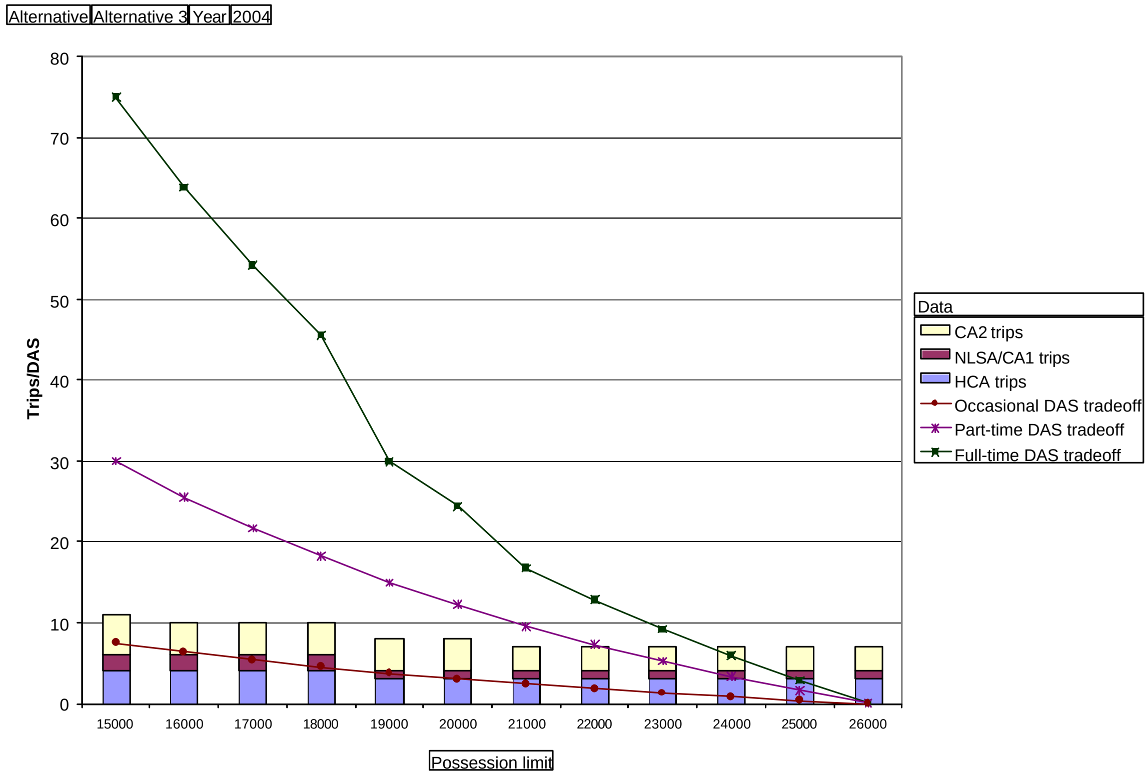


Figure 103. Trips and day-at-sea tradeoffs for 2004, area access alternative 3.

8.2.3.5 Varying controlled access trip lengths with a 1,500 lbs./DAS scallop possession limit equivalent

Narrowing the focus of the final alternative, the Council sought additional information on the effect of varying the length of controlled access trips using possession limits that were equivalent to a 1,500 lb./DAS cap. Thus for trips ranging from 8 to 15 DAS, the scallop possession limit would range from 12,000.

Using the table of results for the 2004 controlled access program (Table 173) as an example, the maximum number of limited access trips that could be allocated for the Hudson Canyon Area ranged from five to three trips, which decline in number because a higher scallop possession limit is divided into a constant TAC, which was reduced by 3 percent to account for the set-aside programs. The number of trips ranges from two to one for the Nantucket Lightship Area and are one for Closed Area I over all scallop possession limit values. Multiplied by the controlled access trip length (or tradeoff), the total number of controlled access DAS to allocate ranges from 64 to 84 DAS. Summing across areas, the number of trips to allocate ranges from 8 to 5 full-time trips, 3 to 2 part-time trips, and one occasional trip.

Unlike the initial procedure suggested by the PDT in a July 22, 2003 memo to the Council, the analysis in this section used simple rounding to derive the number of allocated trips, rather than rounding up. Some cases nonetheless would potentially allow landings for a particular area to exceed the TAC, by as much as 89 percent with a 15 DAS/22,500 lb. trip in Closed Area I. Partly this results from rounding up and partly from the final policy of allocating no less than one trip per area. With a 12 DAS/18,000 lb. tradeoff that the Council ultimately approved, the trip allocations could allow landings of 109 percent of the Hudson Canyon Area TAC, 152 percent of the Closed Area I TAC, and 133 percent of the Nantucket Lightship Area TAC, averaging 115 percent (weighted) over all controlled access areas.

Although there is a potential to exceed the TAC in some areas and years, overall the average would be 100 percent of the TAC, except for areas that could allow less than one trip per year, which were raised to one trip to allow any access. There are, as a result, implications for habitat effects (see Section 8.5.7.2.1.1 on the habitat impacts of area rotation and access), scallop fishing mortality (this section), and bycatch (to be addressed in Framework Adjustment 16/39). Except for scallop fishing mortality, the impacts on habitat and bycatch within the access areas will obviously increase as more of the scallop TAC is taken. Relative to scallop fishing mortality, taking more of the TAC actually better approaches optimum yield because the scallops in the controlled access areas are near or older than the point at which maximum yield is obtained.

On the other hand, calculations using a rounding-down process greatly reduced the yield to be obtained from the controlled access programs. With a 12 DAS/18,000 lb. tradeoff, only 63% of the aggregate TAC could be taken if a procedure of rounding down the number of trips were used. This value ranged from 58 to 86 percent of the aggregate TAC for trip lengths ranging from 8 to 15 DAS.

A reasonable over-allocation of trips is not as problematic as it may seem at face value, since even with a new policy regarding the use of DAS only in areas for which they have been allocated, not all limited access vessels will take trips to controlled access areas. Smaller vessels, sometimes with part-time or occasional permits might be unable to fish in the available controlled access areas, even with trading. At this time, vessels in NC are quite far from the nearest controlled access area – Hudson Canyon. Some vessels may travel far enough to make a trip, but other vessels may find it is not worthwhile to travel from NC to the Hudson Canyon Area for one trips and 18,000 lbs. of scallop meats. Vessels from Maine might be in a similar situation, although limited access vessels in Maine are known to travel seasonally to Cape Cod to fish in the South Channel.

At the same time, full-time vessels have more of an opportunity to use their controlled access trips, but although one-to-one exchanges will be allowed for vessels that fish in a preferred area, not all vessels will be able to take advantage of the opportunity. Vessels that do not exchange trips with other limited access scallop vessels will either have to travel to all the controlled access areas or similar to vessels that did not fish their full compliment of DAS, would simply not take trips to distant controlled access areas. In 2004, vessels not taking trips to Nantucket Lightship Area and Closed Area I is probably more likely for vessels in the Mid-Atlantic due to the fewer number of trips available than for the Hudson Canyon Area when New England vessels consider fishing there. On the other hand, the catch rates are expected to be higher in the Nantucket Lightship Area and Closed Area I than in the Hudson Canyon Area, which could reduce fishing costs and balance the effect of the differential trip allocations.

Two other factors make it less likely for the trip allocations to actually exceed the controlled access target TACs. First, very few vessels actually land the scallop possession limit. Most landings during the controlled access programs in 1999 – 2002 landed several hundred to a thousand pounds less than the scallop possession limit, mostly due to uncertainties due to scallop swelling and water uptake in the hold and the difficulty in measuring weights at sea without sophisticated equipment. Often captains stop fishing to ensure their landings do not exceed the possession limit and deliberately land a bit less than allowed. This could account for 5 to 10 percent of the potential overage. Second, although Amendment 10 includes a new provision for broken trips, it does not entirely remove the business risk associated with a controlled access trip which at a minimum will cost two DAS, even if no landings are made. As with past experience, some vessel captains may decide not to take some controlled access trips because of this risk.

The actual DAS fished are less than the controlled DAS allocated and this can be calculated by estimating the average trip length by dividing the scallop possession limit by the average LPUE from the projections. Since the projection LPUEs factor in steam time on regular, open area trips, the LPUEs were adjusted to account for the increasing amount of total steam time associated with shorter controlled access trips. Assuming that the average open area trip lasts 14 days (although trip length varies by season, a 14-day trip is fairly customary in previous years) and the steam time to a controlled access area takes 36 hours to the Hudson Canyon Area and Closed Area I, 72 hours to Closed Area II, and 24 hours to the Nantucket Lightship Area, the average LPUE would vary between 2,230 lbs to 2,471 lbs. for the Hudson Canyon Area. Table 173 shows how the LPUE would vary for the other controlled access areas.

Using these average LPUE estimates, the average trip length was calculated and the number of DAS actually fished were derived from these estimates. With a 12 DAS/18,000 lb. tradeoff, full-time vessels will be allocated 84 DAS, but only fish 50.1 DAS if the vessel took all seven trips to the areas allocated. Exchanging trips may alter this value for an individual vessel (Nantucket Lightship Area is expected to have the highest LPUEs, the shortest trips, and therefore the least cost, for example), but over the entire fleet, the averages should occur anyway when averaged over the entire fleet. For full-time vessels, the expected DAS fished varies from 41.1 to 50.1 over controlled access tradeoffs ranging from 8 to 15 DAS.

Part-time vessel allocated 24 DAS are expected to fish only 14.3 DAS on average and occasional vessels allocated 12 DAS would be expected to fish for 8.4 DAS on average. It was not possible to factor in differences in fishing capacity with permit category or gear type, but the percent of days fished by vessels with lower crew limits[74] or different gear is a small fraction of the total.

As a result of the tradeoff and DAS allocations, the expected number of DAS fished from the allocations range from 10,721 to 13,533 DAS. With a 12 DAS/18,000 lb. tradeoff, the expected number of DAS fished[75] is 13,533 in 2004 (Table 173), 15,491 in 2005 (Table 174), 8,393 in 2006 (Table 175), and 6,860 in 2007 (Table 176). Thus the total DAS use combined for open and controlled access areas is 25,608 DAS in 2004, 27,104 in 2005, and 27,312 in 2006.

Thus, the total DAS use is about 10 to 20 percent lower than the 30,050 DAS used during the 2002 fishing year. Due to the area-specific DAS allocation system in this amendment, however, a much greater share of the total DAS (50-60 percent vs. 10 percent) of the DAS allocations will be used while fishing in the controlled access areas, where scallops are more abundant , catch rates are correspondingly higher and as a result the amount of bottom contact time is drastically reduced.

Although controlled access DAS allocations and their effects were calculated for 2005, 2006, and 2007, they follow the same general pattern and the calculations are shown in Table 174 to Table 176below.

[74] Vessels with small dredge permits are authorized to carry no more than 5 crew members, which implies a different shucking capacity per DAS.
[75] Includes time steaming to and from port.

Table 173. Trip and DAS allocations in 2004 with controlled access trip lengths ranging from 8 to 15 DAS.

DAS charge	8	9	10	11	12	13	14	15
Scallop possession limit	12,000	13,500	15,000	16,500	18,000	19,500	21,000	22,500
Trip length adjusted LPUE								
Hudson Canyon Area	2,230	2,288	2,333	2,371	2,402	2,428	2,451	2,471
Closed Area I	2,074	2,127	2,170	2,204	2,233	2,258	2,279	2,297
Nantucket Lightship Area	2,850	2,895	2,931	2,961	2,985	3,006	3,024	3,040
Closed Area II	2,121	2,262	2,375	2,468	2,545	2,610	2,666	2,714
Maximum trips allocated								
Hudson Canyon Area	5	5	4	4	4	3	3	3
Closed Area I	1	1	1	1	1	1	1	1
Nantucket Lightship Area	2	2	2	2	2	1	1	1
Closed Area II	0	0	0	0	0	0	0	0
Maximum days allocated and charged								
Hudson Canyon Area	40	45	40	44	48	39	42	45
Closed Area I	8	9	10	11	12	13	14	15
Nantucket Lightship Area	16	18	20	22	24	13	14	15
Closed Area II	0	0	0	0	0	0	0	0
Controlled access days	64	72	70	77	84	65	70	75
Maximum controlled access trips taken								
Full-time	8	8	7	7	7	5	5	5
Part-time	3	3	2	2	2	2	2	2
Occasional	1	1	1	1	1	1	1	1
Potential percent of TAC landed								
Hudson Canyon Area	91.8%	103.3%	90.9%	100.0%	109.1%	90.2%	97.1%	104.1%
Closed Area I	101.0%	113.6%	126.3%	138.9%	151.5%	164.2%	176.8%	189.4%
Nantucket Lightship Area	88.5%	99.5%	110.6%	121.7%	132.7%	72.3%	77.8%	83.4%
Closed Area II								
Combined	88.5%	99.5%	95.9%	105.5%	115.1%	90.1%	97.1%	104.0%
Average days used per trip and annual day-at-sea tradeoff per full-time vessel								
Hudson Canyon Area	5.4	5.9	6.4	7.0	7.5	8.0	8.6	9.1
Closed Area I	5.8	6.3	6.9	7.5	8.1	8.6	9.2	9.8
Nantucket Lightship Area	4.2	4.7	5.1	5.6	6.0	6.5	6.9	7.4
Closed Area II								
Days charged, but not used (all allocated trips)	22.9	26.8	27.1	30.5	33.9	25.8	28.1	30.5
Total expected DAS use								
Hudson Canyon Area	7,330	8,041	6,946	7,520	8,098	6,586	7,027	7,470
Closed Area I	1,577	1,729	1,868	2,022	2,177	2,361	2,519	2,678
Nantucket Lightship Area	2,295	2,542	2,765	3,011	3,258	1,773	1,899	2,024
Closed Area II	-	-	-	-	-	-	-	-
Total DAS used	11,202	12,312	11,579	12,554	13,533	10,721	11,445	12,171
Full time — **Area specific DAS allocations**								
Hudson Canyon Area	40	45	40	44	48	39	42	45
Closed Area I	8	9	10	11	12	13	14	15
Nantucket Lightship Area	16	18	20	22	24	13	14	15
Closed Area II	-	-	-	-	-	-	-	-
Total controlled access DAS allocated	64	72	70	77	84	65	70	75
Days charged, but not used	22.9	26.8	27.1	30.5	33.9	25.8	28.1	30.5
DAS fished	41.1	45.2	42.9	46.5	50.1	39.2	41.9	44.5
Part time — **Area specific DAS allocations**								
Hudson Canyon Area	24	27	20	22	24	26	28	30
Closed Area I	8	9	10	11	12	13	14	15
Nantucket Lightship Area	16	18	20	22	24	13	14	15
Closed Area II	-	-	-	-	-	-	-	-
Total controlled access DAS allocated	24	27	20	22	24	26	28	30
Days charged, but not used	8.6	10.1	7.8	8.7	9.7	10.3	11.3	12.2
DAS fished	15.4	16.9	12.2	13.3	14.3	15.7	16.7	17.8

Table 174. Trip and DAS allocations in 2005 with controlled access trip lengths ranging from 8 to 15 DAS.

DAS charge Scallop possession limit	8 12,000	9 13,500	10 15,000	11 16,500	12 18,000	13 19,500	14 21,000	15 22,500
Trip length adjusted LPUE								
Hudson Canyon Area	1,775	1,821	1,857	1,887	1,912	1,933	1,951	1,967
Closed Area I	1,514	1,553	1,584	1,610	1,631	1,649	1,664	1,677
Nantucket Lightship Area	2,026	2,058	2,084	2,105	2,122	2,137	2,150	2,161
Closed Area II	2,062	2,199	2,309	2,399	2,474	2,538	2,592	2,639
Maximum trips allocated								
Hudson Canyon Area	4	4	3	3	3	3	2	2
Closed Area I	0	0	0	0	0	0	0	0
Nantucket Lightship Area	0	0	0	0	0	0	0	0
Closed Area II	6	5	5	4	4	4	3	3
Maximum days allocated and charged								
Hudson Canyon Area	32	36	30	33	36	39	28	30
Closed Area I	0	0	0	0	0	0	0	0
Nantucket Lightship Area	0	0	0	0	0	0	0	0
Closed Area II	48	45	50	44	48	52	42	45
Controlled access days	80	81	80	77	84	91	70	75
Maximum controlled access trips taken								
Full-time	10	9	8	7	7	7	5	5
Part-time	4	3	3	2	2	2	2	2
Occasional	1	1	1	1	1	1	1	1
Potential percent of TAC landed								
Hudson Canyon Area	95.9%	105.3%	90.0%	95.9%	104.6%	113.3%	84.1%	90.1%
Closed Area I								
Nantucket Lightship Area								
Closed Area II	101.8%	94.8%	105.4%	91.9%	100.2%	108.6%	89.2%	95.6%
Combined	95.4%	96.0%	95.2%	90.8%	99.1%	107.4%	83.6%	89.5%
Average days used per trip and annual day-at-sea tradeoff per full-time vessel								
Hudson Canyon Area	6.8	7.4	8.1	8.7	9.4	10.1	10.8	11.4
Closed Area I								
Nantucket Lightship Area								
Closed Area II	5.8	6.1	6.5	6.9	7.3	7.7	8.1	8.5
Days charged, but not used (all allocated trips)	18.0	20.7	23.3	23.3	26.7	30.0	24.2	26.5
Total expected DAS use								
Hudson Canyon Area	7,384	8,046	6,602	7,086	7,630	8,176	5,886	6,256
Closed Area I	-	-	-	-	-	-	-	-
Nantucket Lightship Area	-	-	-	-	-	-	-	-
Closed Area II	9,537	8,328	8,850	7,431	7,861	8,303	6,645	6,993
Total DAS used	16,920	16,374	15,452	14,517	15,491	16,479	12,531	13,249
Full time — **Area specific DAS allocations**								
Hudson Canyon Area	32	36	30	33	36	39	28	30
Closed Area I	-	-	-	-	-	-	-	-
Nantucket Lightship Area	-	-	-	-	-	-	-	-
Closed Area II	48	45	50	44	48	52	42	45
Total controlled access DAS allocated	80	81	80	77	84	91	70	75
Days charged, but not used	18.0	20.7	23.3	23.3	26.7	30.0	24.2	26.5
DAS fished	62.0	60.3	56.7	53.7	57.3	61.0	45.8	48.5
Part time — **Area specific DAS allocations**								
Hudson Canyon Area	32	27	30	22	24	26	28	30
Closed Area I	-	-	-	-	-	-	-	-
Nantucket Lightship Area	-	-	-	-	-	-	-	-
Closed Area II	32	27	30	22	24	26	28	30
Total controlled access DAS allocated	32	27	30	22	24	26	28	30
Days charged, but not used	7.2	6.9	8.7	6.6	7.6	8.6	9.7	10.6
DAS fished	24.8	20.1	21.3	15.4	16.4	17.4	18.3	19.4

Table 175. Trip and DAS allocations in 2006 with controlled access trip lengths ranging from 8 to 15 DAS.

DAS charge	8	9	10	11	12	13	14	15
Scallop possession limit	12,000	13,500	15,000	16,500	18,000	19,500	21,000	22,500
Trip length adjusted LPUE								
Hudson Canyon Area	1,414	1,450	1,479	1,503	1,523	1,540	1,554	1,566
Closed Area I	1,653	1,695	1,729	1,757	1,780	1,799	1,816	1,831
Nantucket Lightship Area	2,144	2,178	2,205	2,227	2,246	2,262	2,275	2,287
Closed Area II	1,927	2,055	2,158	2,242	2,312	2,371	2,422	2,466
Maximum trips allocated								
Hudson Canyon Area	0	0	0	0	0	0	0	0
Closed Area I	0	0	0	0	0	0	0	0
Nantucket Lightship Area	0	0	0	0	0	0	0	0
Closed Area II	5	5	4	4	4	3	3	3
Maximum days allocated and charged								
Hudson Canyon Area	0	0	0	0	0	0	0	0
Closed Area I	0	0	0	0	0	0	0	0
Nantucket Lightship Area	0	0	0	0	0	0	0	0
Closed Area II	40	45	40	44	48	39	42	45
Controlled access days	40	45	40	44	48	39	42	45
Maximum controlled access trips taken								
Full-time	5	5	4	4	4	3	3	3
Part-time	2	2	1	1	1	1	1	1
Occasional	1	1	1	1	1	1	1	1
Potential percent of TAC landed								
Hudson Canyon Area								
Closed Area I								
Nantucket Lightship Area								
Closed Area II	88.5%	99.5%	87.2%	95.9%	104.7%	85.8%	92.4%	99.0%
Combined	88.5%	99.5%	87.2%	95.9%	104.7%	85.8%	92.4%	99.0%
Average days used per trip and annual day-at-sea tradeoff per full-time vessel								
Hudson Canyon Area								
Closed Area I								
Nantucket Lightship Area								
Closed Area II	6.2	6.6	7.0	7.4	7.8	8.2	8.7	9.1
Days charged, but not used (all allocated trips)	8.9	12.2	12.2	14.6	16.9	14.3	16.0	17.6
Total expected DAS use								
Hudson Canyon Area	-	-	-	-	-	-	-	-
Closed Area I	-	-	-	-	-	-	-	-
Nantucket Lightship Area	-	-	-	-	-	-	-	-
Closed Area II	8,515	8,980	7,494	7,934	8,393	6,711	7,075	7,445
Total DAS used	8,515	8,980	7,494	7,934	8,393	6,711	7,075	7,445
Full time — **Area specific DAS allocations**								
Hudson Canyon Area	-	-	-	-	-	-	-	-
Closed Area I	-	-	-	-	-	-	-	-
Nantucket Lightship Area	-	-	-	-	-	-	-	-
Closed Area II	40	45	40	44	48	39	42	45
Total controlled access DAS allocated	40	45	40	44	48	39	42	45
Days charged, but not used	8.9	12.2	12.2	14.6	16.9	14.3	16.0	17.6
DAS fished	31.1	32.8	27.8	29.4	31.1	24.7	26.0	27.4
Part time — **Area specific DAS allocations**								
Hudson Canyon Area	-	-	-	-	-	-	-	-
Closed Area I	-	-	-	-	-	-	-	-
Nantucket Lightship Area	-	-	-	-	-	-	-	-
Closed Area II	16	18	10	11	12	13	14	15
Total controlled access DAS allocated	16	18	10	11	12	13	14	15
Days charged, but not used	3.5	4.9	3.0	3.6	4.2	4.8	5.3	5.9
DAS fished	12.5	13.1	7.0	7.4	7.8	8.2	8.7	9.1

Table 176. Trip and DAS allocations in 2006 with controlled access trip lengths ranging from 8 to 15 DAS.

DAS charge	8	9	10	11	12	13	14	15
Scallop possession limit	12,000	13,500	15,000	16,500	18,000	19,500	21,000	22,500
Trip length adjusted LPUE								
Hudson Canyon Area	1,063	1,090	1,112	1,130	1,145	1,157	1,168	1,177
Closed Area I	1,820	1,867	1,904	1,935	1,960	1,982	2,000	2,016
Nantucket Lightship Area	2,281	2,318	2,347	2,370	2,390	2,407	2,421	2,433
Closed Area II	1,784	1,903	1,998	2,076	2,141	2,196	2,243	2,284
Maximum trips allocated								
Hudson Canyon Area	0	0	0	0	0	0	0	0
Closed Area I	0	0	0	0	0	0	0	0
Nantucket Lightship Area	0	0	0	0	0	0	0	0
Closed Area II	5	4	4	4	3	3	3	3
Maximum days allocated and charged								
Hudson Canyon Area	0	0	0	0	0	0	0	0
Closed Area I	0	0	0	0	0	0	0	0
Nantucket Lightship Area	0	0	0	0	0	0	0	0
Closed Area II	40	36	40	44	36	39	42	45
Controlled access days	40	36	40	44	36	39	42	45
Maximum controlled access trips taken								
Full-time	5	4	4	4	3	3	3	3
Part-time	2	1	1	1	1	1	1	1
Occasional	1	1	1	1	1	1	1	1
Potential percent of TAC landed								
Hudson Canyon Area								
Closed Area I								
Nantucket Lightship Area								
Closed Area II	95.5%	84.7%	94.2%	103.6%	85.5%	92.7%	99.8%	106.9%
Combined	95.5%	84.7%	94.2%	103.6%	85.5%	92.7%	99.8%	106.9%
Average days used per trip and annual day-at-sea tradeoff per full-time vessel								
Hudson Canyon Area								
Closed Area I								
Nantucket Lightship Area								
Closed Area II	6.7	7.1	7.5	7.9	8.4	8.9	9.4	9.9
Days charged, but not used (all allocated trips)	6.4	7.6	10.0	12.2	10.8	12.4	13.9	15.4
Total expected DAS use								
Hudson Canyon Area	-	-	-	-	-	-	-	-
Closed Area I	-	-	-	-	-	-	-	-
Nantucket Lightship Area	-	-	-	-	-	-	-	-
Closed Area II	9,194	7,647	8,092	8,567	6,860	7,246	7,640	8,039
Total DAS used	9,194	7,647	8,092	8,567	6,860	7,246	7,640	8,039
Full time — **Area specific DAS allocations**								
Hudson Canyon Area	-	-	-	-	-	-	-	-
Closed Area I	-	-	-	-	-	-	-	-
Nantucket Lightship Area	-	-	-	-	-	-	-	-
Closed Area II	40	36	40	44	36	39	42	45
Total controlled access DAS allocated	40	36	40	44	36	39	42	45
Days charged, but not used	6.4	7.6	10.0	12.2	10.8	12.4	13.9	15.4
DAS fished	33.6	28.4	30.0	31.8	25.2	26.6	28.1	29.6
Part time — **Area specific DAS allocations**								
Hudson Canyon Area	-	-	-	-	-	-	-	-
Closed Area I	-	-	-	-	-	-	-	-
Nantucket Lightship Area	-	-	-	-	-	-	-	-
Closed Area II	16	9	10	11	12	13	14	15
Total controlled access DAS allocated	16	9	10	11	12	13	14	15
Days charged, but not used	2.5	1.9	2.5	3.1	3.6	4.1	4.6	5.1
DAS fished	13.5	7.1	7.5	7.9	8.4	8.9	9.4	9.9

8.2.4 Observer Sampling Frequency Funded via TAC and DAS Set-aside

Section 5.1.8.1 provides a one-percent set aside from the controlled access area TACs and from the open area target DAS use to defray the cost of mandatory observers on scallop vessels. This program spreads the cost of observer over all limited access vessels that use DAS to fish for scallops and that fish in the controlled access areas. Without this procedure or government funding, the entire cost of carrying the observer would be borne by that vessel and some vessels may, as a result, shoulder an undue burden for the observer program.

Under the system that applies for controlled access areas, a vessel carrying an observer will be allowed to land more than the 18,000 lb. scallop possession limit on an observed trip. For open fishing areas, a vessel carrying a mandatory observer would be granted a DAS adjustment or rebate, using a constant factor per observer day. The Regional Administrator may reduce the number of DAS charged for an observed trip, or may increase the vessel's annual DAS allocation to allow the vessel to fish more DAS in the year than it would have without carrying observers.

For both areas, increasing the allowance to compensate the vessel will reduce the number of trips and the proportion of observed trips. The medium of exchange between these two systems is different and as a result the effects on the number and proportion of observed trips varies.

8.2.4.1 Controlled access areas

With an allowance to land more scallops per trip when an observer is onboard, the results vary because the vessel must catch and process the extra allowance while the observer is onboard, which incurs additional observer cost. Differences in LPUE also effect trip length to catch 18,000 lbs. of scallops and this changes the trips' observer cost, since vessels are charged per DAS on observed trips. How quickly the vessel catches and processes these extra scallops depends on the catch rate and shucking capacity (LPUE).

Table 177 to Table 180 estimate the proportion of trips that would be observed without exceeding the TAC set aside for the 2004 to 2007 fishing years. All analyses assume that access to the Georges Bank closed areas will occur and that the TACs and trip allocations will be what are estimated in this document. The results vary because different areas are open to controlled access scallop fishing in different years. Thus, the estimated catch rates differ by area and over time within an area. Also estimated is the amount of revenue that the extra landings would generate, by applying the daily observer landings allowance to the trip length and multiplying by the predicted price per pound for each year. This is a gross revenue calculation and does not account for other costs to the vessel and crew, associated with the time and effort catching and processing the observer allowance. These costs include all variable expenses associated with fishing, including extra food, ice, and fuel, which are customarily paid out of the crew share.

Results were calculated for observer allowances of 200, 400, 600, and 1,000 lbs./day. A 200 lbs./day allowance would generate ex-vessel revenue of $700 to 800 per DAS, approximately the amount charged to the vessel carrying an observer. Ex-vessel revenues increase in proportion to the allowance, but net revenues would increase less because of the added variable fishing costs to catch and process the observer allowance.

The number and proportion of trips also do not change proportionally with the observer allowance for the same reason. A minimum estimate assumes that limited access scallop vessels use all available controlled access area DAS and trips during the fishing year. Also it assumes that all vessels with observers catch and land the entire observer compensation allowance. A more probably result is that the limited access vessels take 75 percent of their controlled access area DAS and trips, and vessels with observers catch and land 50 percent of the observer compensation allowance, on average.

Although we have no experience and track record with area-specific DAS allocations (previously, vessels could use controlled access area allocations to fish in regular, open fishing areas without being assessed the DAS tradeoff), it is unlikely that limited access vessels will utilize all the controlled access area trips. First, vessels that have historically fished few of their allocated days will be unlikely to use much of their controlled access area allocations. Second, even with one-to-one exchanges, it is unlikely that all vessels will be able to utilize all controlled access area trips, because they might not be able to fish in a distant area or find someone willing to exchange trips.

Our experience with the observer compensation allowance is that many vessels do not take advantage of the extra landings allowance to defray the observer cost. Some vessels don't even land the scallop possession limit, so the extra allowance doesn't offer the vessel something more that it already has. In any case, during 2002 and 2003, little if any of the TAC set-aside for the Hudson Canyon and VA/NC Areas had been used.

In 2004 (Table 177), a 400 lbs./day trip allowance would fund observers on a minimum of 93 trips, or 4.9% of the total. Decreasing the observer compensation allowance to 200 lbs./day would increase the number of observed trips to 199 trips, or 10.5%. Compared to observer programs to monitor bycatch with relatively good precision, these sampling frequencies are a little low. If, however, the controlled access area allocation use declines to 75% of the total, and on average vessels land 200 lbs./day on observed trips against the TAC set aside (this is equivalent to a 400 lbs./day observer compensation allowance), the number of observed trips increases to 199 (essentially the same as if vessel had landed 100% of a 200 lbs./day observer compensation allowance) but the proportion of observed trips increases to 14%.

Although the results for each year vary, the trends in revenue generated and sampling frequency are fairly constant. The amount of trips sampled varies due to differences in the TACs for controlled access areas open at the time. Also, the results for no access (i.e. only the Hudson Canyon Area would be subject to a TAC and controlled access) are pretty consistent with those in Table 177 and Table 178.

Using the "probable" scenario for 2004 as an example, a 1,000 lbs./day observer compensation allowance would generate about $3,800 per day in income to pay an observer cost around $800 – 1,000 per day and allow sampling on about 5% of the controlled access area trips taken. A 600 lbs./day observer compensation allowance would generate about $2,300 per day and allow sampling on about 9% of the controlled access area trips taken. A 400 lbs./day observer compensation allowance would generate about $1,500 per day and allow sampling on about 14% of the controlled access area trips taken. A 600 lbs./day observer compensation allowance would generate about $800 per day and allow sampling on about 29% of the controlled access area trips taken.

While a 200 lbs./day allowance might not compensate the vessel and crew for carrying an observer, after deducting variable fishing costs, a 400 lbs./day might accomplish this objective and still allow sampling of about 15% of trips taken which often is sufficient to characterize bycatch on a resource-wide or stock-wide basis. Sampling rates higher than 15% might be needed to characterize an area-specific catch of a finfish species to compare with a hard TAC.

Table 177. Number and proportion of observed trips in controlled access areas in **2004** vs. daily scallop possession limit allowance. The "probable" estimate assumes that 75% of allocated trips are taken during the fishing year and that 50% of vessels carrying observers land more than the 18,000 lb. scallop possession limit to defray the costs of the observer.

Landings allowance per observer day	Ex-vessel revenue per observer day	Minimum estimate of observed trips in controlled access areas		"Probable" estimate of observed trips in controlled access areas	
		Trips	Percent	Trips	Percent
200	$ 768	199	10.5%	414	29.2%
400	$ 1,536	93	4.9%	199	14.0%
600	$ 2,304	58	3.1%	128	9.0%
1,000	$ 3,839	31	1.6%	72	5.1%

Table 178. Number and proportion of observed trips in controlled access areas in **2005** vs. daily scallop possession limit allowance. The "probable" estimate assumes that 75% of allocated trips are taken during the fishing year and that 50% of vessels carrying observers land more than the 18,000 lb. scallop possession limit to defray the costs of the observer.

Landings allowance per observer day	Ex-vessel revenue per observer day	Minimum estimate of observed trips in controlled access areas		"Probable" estimate of observed trips in controlled access areas	
		Trips	Percent	Trips	Percent
200	$ 719	202	10.7%	421	29.7%
400	$ 1,438	93	4.9%	202	14.2%
600	$ 2,157	58	3.1%	129	9.1%
1,000	$ 3,596	30	1.6%	72	5.1%

Table 179. Number and proportion of observed trips in controlled access areas in **2006** vs. daily scallop possession limit allowance. The "probable" estimate assumes that 75% of allocated trips are taken during the fishing year and that 50% of vessels carrying observers land more than the 18,000 lb. scallop possession limit to defray the costs of the observer.

Landings allowance per observer day	Ex-vessel revenue per observer day	Minimum estimate of observed trips in controlled access areas		"Probable" estimate of observed trips in controlled access areas	
		Trips	Percent	Trips	Percent
200	$ 732	113	10.5%	235	29.1%
400	$ 1,464	52	4.9%	113	14.0%
600	$ 2,196	32	3.0%	72	9.0%
1,000	$ 3,660	17	1.6%	40	5.0%

Table 180. Number and proportion of observed trips in controlled access areas in **2007** vs. daily scallop possession limit allowance. The "probable" estimate assumes that 75% of allocated trips are taken during the fishing year and that 50% of vessels carrying observers land more than the 18,000 lb. scallop possession limit to defray the costs of the observer.

Landings allowance per observer day	Ex-vessel revenue per observer day	Minimum estimate of observed trips in controlled access areas		"Probable" estimate of observed trips in controlled access areas	
		Trips	Percent	Trips	Percent
200	$ 771	96	11.8%	201	32.9%
400	$ 1,542	44	5.4%	96	15.7%
600	$ 2,312	27	3.4%	62	10.1%
1,000	$ 3,854	14	1.8%	34	5.6%

8.2.4.2 Regular, open scallop fishing areas

Unlike the analysis for controlled access areas, the proportion of trips observed in regular, open fishing areas does not vary with catch rates or total DAS allocations, since the changes in LPUE affect observed and unobserved trips equally. All analysis assumes that in the absence of a scallop possession limit, the average trip length is the historical average around 14 DAS. The factor that changes with LPUE over time is the DAS equivalency with the scallop possession limit allowances in the controlled access areas. With lower LPUE in open areas, particularly when the status quo overfishing definition is applied without access, it takes longer to catch and process 200, 400, or 600 lbs./day.

Several DAS adjustment factors were applied in the analysis to determine the effect of changing the DAS adjustment factor on sampling frequency, i.e. the proportion of observed trips to total trips taken. DAS adjustment factors were chosen to be equivalent to 50, 100, 200, 400, and 600 lbs./day in 2004 (Table 181). The ex-vessel revenue generated by the DAS adjustments is in 2004 equivalent to the revenue per day for vessels fishing in the controlled access areas. For example, a DAS adjustment factor of 0.13-0.14 per DAS generates about $750 of revenue per day, assuming that the vessel uses the extra DAS to fish for scallops. That adjustment factor, dividing the DAS rebate for a 14 day trip into the DAS set asides would allow the program to sample 6.9 to 7.8% of all trips in the open fishing areas. The sampling frequency is relatively constant across years, because the total number of DAS used and the DAS set aside are proportional by set policy (i.e. a 1% set aside).

Increasing the DAS adjustment factor to 0.26 to 0.29, equivalent to 400 lbs./day in 2004, generates about $1,500 per day of ex-vessel revenue to compensate the vessels, but allows sampling on only 3.5 to 3.9 percent of trips. As the LPUE declines (Open area LPUE is projected to decline with the status quo overfishing definition, even with access. Without access, open area LPUE declines more quickly than with access.), the sampling frequency remains nearly constant, but the revenue generated per DAS also declines, decreasing compensation to the vessel for carrying an observer.

The DAS adjustment factor is a constant value that compensates the vessel for carrying an observer. With a DAS adjustment factor of 0.14, a 10-day trip would be charged 8.6 DAS, for example. Alternatively, the vessel paying for 10 observer days would be credited with 1.4 DAS on its annual DAS allocation. A vessel taking a 14-day observed trip would be credited with 1.96 DAS.

While the analysis for the open area DAS set aside program indicates that a slightly lower sampling frequency would be possible than under the controlled access area TAC set-aside, this may not be as critical if it isn't as important to sample finfish bycatch as accurately in the open areas as it is in the controlled access areas.

Table 181. Estimated sampling frequency (proportion of observed trips) vs. DAS adjustment factor for vessels carrying an observer on open area trips.

Scallop catch equivalent	50	100	200	400	600
With Georges Bank access					
DAS Adjustment Factor	0.03	0.06	0.13	0.26	0.39
Sampling frequency	31.0%	15.5%	7.8%	3.9%	2.6%
Ex-vessel revenue (2004-2007 average)	$187	$374	$747	$1,495	$2,242
No Georges Bank access					
DAS Adjustment Factor	0.04	0.07	0.14	0.29	0.43
Sampling frequency	27.6%	13.8%	6.9%	3.5%	2.3%
Ex-vessel revenue (2004-2007 average)	$192	$384	$769	$1,538	$2,307

8.2.5 Rotation management areas: "Elephant Trunk Area"

New data that became available since the publication of the DSEIS led the Council to re-analyze and re-evaluate the proposed rotation management area closures. In particular, SMAST had begun to survey the resource in the Mid-Atlantic during 2003 and scallop density estimates for stations that appeared visually to be dominated by 'seed' scallops could be plotted. The annual R/V Albatross scallop survey had also just completed the Mid-Atlantic leg of the resource survey, and although the data had not yet been processed, survey personal helped to identify where they had observed high abundances of small scallops. Discard ratios on observed commercial scallop trips during 2003 were also available, and could help to better identify where small scallops appeared based on the locations of tows with high discard-to-kept scallop ratios.

These preliminary data were combined with detailed size-frequency distributions for small scallops in the 2001 and 2002 annual resource survey. The smallest scallops observed in the survey during 2001 would be age 3 in the 2003 survey, and likewise the smallest scallops and the next larger year class observed in the 2002 survey would be age 2 and 3 in the 2003 survey.

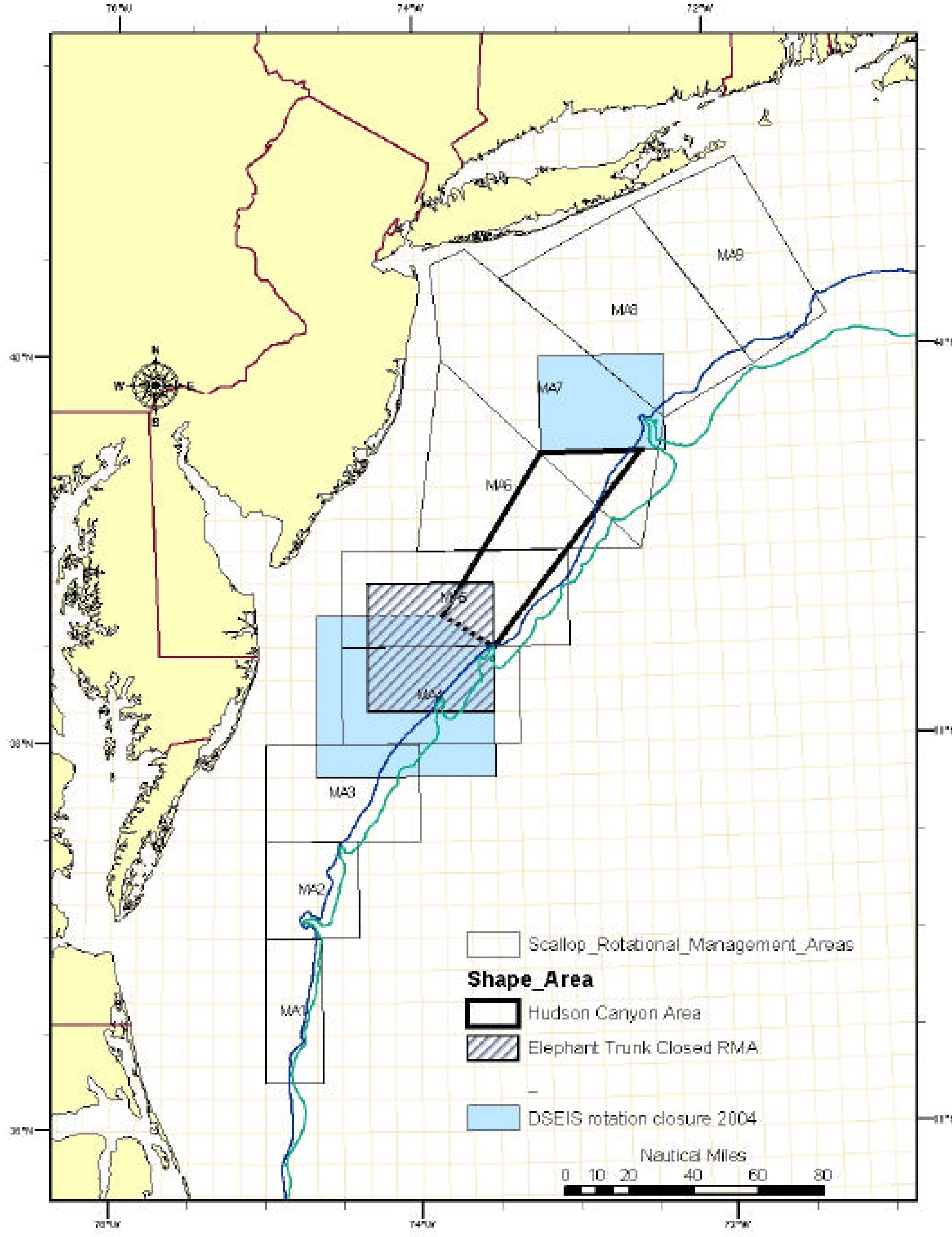
These data and more detailed analysis caused the Council to re-examine the proposed rotation area management closures in the DSEIS. The new rotation closure (Map 48) is a slight modification of the southern Mid-Atlantic closure taken out to public hearing, which better targets the distribution of small scallops that were present during the summer of 2003. Neither the SMAST video survey or the Mid-Atlantic leg of the Albatross survey indicated that the northern Mid-Atlantic closures would serve the purpose it was intended to serve and was no longer needed for area rotation. Similarly, the closure of the GB2 rotation area off of Cape Cod was intended to protect the abundant young scallops that had been first observed in the 2001 resource survey and originally considered for closure in Framework Adjustment 14 in 2001. The scallops that appeared then have been vulnerable to fishing for two years and that closure of this area is no longer needed. New data when available may spur the Council into taking action to implement a rotation management area closure on Georges Bank when new beds of small scallops are observed.

The SMAST data suggested that the rotation management area closure of a 3 x 5 ten-minute square block from 38°30' to 38°50' N longitude would be sufficient to encompass the distribution of small scallops observed by the video survey. The Albatross data from the 2002 survey and an analysis of 2003 small scallop discards, however, indicated that a southerly extension of 10' would be needed to protect abundant small scallops found further to the south. The PDT therefore also recommend consideration of a 4 x 5 ten-minute square block between 38°20' and 38°50' N latitude, although there were also beds of commercial-size scallops interspersed in this southerly extension. In the final analysis, the Council concluded that it would be best to protect the full range of these abundant small scallops to help address some of the conservation concerns over the Mid-Atlantic scallop resource.

The effects of this proposed closure on future scallop management, biology, and yield have been analyzed by folding the proposed closure into the final projections in Section 8.2.2.2. Because redefining the boundaries adaptively requires scallop distribution data that are not yet available for analysis, the projections assume that the substantial majority of the scallop resource in the Elephant Trunk Area are in the rotation management area known as MA4. The projections were modified to assume in all iterations that the MA4 rotation management area would close on March 1, 2004 and remain closed for a three-year period. Results for adaptive strategies to re-opening the Elephant Trunk Area may deviate from this three-year assumption and affect future benefits analyzed above.

Some concern was also raised before the Council took final action about the effects on finfish bycatch and sea turtle interactions, compared with the analysis in the DSEIS. For the proposed Mid-Atlantic closures, data do not exist at the scale needed to distinguish between the DSEIS closures and the final rotation closure. With respect to sea turtle interactions, rotation closures have a minimal impact on interactions with sea turtles, because the effort shift associated with meeting the overfishing definition mortality target is shifted in general throughout the resource. On the other hand, what will matter more is the implementation and timing of when the area re-opens to fishing, which will be an important consideration in the framework adjustment that will re-open the Elephant Trunk area to controlled access, probably in 2006, 2007, or 2008.

Habitat impacts of the new closure area are not terribly different from those analyzed in the DSEIS. Nonetheless, additional analysis of the final alternative with the closure, with rotation management, and with and without Georges Bank area access is presented in Section 8.2.2.2. As far as keeping the GB2 area open, incidental and bycatch of finfish species that inhabit the South Channel will be higher than if the area had closed under area rotation. These include yellowtail flounder and skates, in particular. Similarly, the GB2 area has more hard substrates and EFH designations than surrounding areas. Impacts on these valuable environmental components have been minimized by other means, including habitat closures in this amendment, and DAS controls coupled with crew limits that reduce bottom contact time.



Map 48. Visual comparison between the final "Elephant Trunk" Mid-Atlantic closed rotation area, the initial proposed closed rotation areas in the DSEIS, the controlled access Hudson Canyon Area, and the rotation management areas that were used in the biological projection analyses.

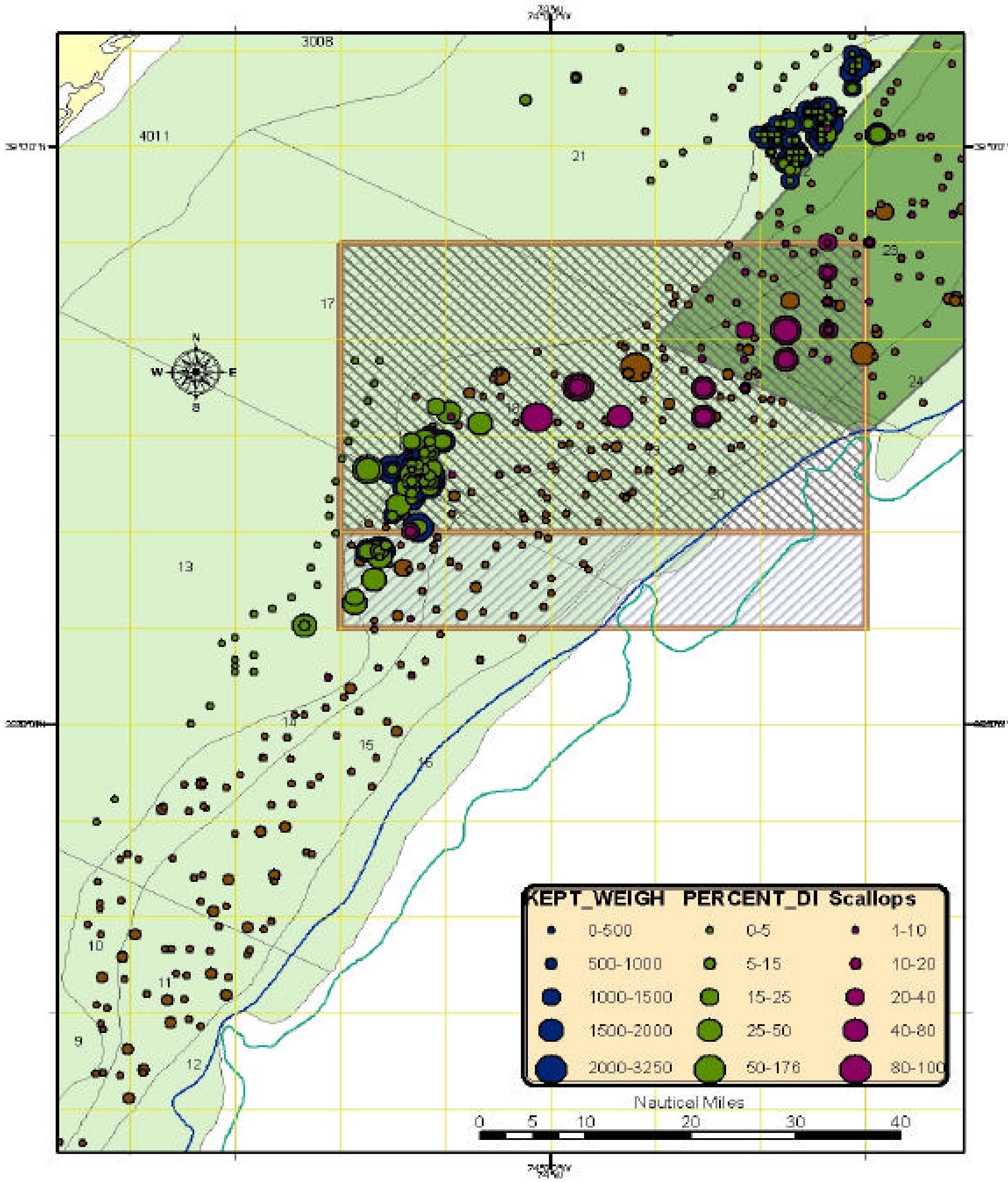
Plan Development Team re-analysis and review of proposed rotation management area closures based on 2003 conditions

The PDT recommended a reconfiguration of the proposed Mid-Atlantic rotation area management closure, south of the Hudson Canyon Area and the omission of the rotation area management closure north of the Hudson Canyon Area. Thus, unless other data come to light, there would be one instead of two closures in the Mid-Atlantic during 2004. The PDT did not do any further analysis on the proposed closure of GB2 in the South Channel, near Nantucket Island and Chatham.

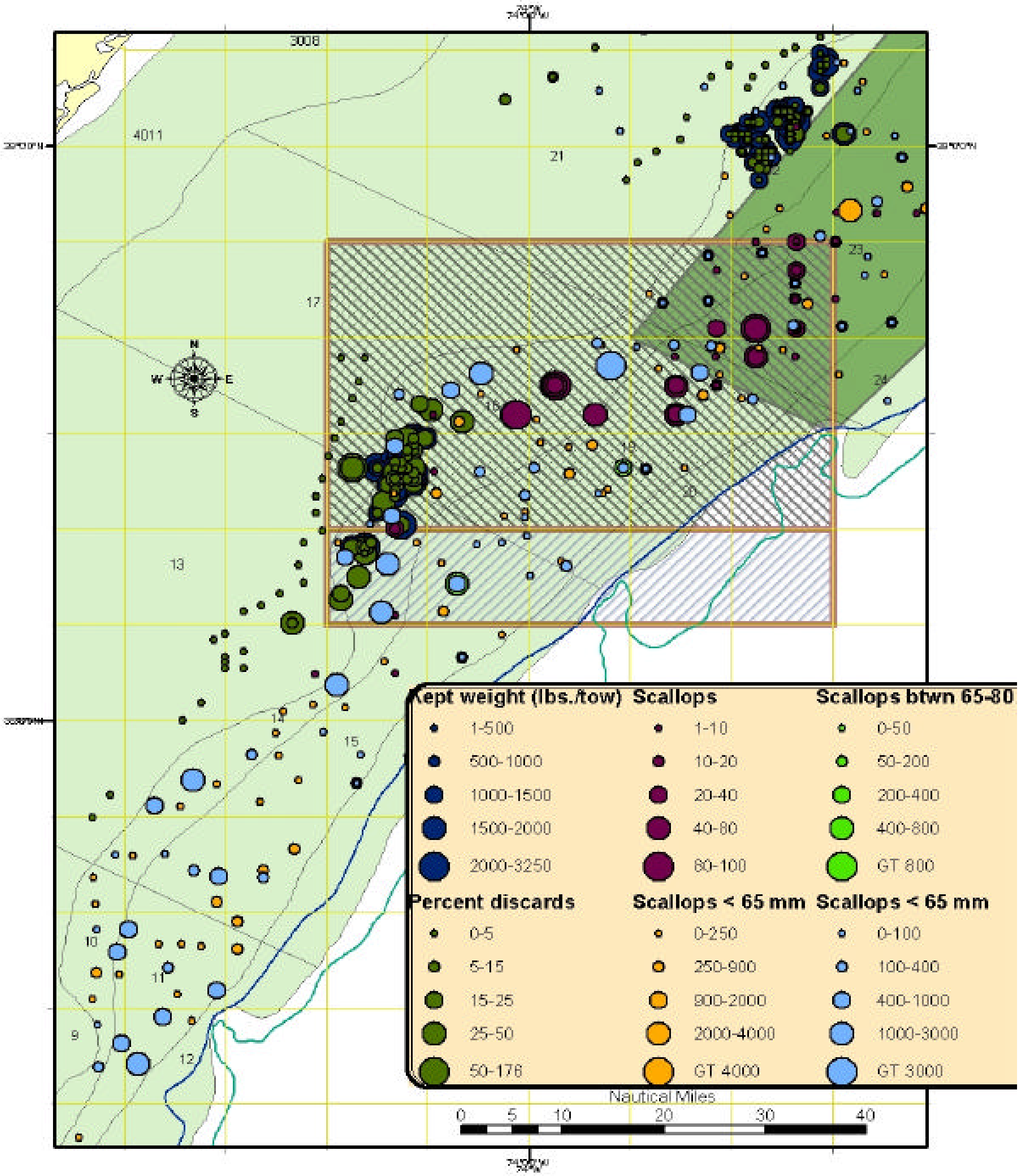
The newly configured Mid-Atlantic closure would overlap the SW corner of the Hudson Canyon Area and as such would re-close a part of the Hudson Canyon Area while it is still under controlled access. The area that the PDT is recommending for closure is a rectangle bounded by 34°10' N latitude, 74°20' W longitude on the SW and 38°50' N latitude, 73°30' W longitude on the NW. This block encompasses 15 ten-minute squares.

In addition, the PDT recommends that the Council consider closing the next set of ten-minute squares to the south, which would include small scallops observed in 2002 by the R/V Albatross scallop survey and in the 2003 sea sampling observer program as discards. This would change the SW corner of the closure area to 34°0' N latitude, 74°20' W longitude.

In 2003, the SMAST video survey encountered significant beds of small scallops from in the SW corner of the Hudson Canyon Area, extending outside the area to the SW (see purple stations in Map 49 and Map 50 below). The 2002 Albatross survey also observed these beds of small scallops, but also observed beds of small scallops yet further to the SW, into stratum 14 (see brown stations in the figures below). Validating this distribution of small scallops, the sea sampling observer program on scallop dredge boats also observed large amounts of small scallops, which commercial fishermen discarded (see distribution of blue and green circles, representing the kept weight and the percent of scallops discarded, respectively).



Map 49. Distribution of small scallops in the annual scallop survey during 1999-2002 (< 65 mm; brown circles); small scallops in the 2003 SMAST survey (no specific size identified; purple circles); and in the percent of discards (green) and kept scallops (blue) in sea sampled scallop dredge trips during 2003 (commercial cull)



Map 50. Distribution of small scallops in the annual scallop survey during 2001-2002 (< 65 mm; orange and light blue circles; 65-80 mm light green circles); small scallops in the 2003 SMAST survey (no specific size identified; purple circles); and in the percent of discards (green) and kept scallops (blue) in sea sampled scallop dredge trips during 2003 (commercial cull)

8.2.6 Effects of habitat and groundfish closures

The above comparative analysis was done without habitat closures. Under the proposed overfishing definition, the change in yield and day-at-sea allocations is in direct proportion to the amount of scallop grounds within the habitat closures for each rotation management area. Under the status quo overfishing definition, instead of determining the appropriate level of effort for exploitable areas, effort associated with the definition's annual fishing mortality target would be applied to remaining fishing areas. Over time, the higher fishing mortality in the open areas would affect the future scallop biomass and differ from the projections given above.

To calculate the quantitative effects of habitat closures with the status quo overfishing definition would require a re-stratification of the survey time series and a different biological projection for each habitat closure alternative. Given the complexity of that analysis and the number of alternatives currently under review, the analysis cannot be done at this time.

We can, however, describe the general effects of the habitat closures under the status quo overfishing definition. A complete projection analysis, re-stratifying the survey time series, will be conducted after the Council selects the proposed action for the final amendment.

The effects of habitat closures with the status quo overfishing definition would be similar to those experienced since the closure of the Georges Bank groundfish areas. Fishing mortality in open fishing areas would generally exceed F_{max} (see NEFMC 2000 and NMFS 2001), causing lower biomass levels, lower landings and revenue, lower average size, and lower daily catches. At the same time, the scallop biomass in the closed areas would increase and allow the plan to meet its biomass targets. If all the habitat closures are in the Georges Bank region, the associated fishing effort could shift to the Mid-Atlantic, raising fishing mortality rates there and increase the risk of an overfished condition for Mid-Atlantic sea scallops.

This outcome can be demonstrated by comparing the total Georges Bank scallop biomass (weight per survey tow) for the two overfishing definitions, assuming that there is no access to the Georges Bank groundfish closed areas (Figure 72 in the DSEIS). With no access, the average weight per tow would be between 10,000 and 12,000 g/tow, **most of the biomass occurring in the groundfish closed areas**. With the proposed overfishing definition, total Georges Bank scallop biomass with no access to the groundfish closed areas would increase to 18,000 g/tow (Figure 72 in the DSEIS), **the difference being the biomass of scallops in areas that are presently open to scallop fishing.**

The distribution of the habitat closures between scallop areas and the proportion of scallop biomass in the habitat closures would have varying indirect effects on scallop biology and management. Under the status quo overfishing definition, more habitat closures that cover a greater proportion of the scallop resource would concentrate the fishing effort into smaller areas, raising fishing mortality on available scallops and cause lower yield-per-recruit. It might require more rotation management area to protect small scallops and/or areas with small scallops would occur more frequently due to localized overexploitation. More habitat closures on Georges Bank and in the South Channel would compound the problem, putting greater fishing pressure on scallops found on the Mid-Atlantic shelf.

With the proposed overfishing definition, the annual fishing mortality targets would be adjusted such that the time averaged fishing mortality on available scallops would approximate F_{max}, thereby maximizing the yield from the scallops that remain available for fishing.

8.2.7 Gulf of Maine scallops

Amendment 10 does not propose area rotation for Gulf of Maine scallops because it is a minor part of the overall scallop resource and because there are various impediments to doing a comprehensive resource survey there. Information with which to begin an area rotation system in the Gulf of Maine is currently lacking and the benefits of doing so would be relatively small76.

Even though there is no formal assessment or survey of scallops in the Gulf of Maine, Amendment 10 will have effects on scallop fishing there. Vessels with a federal scallop permit or that fish in federal waters would still be subject to the regulations associated with this management plan, including crew limits, gear restrictions, area closures, and day-at-sea allocations. Amendment 10 proposes several combinations of area closures to protect essential fish habitat in the Gulf of Maine and the different day-at-sea allocations associated with the overfishing definition fishing mortality target would have an effect.

The direct effects on scallop fishing in the Gulf of Maine and on ports that derive landings from effected trips is analyzed in Section 8.8.4.1 . Closures may increase fishing mortality on scallops elsewhere in the Gulf of Maine under either overfishing definition, because a closure in an unsurveyed scallop area would not affect the fishing mortality target. Thus the displaced fishing effort may be used to fish in the remaining open areas, potentially reducing yield-per-recruit in addition to the yield loss directly caused by closing areas indefinitely to protect habitat from the effects of scallop fishing.

8.2.8 Effects of ring size on scallop size selection.

The use of a 4" (102 mm) ring sea scallop dredge is not new. In the 1970s, some mid-Atlantic scallopers used 4" rings to reduce the amount of surf clam shell retained by the dredges. In the Alaskan scallop fishery, the use of 4" rings without chaffing gear is required. Bourne (1965) evaluated the performance of a 4" ring dredge and concluded that larger ring dredges were more efficient at capturing large scallop than did smaller ring dredges. This phenomenon was also observed by DuPaul *et. al.* (1995) in evaluating a 3.5" ring dredge.

The present study was designed to evaluate the performance of a 4" ring dredge relative to a 3.5" ring dredge in the Georges Bank and Hudson Canyon Closed Areas during and after controlled openings for commercial harvests. Criteria for evaluation centered around: (1) the decrease in capture rates of small scallops that would be discarded if captured; (2) the change in dredge efficiency relative to the capture of larger scallops to be retained; (3) the change in the amount of invertebrate and other "trash" retained by the dredge; and (4) any changes in the capture of finfish bycatch.

Eight research trips were conducted aboard the commercial scallop vessel, F/V *Celtic* from the port of New Bedford, Massachusetts into the three Georges Bank Closed Areas and into the Hudson Canyon Closed Area. Three trips were conducted into Georges Bank Closed Area II (CAII) in July 2000, September 2000 and June 2001, two trips into Closed Area I (CAI) in October 2000, one trip into the Nantucket Lightship Closed Area (NLCA) in July 2001 and two trips into the Hudson Canyon Closed Area (HCCA) in June 2001 and September 2001. The goal was to evaluate the performance of the 4" ring dredge in a variety of resource areas, bottom types, with scallop sizes and abundance similar to those expected under an area management strategy and, of course, weather conditions. The gear trials employed a paired design: two dredges, one constructed with 3.5" (89 mm) and the other with 4.0" (102

76 This does not imply that more intensive mariculture methods would be unproductive there.

mm) rings towed simultaneously, side-by-side. The dredges were 15' (4.6 m) wide offshore New Bedford dredges with bags configured as identical as possible, expect for the size of the rings.

A comparison of the relative scallop size distribution captured by each dredge revealed that the 4" ring dredge had a 100% retention size of scallops at approximately 115 mm. Scallops in the 60-95 mm size range were significantly (p=0.005) less vulnerable to capture with the 4" ring dredge relative to the 3.5" ring dredge which effectively provided a window for conservation. In comparison, the 100% retention size for a 3.5" ring dredge was 100 mm, for a 3.25" ring dredge, 90-95 mm, and for a 3.0" ring dredge, 80-85 mm (Burst *et. al.* 2001, DuPaul, *et. al.* 1999).

Catch data for all the trips is summarized in Tables 1 and 2. The evaluation criteria used for this analysis is the number of scallops captured that were 115 mm and larger. This comparison is reflective of all scallops harvested and not what was retained by the crew for shucking. Significant increases in harvest efficiency was noted for five of the eight trips. A slight and non-significant reduction was noted for the second trip to the HCCA where the average size of the scallops harvested was between 110-115 mm. Based on the criteria of 115 mm and above size scallops, the 4" ring dredge performed equally or better than the 3.5" ring dredge with increased efficiencies as high as 18.4%.

Another criteria for evaluating the performance of the 4" ring dredge was the amount of scallops harvested and expressed as weights of shucked meats (Table 3). A significant increase in harvest efficiency was noted for four of the eight trips with non-significant increases noted for three trips. A small non-significant decrease was noted for the September 2001 trip to the HCCA. It must be noted that these results can be influenced by the culling practices of the crew which is influenced by the quantity of scallops harvested and the ex-vessel price of scallops.

The 4" ring dredge significantly reduced the amount of "trash" (invertebrate and debris) retained relative to the 3.5" ring dredge. This reduction is important in considering gear impacts on habitat and most likely had a positive effect on overall gear efficiency (Table 4). Reductions in the amount of "trash" ranged from 13.9% to 40.4% depending on the area fished.

Finfish bycatch was also recorded during the 4" ring dredge gear trials. Minor reductions in finfish bycatch was noted for small fusiform fish (red hake, silver hake, sculpins) and small flatfish (yellowtail flounder <30 cm, four-spot flounder). Potential reductions in finfish bycatch can be realized through reduction in the time the gear is on the bottom to harvest a given amount of scallops. Consequently, the increase in harvest efficiency demonstrated for the 4" ring dredge in areas of high scallop abundance (recovered populations) can be translated to reductions in bottom time and bycatch. Bycatch data for each of the Georges Bank Closed Area trips based on the amount of scallops harvested (per metric ton) is presented in Tables 5, 6 and 7. Data indicate that any reductions in overall finfish bycatch are minimal. Observations for the NLCA are too few to warrant conclusions as the data is from only six tows.

Table 182. Comparison of scallops greater than 115 mm caught by 3.5" rings and 4.0"rings. Paired t-test analyzes the set of tow-by-tow differences in total catch of scallops by each dredge (Goff 2002).

	Number of Tows Sampled	Total 3.5"	Total 4.0"	Percent Increase with 4.0"	Mean Difference per Tow	p-value (paired t-test)
Area II, July 2000	**53**	**15,233**	**18,031**	**18.4%**	**52.8****	**0.0002**
Area II, Sept 2000	**24**	**4,568**	**5,051**	**10.6%**	**20.1****	**0.0018**
Area II, June 2001	**23**	**4,446**	**4,743**	**6.7%**	**13.0***	**0.038**
H. Canyon, June 2001	**27**	**23,978**	**25,501**	**6.4%**	**56.4^{ns}**	**0.092**
H. Canyon, Sept 2001	**31**	**17,529**	**17,295**	**0.0%**	**-7.6^{ns}**	**0.57**
Area I, Oct 2000a	**17**	**41,789**	**49,168**	**17.7%**	**434.1****	**0.0051**
Area 1, Oct 2000b	**16**	**32,083**	**32,440**	**1.1%**	**22.3^{ns}**	**0.43**
Lightship, Aug 2001	**6**	**14,801**	**17,255**	**16.6%**	**409****	**0.0097**

Table 183. Comparison of scallops less than 115 mm caught by 3.5" rings and 4.0"rings. Paired t-test analyzes the set of tow-by-tow differences in total catch of scallops by each dredge (Goff 2002).

	Number of Tows Sampled	Total 3.5"	Total 4.0"	Percent Reduction with 4.0"	Mean Difference per Tow	p-value (paired t-test)
Area II, July 2000	**53**	**179,096**	**171,014**	**4.5%**	**-152.5^{ns}**	**0.27**
Area II, Sept 2000	**24**	**28,224**	**16,591**	**41.2%**	**-484.7****	**0.0001**
Area II, June 2001	**23**	**25,817**	**25,219**	**2.3%**	**-26.0***	**0.021**
H. Canyon, June 2001	**27**	**41,834**	**37,709**	**9.9%**	**-152.8***	**0.015**
H. Canyon, Sept 2001	**31**	**45,937**	**33,789**	**26.4%**	**-391.9****	**0**
Area I, Oct 2000a	**17**	**17,579**	**15,979**	**9.1%**	**-94.1^{ns}**	**0.15**
Area 1, Oct 2000b	**16**	**10,212**	**10,405**	**-1.9%**	**+12.0^{ns}**	**0.63**
Lightship, Aug 2001	**6**	**2,151**	**2,688**	**-25.0%**	**+89.5^{ns}**	**0.91**

Table 184. Comparison of harvest by 4.0” and 3.5” rings in terms of meat weight (sampled tows only). Meat weights estimated using shell-height:meat-weight models specific to each closed area. These meat weights are only from scallops retained by the crew for processing, not those discarded (Goff 2002).

	Harvest Weight, 3.5” Rings Pounds (Kilograms)	Harvest Weight, 4.0” Rings Pounds (Kilograms)	Percent Increase with 4.0” Rings
Area II, July 2000	**1399 (636)**	**1600 (727)**	**14.4%**
Area II, Sept 2000	**419 (191)**	**478 (217)**	**14.1%**
Area II, June 2001	**1194 (543)**	**1200 (454)**	**0.5%**
H. Canyon, June 2001	**2078 (945)**	**2246 (1021)**	**8.1%**
H. Canyon, Sept 2001	**2096 (953)**	**1948 (885)**	**-7.1%**
Area I, Oct 2000a	**2563 (1165)**	**3073 (1397)**	**19.9%**
Area 1, Oct 2000b	**1887 (858)**	**1951 (887)**	**3.4%**
Lightship, Aug 2001	**1203 (547)**	**1441 (655)**	**19.8%**

Table 185. Comparison of volume of trash (invertebrates and debris, in baskets) retained by 4.0” and 3.5” rings. Data from the Nantucket Lightship trip is excluded due to low sample size (data available for only four tows) (Goff 2002).

Trip	**Mean Trash per Tow Retained by 3.5” Rings (baskets)**	**Mean Trash per Tow Retained by 4.0” Rings (baskets)**	**Mean Difference per Tow**	**p – value (paired t test)**	**Mean Percent Reduction in Trash**
Area II, July 2000	**5.94**	**4.67**	**1.27**	**0.003****	***21.4%***
Area II, Sept 2000	**14.42**	**8.60**	**5.82**	**0****	***40.4%***
Area II, June 2001	**6.79**	**4.92**	**1.88**	**0.0003****	***27.7%***
Hudson Canyon, June 2001	**8.63**	**6.67**	**1.96**	**0.0063****	***22.7%***
Hudson Canyon, September 2001	**4.50**	**2.96**	**1.54**	**0.001****	***34.2%***
Area I, Oct 2000a	**4.10**	**3.54**	**0.57**	**0.04***	***13.9%***
Area I, Oct 2000b	**5.73**	**4.69**	**1.04**	**0.0087****	***18.2%***

Table 186. Number of finfish bycatch relative to weight of sea scallops harvested from comparative gear research inside Closed Area I. Trips were conducted 10/2/00 through 10/5/00 and 10/12/00 through 10/16/00.

Common Name	Number per Metric Ton of Retained Scallops (3.5")	Number per Metric Ton of Retained Scallops (4.0")
Skate Uncl.	290.676	245.241
Silver Hake	8.168	3.812
Atlantic Cod	1.922	0.424
Red Hake	5.765	3.388
Fourspot Flounder	32.191	16.942
Yellowtail Flounder	19.218	17.790
Winter Flounder	24.023	20.754
Windowpane Flounder	30.749	27.955
Longhorn Sculpin	38.436	28.802
Sea Raven	11.050	4.659
Monkfish	19.699	13.977
Eelpout Uncl.	1.441	0.424
American Lobster	0.480	0.424
Squid Uncl.	0.480	0.847

Table 187. Number of finfish bycatch relative to weight of sea scallops harvested from comparative gear research inside Closed Area II. Trips were conducted 7/11/00 through 7/19/00, 9/7/00 through 9/10/00 and 6/20/01 through 6/25/01.

Common Name	Number per Metric Ton of Retained Scallops (3.5")	Number per Metric Ton of Retained Scallops (4.0")
Skate Uncl.	5721.114	5680.735
Atlantic Torpedo	0.000	0.892
Silver Hake	850.777	664.017
Atlantic Cod	1.802	0.892
Haddock	1.802	1.785
Red Hake	236.127	158.864
American Plaice	65.791	66.045
Summer Flounder	0.901	0.000
Fourspot Flounder	709.281	559.595
Yellowtail Flounder	2681.209	2640.895
Winter Flounder	15.321	10.710
Witch Flounder	135.187	134.767
Windowpane Flounder	145.101	164.219
Gulf Stream Flounder	0.901	0.000
Longhorn Sculpin	598.428	342.718
Sea Raven	54.976	38.377
Monkfish	352.387	382.881
Eelpout Uncl.	4.506	1.785
American Lobster	0.901	0.892
Squid Uncl.	5.407	5.355

Table 188. Number of finfish bycatch relative to weight of sea scallops harvested from comparative gear research inside the Nantucket Lightship Closed Area. A trip was conducted 8/21/01 through 8/23/01.

Common Name	Number per Metric Ton of Retained Scallops (3.5")	Number per Metric Ton of Retained Scallops (4.0")
Spiny Dogfish	3.448	0.000
Skate Uncl.	351.730	318.727
Red Hake	1.724	0.000
American Plaice	3.448	2.871
Summer Flounder	1.724	0.000
Fourspot Flounder	6.897	2.871
Yellowtail Flounder	36.208	50.250
Winter Flounder	22.414	20.100
Windowpane Flounder	3.448	0.000
Longhorn Sculpin	17.242	8.614
Sea Raven	3.448	7.179
Monkfish	8.621	11.486
Eelpout Uncl.	1.724	1.436

8.2.9 Impacts from reducing dredge width to 13-feet

The alternative to reduce the maximum allowable dredge width from 15 to 13-feet is intended to minimize habitat and bycatch impacts by reducing area swept by commercial fishing gear and inducing changes in fishing locations. Trawls would have a similar reduction in width, but the effects and compensatory mechanisms would be the same. The following analysis shows that reducing the dredge and trawl width probably would not produce any significant changes.

There are several ways that would compensate for reducing the dredge width including,

Changing tow speed
Changing the amount of fishing time per day
Changing tow duration and slightly reducing gear handling time
Fishing closer to home and/or making longer trips
Increasing the day-at-sea allocation to achieve the scallop fishing mortality target

At face value, reducing the dredge width to 13-feet would reduce area swept by 13.3 percent, the ratio of the proposed size to the current size. This alternative had previously been proposed for Amendment 7 to reduce mortality and improve size selectivity. At that time, DuPaul (pers. comm.) compared the effects of the two dredge sizes. He found that, “Reducing the scallop dredge size, in itself, does little or nothing to selectively reduce the PR of age 3+ scallops and does not change the target Fmax. The reduction in dredge size would likely effect all age classes in proportion to the reduction . . . in total width.”

DuPaul pointed out that minor changes in fishing strategies could easily offset any perceived gains in conservation. Comparing data from vessels using 13-foot dredges to ones using 15-foot dredges, DuPaul found some important differences, however. He reported:

"Using catch data (catch per day) for 21 vessels fishing between 1987 and 1991 (N = 1317 trips), the ratio of catch by 13' dredges to the catch by 15' dredges was 0.87. The difference is statistically significant. The horsepower for vessels using 13 dredges was £ 520 and for vessels using 15' dredges, most were 600 to 620. The observed catch ration of 0.87 is almost exactly the same as the calculated or expected ratio for the two dredge sizes."

It is possible that the use of smaller dredges was a result of vessels having insufficient horsepower to tow the larger dredges. The catch differences could be explained as the result of a vessel with less horsepower pulling the smaller dredge at the same speed as another vessel with more horsepower pulling larger dredges. DuPaul furthermore demonstrated that increasing the towing speed by 13.3 percent exactly compensated for the reduced dredge width.

Actually it is even less difficult to compensate for the different width than he indicated. At the time, the catch with 15-foot dredges was less than the shucking capacity of a seven-man crew and fishing was generally continuous while at sea. Fishermen would have to change something to cover the same amount of bottom per day-at-sea, tow speed probably being the most obvious. With a smaller and lighter dredge, tow speed would increase naturally without changing engine rpm or fuel consumption. Towing the gear modestly faster would cause the gear to sweep the same amount of area, presumably having nearly the same mortality and bycatch effects. Towing lighter gear more quickly typically pulls it off the bottom and keeps the gear from fishing effectively. To compensate, fishermen might add more weight to the smaller dredge to keep it on the bottom, causing similar habitat impacts per square foot swept by the two dredges.

Under the present rebuilt conditions, 15-foot dredges catch more scallops than can be processed by the maximum seven-man crew. Fishermen actively fish less time per day by towing for shorter periods or laying to while the crew catches up. Total area swept declines, fishermen seek larger scallops, or the cull size increases to improve shucking capacity[77]. Counter to the previous argument in Amendment 7, size selection for a vessel using a 15-foot dredge may be better than the same vessel and crew using a 13-foot dredge if the catch volume influences fishing location and cull size. On the other hand, a vessel with a 13-foot dredge can now simply increase the number of tows per day or tow duration to easily compensate for the 13.3 percent reduction in catches.

To show how this works, a simple analysis was performed comparing 15 and 13-foot dredge performance when the catch rate ranges from 1,400 to 3,000 pounds per day fished, assuming an average 1,800 pound shucking capacity for a seven man crew[78]. When catch is less than the shucking capacity, total tow time per day is a function of tow duration and the time it takes to handle the gear[79]. Assuming a typical 60-minute tow duration and a 10-minute gear handling time, a vessel can average 20.6 tows per day or 20.6 out of 24 hours in a day-at-sea (Table 189). At higher catch rates, fishermen compensate by taking shorter or fewer tows per day.

Total hours fished declines to 16.8 hours with a 2,200 pound per day catch rate and 12.3 hours per day with a 3,000 pound per day catch rate. This doesn't mean the crew is in the galley playing gin-rummy – actually quite the opposite. To keep up with the high catches, crews also compensate by breaking watches and finding other ways to increase shucking capacity.

[77] Shown in another DSEIS analysis, crews can shuck more pounds of more valuable large scallops when they are available or shuck fewer small scallops when the catch rates increase.
[78] This is about the landings per day-at-sea observed in the 2001 fishing year.
[79] From the time it is pulled from the bottom and stops fishing to the time it is back fishing on the bottom.

For purposes of analysis, let's assume that the target fishing mortality rate is achieved by allocating 24,000 days used[80] when the scallop biomass and average size translates into a commercial catch per day of 3,000 pounds. Accounting for steam time, average trip duration, towing speed, and tow duration, it translates into 236,983 total hours fished, or 5,265 nm^2, landing 34.56 million pounds of scallops (Table 189, top).

Since effort is classically directly proportional to fishing mortality (assuming all other inputs remain constant), the number of days used must decline as the hours fished per day increases at lower catch rates. Days decline to 17,600 when the catch is at 2,200 pounds per day-at-sea and total fishing time increases to 16.8 per 24 hours. Once the catch rate falls below the shucking capacity, the time fished per day tops out at 20.6 per 24 hours and the days used remains constant at 14,400. Catch per unit effort and landings trend in the same direction, as expected.

For a 13-foot dredge, the effects depend on whether the dredge's catch exceeds the shucking capacity or not (Table 189, bottom). A 13.3 percent decline in the catch rate simply translates into a 13.3 percent increase in total fishing time per day, from 16.8 to 19.4 and from 12.3 to 14.2 hours per day in the two examples. Total hours fished increases from 236,983 hours to 273,442 hours, but the total area swept is exactly the same because the 13-foot dredge sweeps less area per hour fished than the 15-foot dredge (assuming constant speed).

At lower catch rates that are below the shucking capacity, the same swept area and hours fished translate into higher day-at-sea amounts because the time fished per day-at-sea tops out at 20.6 hours (assuming no changes in tow duration or gear handling). Day-at-sea use to achieve 273,442 hours of fishing or constant effort increases from 14,400 to 16,615 days.

Even if days used remain constant, modest changes in inputs controlled by fishermen can easily compensate for the 13-foot dredge. These changes include changing the towing speed, the length of tow, gear handling, trip duration, steam time, or all of them to a minor degree. In nearly all cases, the total amount of area swept (and impacts on mortality and the environment) are the same as with the 15-foot dredge. If applied to situations when the catch rates exceed shucking capacity, these changes could also increase the area swept and impacts more than the present fishing activity, but there is no incentive for fishermen to increase catches as long as the crew and shucking limits remain in place.

Speed

As DuPaul showed in Amendment 7, increasing the towing speed from 4.5 knots to 5.2 knots completely compensates for the reduced dredge width (Table 190). At slower speed, the increases are less dramatic, from 3.0 to 3.5 knots for example. This change does not affect any of the estimates except for area swept, because the longer tow distance is achieved in the same number of hours fished when the gear has equal efficiency. Landings are the same with both dredges.

Tow duration

Instead of increasing speed, fishermen could also compensate for the narrower dredge by increasing tow length or duration, without increasing speed. Actually, the results are more sensitive to differences in gear handling time, but this is more difficult to achieve than simply towing for a longer period.

[80] Not including unused days or Confirmation of Permit Histories.

Doubling the tow duration to 120 minutes and decreasing gear handling time to 7 minutes (Table 191) achieves an increase in total area swept (to 5,030 nm2), but doesn't quite come up to 5,265 nm2 for the 15 foot dredge, all other inputs being equal.

Trip duration and steam time

Increasing trip duration and decreasing steam time increase fishing time per day-at-sea, because vessels take fewer trips with a fixed day-at-sea limit and fishing time becomes a greater proportion of the total trip.

In this case, total hours fished increases to compensate for the reduced dredge width, increasing from 236,983 to 271,543 hours (Table 192). Landings and impacts to the environment would be approximately the same as with a 15-foot dredge, because total area swept would remain the same. Although not unheard of, it would take a trip duration increase from 15 to 24 days and a reduction in steam time from 3 to 2 days (round trip) to achieve these results.

Combination effects

Slight changes in more than one input could also have the same effects and compensate for the smaller dredge width. Increasing tow time by 20 minutes, decreasing gear handling time by 2 minutes, increasing tow speed by just 0.2 knots, and increasing trip duration by 3 days could achieve the same area swept and catches. When the catch rate is less than shucking capacity, hours fished per day increase from 20.6 to 21.8 per 24 hours, days fished increase from 11,520 to 12,000 days, and as a result total hours fished increase from 236,983 to 261,818. The extra tow speed adds to the length of each tow and combined result in the same total area swept, landings, mortality and environmental impacts.

Changes in location

The only remaining element that might change is where vessels with 13-foot dredges fish. This response would be expected if there were differences in the distribution of vessels using the two gear types. Unfortunately, there are not any differences.

Comparisons of vessel trip reports for scallop dredge vessels reveal that there are significant differences in the distribution of fishing for vessels using dredges less than 12 feet vs. vessels using dredges greater than 14 feet. Primarily the former are vessels with a general category scallop permit fishing in exempted fisheries[81]. Clusters of fishing activity have been observed along coastal Maine, along the outer part of Cape Cod, MA, and near Long Island and NJ. Most trips occur near shore on accessible scallop concentrations.

The latter are limited access scallop vessels using 15-foot dredges. Most of these trips occur in traditional scallop fishing areas: around Georges Bank, the Great South Channel, NY Bight, and the Delmarva. Typically, these trips occur farther offshore than for vessels using 10-foot dredges.

In between are limited access scallop vessels using dredges between 12 and 14-feet. Some vessels use smaller dredges for ease of handling or because the vessel has insufficient horsepower to use larger dredges. Differences are difficult to discern between the distribution fishing effort for this fleet and the fleet using 15-foot dredges. Since vessels using 12 to 14 foot dredges tend to fish in the same areas as

[81] Exempted fisheries are those fishing activities that are allowed because they have less than 5 percent groundfish bycatch. Most of these fisheries are restricted to specific areas, gears, and/or seasons.

vessels using full-size dredges, it is impossible to forecast any changes in fishing patterns due to the smaller dredge.

Table 189. Example comparison of 15 and 13 foot dredges assuming equal day-at-sea allocation. When catches exceed shucking capacity, fishing time per day increases to compensate for the lower catch rate of a 13-foot dredge. Otherwise, increases in tow speed can compensate for the narrower dredge width.

15-foot dredge

Tow duration, minutes	60	**Catch per day, pounds**	1,400	1,800	2,200	3,000
Gear handling time, minutes	10	**Shucking capacity per day, pounds**	1,800	1,800	1,800	1,800
Tows per 24 hours	20.6	**Hours per day fished**	20.6	20.6	16.8	12.3
Hours per day fished	20.6	**Total day-at-sea use, F=0.20**	14,400	14,400	17,600	24,000
Tow speed, knots	4.5	**Total days fished**	11,520	11,520	14,080	19,200
Trip length, days	15	**Total hours fished**	236,983	236,983	236,983	236,983
Steam time per trip, days	3	**Total swept area (nm^2), non-overlapping**	5,265	5,265	5,265	5,265
Area swept (nm^2) per hour	0.0222	**Total landed, million lbs.**	16.13	20.74	25.34	34.56

13-foot dredge, constant day-at-sea allocations

Tow duration, minutes	60	**Catch per day, pounds**	1,399	1,799	2,199	2,999
Gear handling time, minutes	10	**Shucking capacity per day, pounds**	1,800	1,800	1,800	1,800
Tows per 24 hours	20.6	**Hours per day fished**	20.6	20.6	16.8	12.3
Hours per day fished	20.6	**Total day-at-sea use**	14,400	14,400	17,600	24,000
Tow speed, knots	5.19	**Total days fished**	11,520	11,520	14,080	19,200
Trip length, days	15	**Total hours fished**	236,983	236,983	237,088	237,088
Steam time per trip, days	3	**Total swept area (nm^2), non-overlapping**	5,263	5,263	5,265	5,265
Area swept (nm^2) per hour	0.0222	**Total landed, million lbs.**	16.12	20.73	25.34	34.56

Table 190. Example comparison of 15 and 13 foot dredges assuming equal day-at-sea allocation. When catches exceed shucking capacity, fishing time per day increases to compensate for the lower catch rate of a 13-foot dredge. Otherwise, increases in tow duration and decreases in gear handling time can compensate for the narrower dredge width.

15-foot dredge

Tow duration, minutes	60	**Catch per day, pounds**	1,400	1,800	2,200	3,000
Gear handling time, minutes	10	**Shucking capacity per day, pounds**	1,800	1,800	1,800	1,800
Tows per 24 hours	20.6	**Hours per day fished**	20.6	20.6	16.8	12.3
Hours per day fished	20.6	**Total day-at-sea use, F=0.20**	14,400	14,400	17,600	24,000
Tow speed, knots	4.5	**Total days fished**	11,520	11,520	14,080	19,200
Trip length, days	15	**Total hours fished**	236,983	236,983	236,983	236,983
Steam time per trip, days	3	**Total swept area (nm^2), non-overlapping**	5,265	5,265	5,265	5,265
Area swept (nm^2) per hour	0.0222	**Total landed, million lbs.**	16.13	20.74	25.34	34.56

13-foot dredge, constant day-at-sea allocations

Tow duration, minutes	120	**Catch per day, pounds**	1,338	1,720	2,102	2,866
Gear handling time, minutes	7	**Shucking capacity per day, pounds**	1,800	1,800	1,800	1,800
Tows per 24 hours	11.3	**Hours per day fished**	22.7	22.7	19.4	14.2
Hours per day fished	22.7	**Total day-at-sea use**	14,400	14,400	17,600	24,000
Tow speed, knots	4.5	**Total days fished**	11,520	11,520	14,080	19,200
Trip length, days	15	**Total hours fished**	261,241	261,241	273,442	273,442
Steam time per trip, days	3	**Total swept area (nm^2), non-overlapping**	5,030	5,030	5,265	5,265
Area swept (nm^2) per hour	0.0193	**Total landed, million lbs.**	15.41	19.81	25.34	34.56

Table 191. Example comparison of 15 and 13 foot dredges assuming equal day-at-sea allocation. When catches exceed shucking capacity, fishing time per day increases to compensate for the lower catch rate of a 13-foot dredge. Otherwise, increases in trip duration or decreases in steam time can compensate for the narrower dredge width.

15-foot dredge

Tow duration, minutes	60	**Catch per day, pounds**	1,400	1,800	2,200	3,000
Gear handling time, minutes	10	**Shucking capacity per day, pounds**	1,800	1,800	1,800	1,800
Tows per 24 hours	20.6	**Hours per day fished**	20.6	20.6	16.8	12.3
Hours per day fished	20.6	**Total day-at-sea use, F=0.20**	14,400	14,400	17,600	24,000
Tow speed, knots	4.5	**Total days fished**	11,520	11,520	14,080	19,200
Trip length, days	15	**Total hours fished**	236,983	236,983	236,983	236,983
Steam time per trip, days	3	**Total swept area (nm^2), non-overlapping**	5,265	5,265	5,265	5,265
Area swept (nm^2) per hour	0.0222	**Total landed, million lbs.**	16.13	20.74	25.34	34.56

13-foot dredge, constant day-at-sea allocations

Tow duration, minutes	60	**Catch per day, pounds**	1,213	1,560	1,907	2,600
Gear handling time, minutes	10	**Shucking capacity per day, pounds**	1,800	1,800	1,800	1,800
Tows per 24 hours	20.6	**Hours per day fished**	20.6	20.6	19.4	14.2
Hours per day fished	20.6	**Total day-at-sea use**	14,400	14,400	17,600	24,000
Tow speed, knots	4.5	**Total days fished**	13,200	13,200	16,133	22,000
Trip length, days	24	**Total hours fished**	271,543	271,543	313,319	313,319
Steam time per trip, days	2	**Total swept area (nm^2), non-overlapping**	5,229	5,229	6,033	6,033
Area swept (nm^2) per hour	0.0193	**Total landed, million lbs.**	16.02	20.59	29.04	39.60

Table 192. Example comparison of 15 and 13 foot dredges assuming equal day-at-sea allocation. When catches exceed shucking capacity, fishing time per day increases to compensate for the lower catch rate of a 13-foot dredge. Otherwise, modest changes in a variety of fishing strategies can compensate for the narrower dredge width.

15-foot dredge

Tow duration, minutes	60	**Catch per day, pounds**	1,400	1,800	2,200	3,000
Gear handling time, minutes	10	**Shucking capacity per day, pounds**	1,800	1,800	1,800	1,800
Tows per 24 hours	20.6	**Hours per day fished**	20.6	20.6	16.8	12.3
Hours per day fished	20.6	**Total day-at-sea use, F=0.20**	14,400	14,400	17,600	24,000
Tow speed, knots	4.5	**Total days fished**	11,520	11,520	14,080	19,200
Trip length, days	15	**Total hours fished**	236,983	236,983	236,983	236,983
Steam time per trip, days	3	**Total swept area (nm^2), non-overlapping**	5,265	5,265	5,265	5,265
Area swept (nm^2) per hour	0.0222	**Total landed, million lbs.**	16.13	20.74	25.34	34.56

13-foot dredge, constant day-at-sea allocations

Tow duration, minutes	80	**Catch per day, pounds**	1,344	1,728	2,112	2,880
Gear handling time, minutes	8	**Shucking capacity per day, pounds**	1,800	1,800	1,800	1,800
Tows per 24 hours	16.4	**Hours per day fished**	21.8	21.8	18.6	13.6
Hours per day fished	21.8	**Total day-at-sea use**	14,400	14,400	17,600	24,000
Tow speed, knots	4.7	**Total days fished**	12,000	12,000	14,667	20,000
Trip length, days	18	**Total hours fished**	261,818	261,818	272,715	272,715
Steam time per trip, days	3	**Total swept area (nm^2), non-overlapping**	5,266	5,266	5,485	5,485
Area swept (nm^2) per hour	0.0201	**Total landed, million lbs.**	16.13	20.74	26.40	36.00

8.2.10 General category alternatives

8.2.10.1 Possession limit

Vessel trip report (VTR) data from 2001 were analyzed for trends in landings to identify potential possession limits for new general category and incidental catch scallop permits. The intent of the two new permits would be to vessels with a general category permit to continue targeting sea scallops and vessels with an incidental catch permit to land scallops captured as bycatch in other fisheries. For purposes of analysis, the trips that might be accommodated by each permit are distinguished by the percent of revenue derived from sea scallop landings. These data were categorized into three percent revenue groups: 100 percent, 50 to 99 percent, and 0 to 49 percent During 2001, 3,606 trips by vessels with general category permits landing sea scallops were reported. The overwhelming majority of VTR trips reporting scallop landings were for trips that landed only sea scallops (Figure 104).

For trips that landed only scallops, there appears to be a strong mode between 350 and 400 pounds, with a relatively uniform distribution of trips landing between 50 and 325 pounds (Figure 104). These landings are constrained by the present 400-pound scallop possession limit and the unconstrained distribution in 2001 could have a higher mode. There is a scatter of trips with scallop landings greater than 400 pounds. Some of these could be landings by vessels with limited access permits that were not matched correctly with the landings. Some may also be aggregated VTRs for multiple, single-day trips. Fishermen may be submitting reports for more than one daily report and reporting them as a 'trip'. Nearly all of the trips with more than 400 pounds landed in MA, which has a state exemption from the scallop day-at-sea regulations for vessels targeting scallops within state waters.

Although much lower in number, the landings distribution for trips where scallop revenue was between 50 and 99 percent appears to be very similar to the distribution of scallop landings when scallops were the only species landed. These trips are ones that scallops were targeted by other species were also landed, presumably as bycatch.

When scallop landings contributed to less than 50 percent of the total trip revenue, the landings distribution was much different than when the vessels targeted scallops (Figure 104). The majority of trips had scallop landings between 50 and 175 pounds when scallop revenue was less than 50 percent of the trip value. From these data, it appears that the majority of trips would not be forced to discard scallop bycatch with a 150 to 200 pound possession limit.

Other ways of examining these VTR data are informative about the disposition of this fleet sector and its attributes. The majority of trips landing scallops were by vessels using scallop dredges, apparently targeting sea scallops (Figure 105). Second in number of trips are vessels using nets. Within this gear category, there appear to be some trips targeting sea scallops and landings around 400 pounds, constrained by the present possession limit. A second mode appears around 100 pounds, apparently from vessels targeting other species and landing scallops as a bycatch.

Scallop landings per trip for vessels using nets tend to increase as the percent of revenue from scallops increases (Figure 105). Due to its high value per pound, summer flounder appears to be a significant component of the landings when scallop revenue is about 50 percent of the total (Table 193). When scallop revenue is a lower proportion of the total (e.g 40 percent or less), groundfish and skates appear to be a significant component of landings.

Most of the trips by vessels with general category permits targeting sea scallops appear to land in MA, ME, and NJ (Figure 106). Targeting of sea scallops and landing about 400 pounds of sea scallops appeared more prevalent in MA and NJ during 2001. Most of the scallop landings in ME were less than 200 pounds, according to the VTR data, presumably when the

Crew size also seems to be a significant correlate with general category vessels targeting sea scallops. Vessels with crews of three or four people tend to target sea scallops and have landings near the possession limit than vessels carrying one or two crewmembers (Figure 107). Presumably, the vessels carry a few more crewmembers to handle the heavy scallop dredge and to shuck scallops.

On a per day basis, the distribution of landings when scallops were the only species landed appears to be very similar to the landings for the entire trip (comparing Figure 108 to Figure 107). A large majority of these trips are day trips where the daily possession limit prevents vessels from making more than one trip per day. When scallop revenue is a less than half of the total trip revenue, the distribution of scallop landings per day absent is less than the scallop landings for the trip, presumably because general category vessels that land their scallop bycatch tend to take multi-day trips. The majority of landings are made by trips that have less than 100 pounds per day absent.

Compared to trip duration, scallop landings appear to be consistent with trips targeting scallops (see Figure 104) when the trip length is one day. Scallop landings have a strong mode about the 400-pound scallop possession limit (Figure 109). The distribution of landings per day also has a mode near the 400-pound possession limit (Figure 110), indicating either that these longer trips also target scallops, or that scallop bycatch on trips targeting other species is higher than 400 pounds.

In 2001, there were 133 trips (107 by vessels using dredges) that had scallop revenue greater than 50 percent of the trip total. The average landings per trip was about 400 pounds and it appeared that these longer trips targeted scallops, especially for vessels using dredges (Table 194). There were also 41 trips (38 by vessels using nets) where scallop landings accounted for less than 50 percent of the trip revenue. Average scallop landings for these trips were 150 pounds, or 78 pounds per day absent. Trips longer than two days appear to be targeting other species and most of the landings per day were less than 100 pounds.

From Figure 104 and Figure 108, it appears that a possession limit of 200 pounds per trip and 100 pounds per day-at-sea would be sufficient to accommodate scallop bycatch for vessels targeting other species, analyzed above as trips having scallop revenue less than 50% of the total trip revenue. Unlike other managed species, bycatch mortality of sea scallops is generally very low (i.e. 10 percent or less). Setting a reasonable possession limit that prevents vessels from using a new incidental catch permit to target scallops is unlikely to cause significant discard mortality.

For the vessels targeting sea scallops, it appears that vessels can catch and land more than 400 pounds in a day trip. Higher limits might be appropriate if compliance and fishing costs for these vessels increase or the scallop biomass increases in areas where these vessels fish (see distribution of trips by vessels using dredges less than 12 feet in Map 45 in the DSEIS), as it would following a rotation management area closure. Unfortunately, cost data for vessels holding general category scallop permits is sparse and it is therefore difficult to analyze profitability.

Table 193. Percent of revenue from species caught on trips by vessels with general category permits landing sea scallops. Data are from VTRs for trips by vessels with general category permits in 2001.

Percent from scallops	Number of trips	Average scallop landings (pounds)	Summer flounder	Squid	Monkfish	Skate	Groundfish	Lobster	Other species
0	99	1.9%	1.4%	0.8%	4.9%	7.7%	79.9%	3.0%	5.7%
10	55	8.9%	20.2%	1.5%	3.4%	13.9%	49.0%	2.2%	3.3%
20	32	20.9%	6.7%	2.5%	3.9%	11.1%	51.3%	2.0%	6.3%
30	9	27.8%	12.2%	0.0%	5.5%	14.4%	38.3%	1.3%	1.8%
40	12	45.1%	15.8%	0.0%	2.7%	1.6%	32.9%	1.2%	8.9%
50	18	51.4%	32.1%	0.1%	2.0%	0.0%	13.1%	0.5%	6.1%
60	14	59.1%	30.2%	0.0%	2.6%	1.4%	6.1%	0.0%	0.8%
70	9	72.9%	7.7%	5.2%	2.7%	0.1%	10.8%	0.1%	4.4%
80	16	80.4%	7.6%	0.2%	0.9%	0.0%	8.1%	1.7%	1.0%
90	18	91.2%	3.5%	0.0%	2.2%	0.2%	2.3%	0.1%	0.7%
100	166	94.5%	0.2%	0.0%	0.1%	0.0%	0.5%	0.0%	0.1%
Grand Total	448	21.6%	3.6%	0.7%	3.7%	6.3%	56.5%	2.1%	4.2%

Table 194. Average scallop landings per trip and per day absent versus trip length and percent of trip revenue from scallop landings (0 –49 percent, 50-99 percent, and 100 percent). Top portion of table are for vessels using scallop dredges and the bottom part of the panel are for vessels using nets. Source: Summaries from VTRs from vessels having a general category scallop permit and landing scallops during 2001.

	Percent class	Data							
	0-49			50-99			100		
Trip duration	Trips	Landings per trip	Piv	Trips	Landings per trip	Piv	Trips	Landings per trip	Piv
1	2	136	103	98	497	486	2,918	408	403
2	2	350	182	19	496	263	88	403	224
3				3	369	123	7	615	238
4	2	360	85				4	358	99
5				1	370	67	2	399	86
6				2	1,337	213	3	294	51
9							1	17,000	1,947
16				1	34,000	2,068			
Grand Total	**6**	**282**	**123**	**124**	**777**	**448**	**3,023**	**414**	**397**

	Percent class	Data							
	0-49			50-99			100		
Trip duration	Trips	Landings per trip	Piv	Trips	Landings per trip	Piv	Trips	Landings per trip	Piv
1	75	103	99	72	1,269	1,261	121	476	470
2	38	141	73	16	364	205	10	741	378
3	13	101	34	4	313	108	3	124	41
4	15	220	60	2	164	40	1	160	38
5	10	164	33	1	247	48			
6	16	128	22						
7	9	100	14						
8	17	117	14						
9	16	159	18						
10	7	188	19						
11	2	280	26						
Grand Total	**218**	**132**	**60**	**95**	**1,042**	**996**	**135**	**486**	**450**

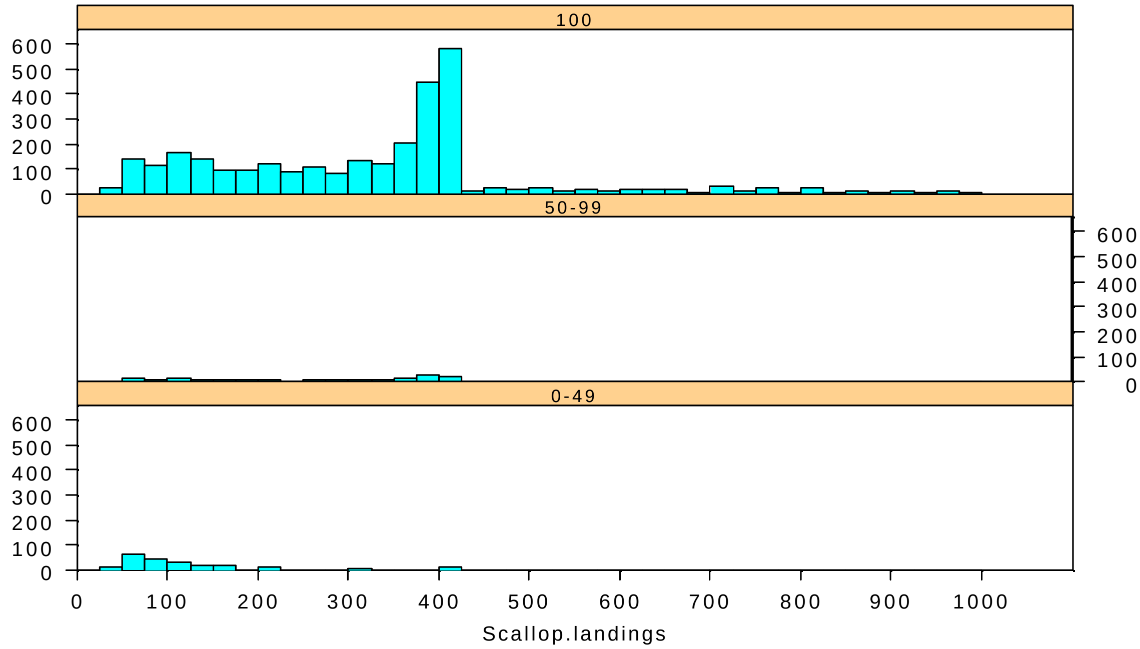


Figure 104. Scallop landings per trip compared to the percent of revenue derived from scallop landings. Data from 2001 VTRs by vessels with general category scallop permits reporting scallop landings.

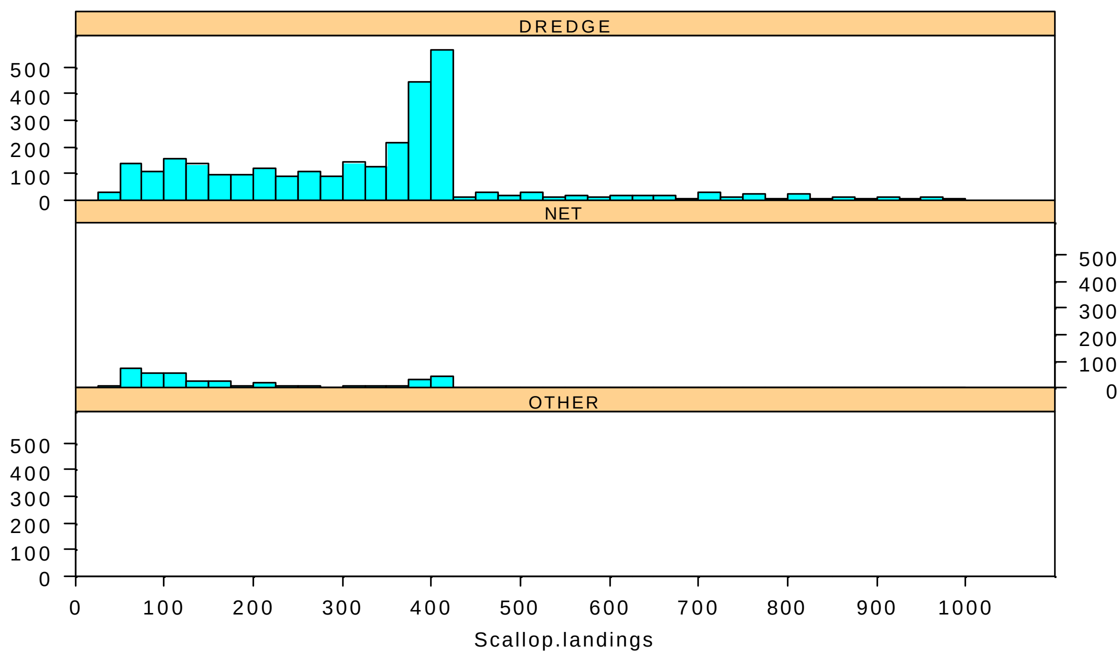


Figure 105. Scallop landings per trip by fishing gear. Data from 2001 VTRs by vessels with general category scallop permits reporting scallop landings.

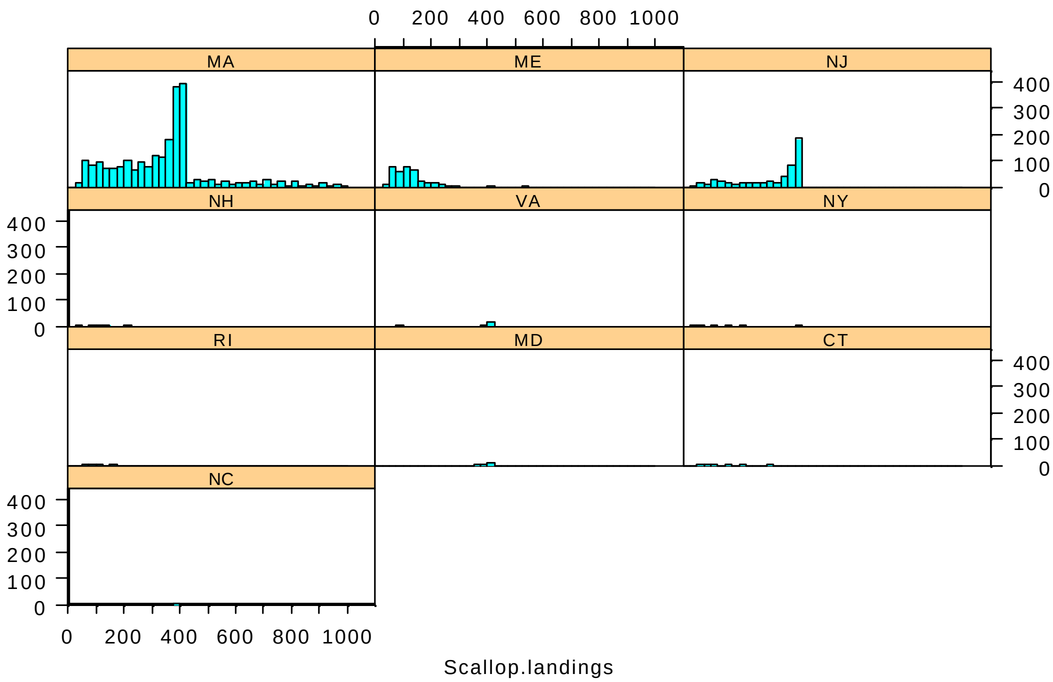


Figure 106. Scallop landings per state of landing for vessels with general category scallop permits. Data from 2001 VTRs by vessels with general category scallop permits reporting scallop landings.

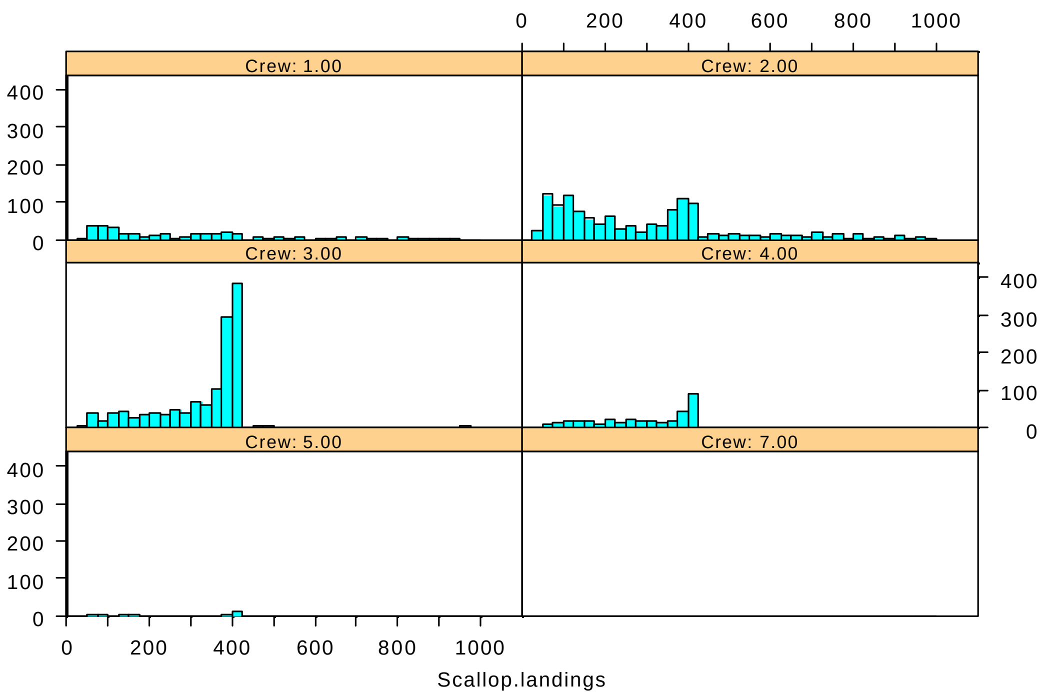


Figure 107. Scallop landings by number of crew for vessels with general category scallop permits. Data from 2001 VTRs by vessels with general category scallop permits reporting scallop landings.

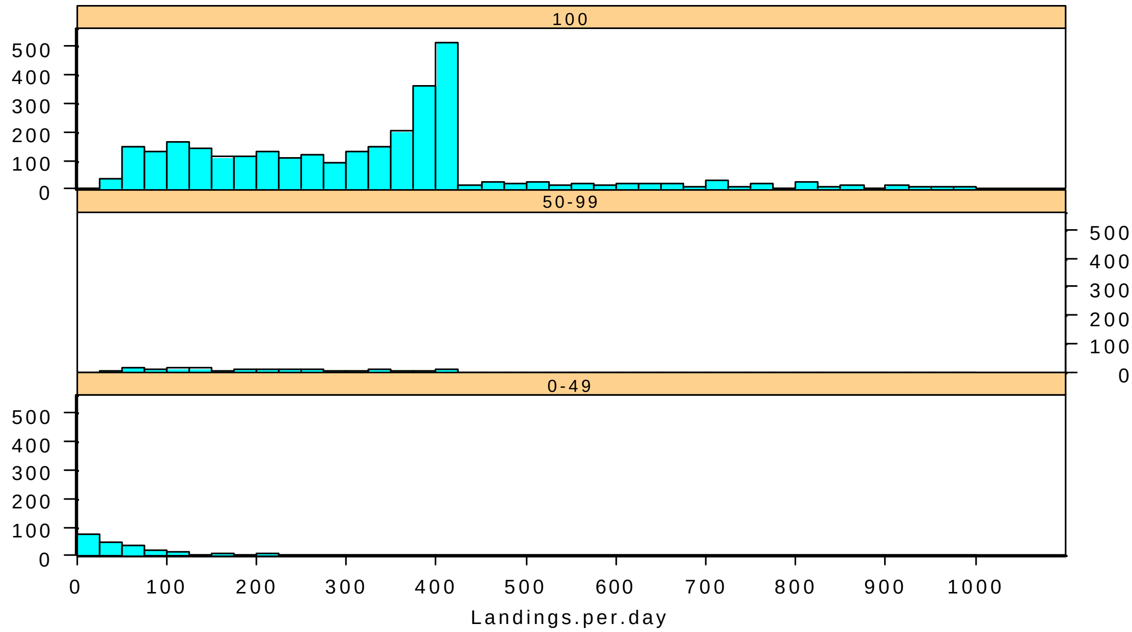


Figure 108. Scallop landings per day absent compared to the percent of revenue derived from scallop landings. Data from 2001 VTRs by vessels with general category scallop permits reporting scallop landings.

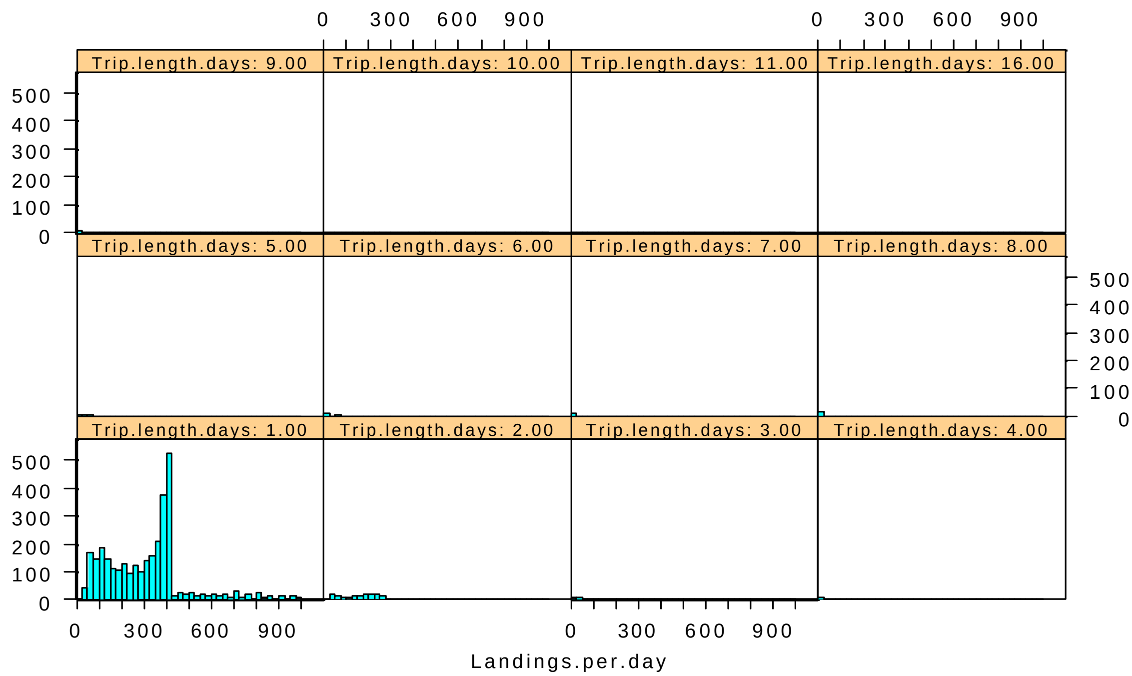


Figure 109. Scallop landings per day absent compared to trip duration (days absent). Data from 2001 VTRs by vessels with general category scallop permits reporting scallop landings.

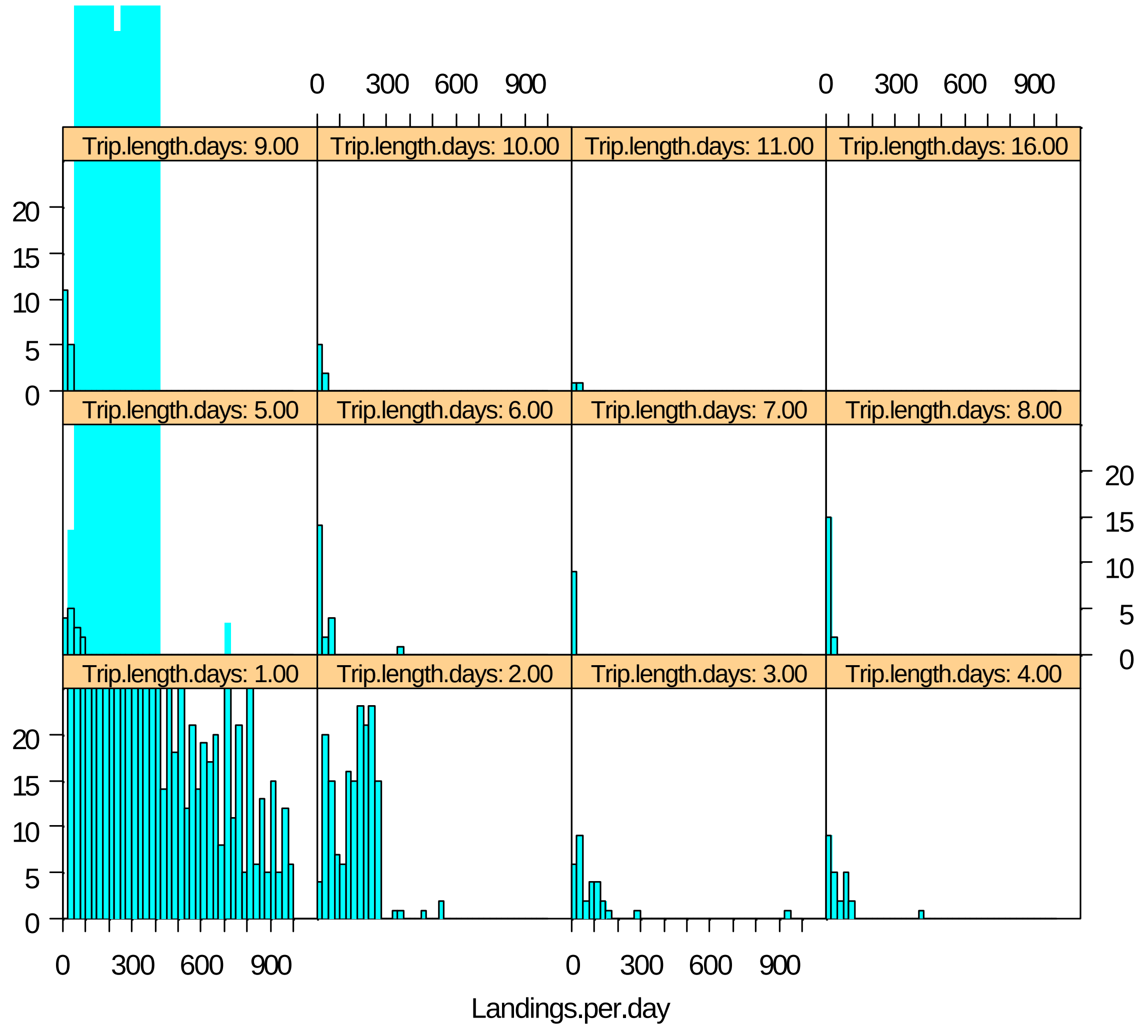


Figure 110. Scallop landings per day absent compared to trip duration (days absent). Y-axis is re-scaled to show the trip distribution relative to landings per day absent for trips longer than one day. Data from 2001 VTRs by vessels with general category scallop permits reporting scallop landings.

8.2.10.2 Prohibiting limited access vessels from targeting sea scallop while not on a day-at-sea

Most limited access scallop vessels derive little additional income from the landings of scallops while not on a day-at-sea, but vessels with part-time and occasional scallop permits derive a greater share of scallop revenue from trips not on a day-at-sea and there is variability between vessels in this regard. Although prohibiting vessels with limited access scallop permits from targeting scallops while not on a day-at-sea (by lowering the possession limit to 40 pounds) will reduce revenue for them, this loss will partly be made up through day-at-sea allocations (see also Section 7.7.4.10 for a discussion of the economics of this re-allocation within a permit category) and by fishing for other species.

The benefit of this alternative is to improve the effectiveness of using day-at-sea limits to prevent overfishing, without which increasing effort in the open access general category fishery could reduce the day-at-sea allocations or run the risk of overfishing the resource.

From 1999 to 2002, an average of 67 full-time, 20 part-time, and 6 occasional vessels landed less than 400 pounds of scallops at a dealer (Table A). This is 25%, 68%, and 40% of the vessels using their day-at-sea allocations in 2001, assuming that vessels targeting scallops while not on a day-at-sea were using scallop days sometime during the 2001 fishing year.

Full-time vessels averaged 322 trips per year, or 4.8 trips per vessel (Table A), or about four percent of a 120-day allocation. The number of trips and total scallop landings on trips with less than 400 pounds, as well as the average scallop catch per trip decline through this period. This downward trend reverses the one observed for day-at-sea use and catches as the resource rebuilt to the target. On average, full-time vessels landed 92,824 lbs. of scallops, or 1,385 lbs. per vessel (less than a day's catch on a limited access trip with a seven-man crew and two dredges). These landings were only 0.3 percent of the scallop landings by full-time scallop vessels when fishing on a day-at-sea. Except for 2002, most trips by full-time scallop vessels when not on a day-at-sea appear to be targeting scallops, landing 310 to 322 pounds (over 75 percent of the scallop possession limit) and contributing to more than half the revenue for the trip. In 2001, the average annual revenue per vessel ($8,089) was only 1.3 percent of the total average scallop revenue per vessel (Table B).

Because of higher amounts of scallop fishing while off the day-at-sea clock and a lower day-at-sea allocation, the proposed prohibition would affect a greater proportion of revenue for part-time scallop vessels. And since any re-allocation of days due to lower general category landings would be in proportion to the base day-at-sea allocations, vessels with part-time scallop permits would be unlikely to recoup their loss through a greater day-at-sea allocation.

Part-time vessels appear to supplement their scallop fishing income off the day-at-sea clock more frequently. The trips and landings do not show the same trend as those for full-time vessels, reaching a peak in 2001 with 322 trips and 100,659 lbs. (Table A). Only 20 part-time vessels, on average, had trips with landings less than 400 pounds, but the scallop landings and revenues per vessel were more substantial. These vessels averaged 235 trips (or 11.8 per vessel), which had average landings of 327 lbs. per trip. Unlike the full-time vessel activity, these trips appear to continue to target scallops right into 2002, when the average catch per trip was 355 lbs., making up more than half of the revenue on trips landing sea scallops. During the period, the part-time vessels averaged 68,908 lbs. per year, or 3,445 lbs. per vessel annually. In 2001, the revenue from scallop landings from trips not on a day-at-sea was 11 percent of the scallop revenue from day-at-sea trips (Table B).

The amount of scallop revenue is insignificant for vessels with occasional scallop permits from trips not on a day-at-sea, averaging 267 pounds per year while using dredges, or 45 pounds per vessel. Landings per trip averaged 152 lbs., when including landings from all gear types. Although there were apparently some trips that targeted sea scallops in 1999, the average landings per trip and the proportion of revenue from scallop landings on these trips declined in 2000-2002, averaging less than 20 percent, indicating that most vessels with occasional scallop permits were targeting other species.

Table A. Average annual landings and revenue by vessels with limited access scallop permits, for trips landing less than 400 pounds of scallop meat.

Category & Number of vessels using 2001 DAS	Fishing year	Number of vessels	Trips	Average catch per trip (lbs)	Scallop landings using dredges	Percent of DAS scallop landings.	Average scallop price	Percent of revenue from scallop landings
Full-time	1999	85	475	322	149,011	0.7%	$6.49	78.7%
	2000	72	342	317	98,548	0.3%	$5.97	66.5%
252	2001	63	352	310	98,541	0.3%	$4.67	57.5%
	2002	48	119	247	25,197	0.1%	$4.20	30.5%
Full-time average		***67***	***322***	***311***	***92,824***	***0.3%***	***$5.33***	***64.5%***
Part-time	1999	20	159	274	38,830	4.2%	$6.19	63.1%
	2000	19	279	338	83,912	5.3%	$6.87	91.6%
38	2001	26	322	329	100,659	4.3%	$5.07	63.0%
	2002	16	178	355	52,231	2.4%	$4.42	58.5%
Part-time average		***20***	***235***	***327***	***68,908***	***3.9%***	***$5.64***	***70.3%***
Occasional	1999	4	12	248	0	14.5%	$4.70	40.3%
	2000	5	17	111	0	6.0%	$4.56	15.2%
20	2001	8	29	126	694	5.1%	$4.28	19.1%
	2002	7	23	164	372	6.4%	$4.44	17.9%
Occasional average		***6***	***20***	***152***	***267***	***6.8%***	***$4.49***	***20.6%***

Table B. Comparison of 2001 scallop revenue per vessel derived from landings while on a day-at-sea trips vs. landings of less than 400 lbs. while not on a day-at-sea.

	Full-time	Part-time	Occasional
Number of vessels that took GC (<=400 lb.) trips	63	26	8
Number of <=400 lb. trips	352	322	29
Average catch (lbs) per trip	310	329	126
Average annual landings per vessel (lb)	1,732	4,075	457
Average ex-vessel price	4.67	5.07	4.28
Average annual revenue per vessel from GC (<=400 lb) trips	8,089	20,658	1,955
Average annual revenues from DAS trips	617,422	188,256	9,750
The revenue from GC trips as a % of revenue from DAS trips	1.31%	10.97%	20.05%

8.3 Finfish bycatch

8.3.1 Effects of area rotation on bycatch (Alternative 5.3.5.1)

Similar to the area access program effects described above, rotation area management is expected to focus fishing effort in areas with higher than average scallop biomass. More of the resource area will also be under controlled access rules, which will have a scallop possession limit and DAS tradeoff. It is projected (Section 8.2.1) that focusing fishing effort in controlled access areas will reduce bottom contact time per DAS and therefore will have a favorable effect in bycatch in general.

This effect would be similar to those observed in the 2000 fishing year, when the Scallop and Multispecies FMP allowed access to closed groundfish areas. Bycatch estimates and an anlysis of the effects on groundfish, barndoor skate, and other species is given in Section 1.0 of Appendix IX and the results are summarized in Section 7.2.4.1.1. Actual results for each future year, however, will vary, depending on the location and timing of re-opened controlled access areas relative to the distribution of finfish species that are susceptible to capture by scallop dredges and trawls.

The framework adjustment process however includes measures that can accommodate seasonal access, modifications of boundaries, or gear modifications when needed to minimize bycatch. Although difficult to predict for each finfish species, the overall impact of area rotation is expected to be positive due to its effect on fishing time per DAS and the framework adjustment process that will allow future management to avoid potential problems with unacceptable bycatch.

8.3.2 Effects on bycatch from increasing the minimum ring size to 4-inches (Alternative 5.3.5.2)

Catches of finfish and invertebrates were monitored during ring-size comparison research conducted by Dr. DuPaul at the VA Institute of Marine Science (Section 8.2.8). In general, it appears that dredges with 4-inch rings may allow greater escapement of smaller finfish and invertebrates. Like the catches of large scallops, however, a dredge with 4-inch rings may increase the catch of larger finfish, although the differences in catches of large fish are insignificant in most cases. More importantly, however, dredges with 4-inch rings are more efficient at catching large scallops and in most areas will decrease fishing time to catch the same number of scallops. Like area rotation and other similar effects that decrease fishing time per day-at-sea, this alternative is expected to reduce bycatch impacts and have a favorable effect on bycatch mortality, particularly for smaller finfish and invertebrates which are capable of passing through or between the rings unharmed by the experience.

8.3.3 Effects on bycatch from increasing the minimum twine top mesh to 10-inches (Alternative 5.3.5.3)

The only formal analysis of the effects of twine top mesh on bycatch and bycatch mortality were done in Framework Adjustment 11 (NEFMC 1998). No new data or analyses are available, partly because similar comparison research has not been conducted in open areas under recent fishing conditions. These earlier studies were often conducted in the groundfish closed areas because the large scallops found there at that time were retained by the dredge, rather than escaping through the large mesh twine top as smaller scallops do.

As the scallop biomass has rebuilt in open areas (see Figure 1 and Figure 2), the average size of sea scallops caught by scallop dredges has also increased. Therefore in many areas the scallop size distribution is more like those in the groundfish closed areas when the twine top comparisons were done. In addition, areas of small scallops are likely to be off-limits to scallop fishing under future rotation area management actions, keeping small scallop escapement through larger twine tops to a minimum.

Not all finfish escapement was improved by adding larger mesh twine tops, but many species saw improvements and bycatch rates for other species that did not see improvements were statistically insignificant. The quantitative effects of requiring a larger twine top mesh are difficult to predict due to a variety of variables and conditions. Overall, the effects of larger twine top mesh are expected to be positive, reducing bycatch and bycatch mortality for many species, especially when coupled with rotation area management.

There has been little published on the methods for reducing finfish bycatch in the sea scallop dredge fishery. In Canada, gear modifications to reduce bycatch have been tested by the scallop industry with modest success. The Canadian work found that the use of large square mesh in the twine top resulted in a 25% decrease in the catch of roundfish (cod, haddock) but not for flatfish. Windows or open squares in the back of the twine top and tickler chains attached to the frame of the dredge resulted in similar reductions for cod and haddock. Dredge modifications to reduce the harvest of flatfish while maintaining the harvest of scallops remained problematic.

Recent studies in the U.S. have demonstrated promising results. Smolowitz et al (1997) reported that increases in the mesh size of the twine top significantly reduced the number of flatfish captured by the dredge. Comparisons of a 6" diamond mesh twine top with that of an 8" square mesh resulted in a 37% reduction in the harvest of yellowtail flounder (1,674 versus 1,042; 78 tows). A similar experiment comparing a 6" diamond mesh twine top with that of a 10" diamond mesh resulted in a 45% reduction in the harvest of yellowtail founder (605 versus 300; 50 tows). There were no statistical differences in the size selection differential between the control and experimental twine tops but this may have been due to the size frequency distribution of the yellowtail flounder in the population at the time of the tests. The reductions in the number of yellowtail harvested by the dredge using the larger mesh twine tops were statistically different at the 95% confidence level. The use of a 10" twine top reduced the amount of scallops captured.

In 1998, DuPaul and Kerstetter (unpublished data) tested the use of larger mesh twine tops to reduce the bycatch of summer flounder in the mid-Atlantic. A comparison between a 6" diamond mesh twine top with that of an 8" diamond mesh produced inconsistent results that were not statistically different (292 versus 265; 28 tows). A comparison of a 6" diamond mesh twine top that of a 9.5" knot-center diamond mesh hung on the diagonal significantly reduced the catch of summer flounder by 42% (543 versus 310; 66 tows; Table I). Hanging the twine top on a diagonal resulted in an "open diamond" configuration similar to a square mesh. The harvest of scallops during this test was highly variable from tow-to-tow due to rough weather and a scarcity of scallops (1-3 baskets per dredge per tow). No conclusions relative to the harvest of scallops could be made.

In 1998, during the cooperative NMFS/Industry/Academia survey of the Georges Bank Closed Area II (CAII), comparative tows using larger mesh twine tops were made both inside and outside the boundaries of CAII (DuPaul et al 1999). A comparison between an 8" diamond mesh twine top with that of an 8" square mesh produced no significant reductions in the catch of yellowtail flounder (p=0.233) and blackback flounder (p=0.670) during the survey within the boundaries of CAII (224 tows). The catch of scallops were not statistically different.

In a second experiment outside the boundaries of CAII, an 8" diamond mesh twine top was compared with that of a 12" square mesh. Significant reductions in the capture of blackback flounder (p=0.004), windowpane flounder (p=0.003) and monkfish (p=0.041) were observed. The reduction in the catch of yellowtail flounder was not significant (219 versus 188; p=0.082). There was a highly significant reduction in the harvest of scallops (p=0.000). A total of 34 tows were made.

These recent studies indicate that increasing the mesh size of the twine top can be effective in reducing finfish bycatch in the sea scallop dredge fishery. However, it is also apparent that increases in mesh size must be balanced with undesirable losses in scallop production. In areas with an abundance of large scallops such as in the Georges Bank Closed Areas, minor losses in scallop production may be tolerated but not the extent where increases in towing time will offset gains in bycatch reduction.

8.3.4 Effects on bycatch from gear modifications based on recent research

Although the Council hoped for more favorable results and progress, developing gear modifications have not materialized to reliably reduce finfish bycatch. If future research shows a more desirable configuration or modification to reduce finfish bycatch, the Council may require changes by framework action, which will have a favorable effect.

Other modifications to the traditional New Bedford scallop dredge have been tested in an effort to reduce finfish bycatch. Smolowitz et al (1997) reported that a gooseneck roller attached to the bail of a standard dredge did not result in a reduction of bycatch. More recently Smolowitz et al (2001) tested a fish sweep in combination with an excluder ring-panel in Georges Bank Closed Area I. The dredge modifications resulted in 40% reduction in the catch of skates (3,197 versus 1,904; p=0.001) a 41% reduction in yellowtail flounder (518 versus 304; p=0.004) and a 48% reduction in blackback flounder (391 versus 201; p=0.0001). There were no significant differences in the catch of monkfish or scallop. These results are extremely promising but more sea trials for the gear area necessary before definite estimates of bycatch reduction can be made.

Recent trials of a 4" ring dredge to estimate improvements in scallop selectivity have provided additional information of finfish bycatch reduction (DuPaul et al 2002). Reductions in bycatch using a 4" ring scallop dredge was only apparent for small fusiform fishes such as red hake, silver hake and sculpins. Reductions in the catch of small flatfish (yellow flounder <30 cm, 4-spot flounders) were also observed.

Table 195. Results of twine top experiments between the standard 6 inch diamond twine top and a 9.5 inch diamond mesh hung on the diagonal which resulted in opening of the mesh. Data was acquired from 66 comparative tows aboard the *F/V Carolina Breeze* during March of 1998 along the Mid-Atlantic Bight. Values represent numbers of summer flounder (*Paralichthys dentatus)* captured by each twine top configuration. Significance was determined by a two sample Student's t-test (∝=0.05).

Total Length	6" Diamond	9.5" Open Diamond	Total	Significant Difference
<12"	160	72	232	yes
12"-14"	182	108	290	yes
14"-16"	161	107	268	yes
16"-"18"	28	12	40	yes
18"-20"	7	5	12	no

>20"	5	6	11	no

8.3.5 Effects on bycatch from area-specific possession limits for some finfish species (Alternative 5.3.5.5)

This alternative was considered in Amendment 10 to enable the FMP to apply finfish possession limits to scallop vessel fishing in specific areas, primarily the controlled access areas re-opened under area rotation. While this alternative was not formally approved in Amendment 10, it remains a viable alternative for future framework adjustments when and where needed.

Unlike a TAC which would close an area when finfish catches reach a limit set to avoid excessive catches, a finfish possession limit often causes regulatory discards (i.e. bycatch) to increase unless the possession limit forces a change in fishing behavior.

When applied to controlled access areas where vessels have time (due to the DAS tradeoff) to seek other fishing areas within the boundaries to avoid catching certain finfish, the effects can be drastically different. At the very least, the possession limit reduces the incentive to stay in an area with high finfish bycatch to partially target those species in addition to targeting sea scallops. When scallop biomass is high, like it would be in a controlled access area, and a DAS tradeoff applies, changing fishing locations to reduce finfish bycatch has few costs to the vessel and fishermen.

During 1999, Closed Area II access had a groundfish possession limit and a yellowtail flounder TAC apply. Generally, vessels successfully evaded yellowtail flounder catches by fishing the more northerly part of the scallop distribution in Closed Area II. Some of this effect broke down late in the season as prices and catches of large scallops from beds where yellowtail flounder began eroding.

Therefore when applied to controlled access areas with DAS tradeoffs, under certain conditions finfish possession limits can help to minimize finfish bycatch and bycatch mortality by changing fishing behavior. Under these circumstances, area-specific possession limits for some species could have a positive effect on minimizing bycatch and bycatch mortality.

8.3.6 Effects on bycatch from area-specific finfish TACs (Alternative 5.3.5.6)

Like the one above, this management alternative was considered primarily to enable establishing finfish TACs in controlled access areas where catches of certain species may be problematic, either causing overfishing on that species or inhibiting recovery of stock biomass. While this alternative was not formally approved in Amendment 10, it remains a viable alternative for future framework adjustments when and where needed.

Ideally, this measure would be applied in controlled access areas where the expected bycatch rates are higher within the area than outside the area. Otherwise, fishing effort that might occur in a controlled access area might be transferred to other places where bycatch rates are higher. On the other hand, with area-specific DAS allocations, this type of effort shift is more difficult which enhances the effectiveness of this alternative to minimize finfish bycatch.

Under the status quo overfishing definition, however, greater amounts of closures (i.e. less scallop catch from controlled access areas) would cause in increase in open-area DAS allocations to achieve the target fishing mortality rate. It would therefore be advantageous to direct area-specific finfish possession limits to areas and for species where the bycatch rates are higher inside an area rather than outside the area. This management alternative is expected to help reduce bycatch and bycatch mortality, but actual results will depend on how it is applied in future framework actions.

8.3.7 Seasonal and geographical variation in non-target finfish catches (Alternatives 5.3.5.7 and 5.3.5.8)

Finfish bycatch on observed scallop dredge trips[82] were analyzed for area and season specific trends to identify where and when finfish catches were abnormally high. The most common occurrences or those species that had high total hail weights were filtered before analyzing the trends by area and season. Cod and barndoor skate were included because of their high importance to management, but haddock were not because catches on scallop dredges are uncommon. The most common finfish or finfish species with high total hail weights were monkfish (angler), little skate, yellowtail flounder, unclassified skates (skates), fourspot flounder, summer flounder, winter flounder, sand-dab flounder, winter (big) skate, cod, clearnose skate, smooth skate, thorny skate (Table 73).

These data summaries represent over 28,000 observed tows from 1991 to 2000. The catches were adjusted for normalized trends in biomass (Table 199) derived in published reports for various assessments and SAFE Reports. The days absent and days fished were adjusted for the proportion of scallop landings from observed vs. unobserved tows during the trip. Kept and discarded components of the catch are shown separately in the summary tables (Table 197 and Table 198) With this statistical treatment to normalize the data with respect to temporal trend and the low sampling frequency in any one year, these sea sampling data are not very useful to examine temporal trends in bycatch. Geographical and seasonal trends in bycatch, as a ratio to fishing effort and scallop landings, however, provides a useful indicator of when and where bycatch for various finfish are higher than normal.

The observed tows were initially binned by ten minute square over a trip for calculating mean weights per tow and time fished, and then further binned into associated rotation management areas. Squares outside of the example rotation management areas are binned into one-degree squares, designated by degrees of latitude and longitude.

Categories (i.e. area and quarter pairs) were highlighted if their mean catch per pound of scallop landings and per day absent were above the 90th percentile for that species' bycatch over all years in the fishery. Analysis of discards and landings of non-target species were performed by quarter and rotation management area (or square degree where the observation did not fall within a scallop rotation management area) for commonly observed 15 species listed in the table below. Discards and landings of non-target species by vessels using scallop dredged on observed trips were summed over species when the amount ranked in the top 10th percentile for that species. The sum of discard and non-target species landings that ranked in the top 10th percentile are totaled by region and scallop management area in Table 197 and Table 198, respectively.

82 No observed trips on vessels using scallop trawls.

Table 196. Species included in geographic and seasonal distribution analysis of discards and non-target species landings on observed trips aboard vessels using scallop dredges during 1991-2000.

Sea scallop (discard only)	Monkfish	Cod[83]
Fourspot flounder	Sand dab flounder	Summer flounder
Winter flounder	Yellowtail flounder	Unclassified skate
Barndoor skate[84]	Clearnose skate	Little skate
Smooth skate	Thorny skate	Winter skate

This statistical summary therefore identifies those occurrences where bycatch was exceptionally high, possible candidates for either a seasonal (Section 5.3.5.7) or long-term (year around, Section 5.3.5.8) closure.

Scallop fishing areas in the Georges Bank region tend to have highest finfish catches (Table 197) in the third and fourth quarters (July to December), compared to the amount of fishing effort and scallops landed. Ranked by 90th percentile of finfish bycatch levels of the most frequently or abundant finfish species in the observed catch by scallop dredges, the areas that had the most frequent high finfish catch levels are GB7 to GB9 (the northern edge of Georges Bank) in July to December, GB10 in October to December (Closed Area I south), and the non-rotation areas around Cape Cod (4070, 4170, 4171). No area had consistently high catches throughout the year.

In the Gulf of Maine, finfish catch on scallop dredges was high most frequently in the third quarter (July to September), particularly in the "4267" degree block. Most of the scallop fishing in this one-degree block is on the northern edge of Georges Bank, and properly belongs in that region.

The high finfish catches on scallop dredges tend to be most frequent in the Mid-Atlantic region during the first and fourth quarters (Jan – Mar, Oct – Dec). Occurrences of high catches were frequent in Oct. to Dec. in MA8, MA9, and "4071". Frequent high catches were observed in MA9 during Jan. to Jun., also. Those areas are near the eastern end of Long Island and south of RI. Also, the high finfish catches were most frequent in the third quarter in degree blocks "3874" and "3974", inshore of the candidate rotation management areas off of NJ.

In terms of management status (Table 198), the closed areas that are within the groundfish closures had the most frequent occurrences of high finfish catches (averaging 17.5 per area), followed by the Framework Adjustment 13 areas (14.0), the candidate rotation management areas (11.4), and finally the areas not within the candidate rotation management areas (9.8). Seasonally the high finfish catches were frequent throughout the year in the groundfish closed areas, , but in the Framework Adjustment 13 areas, the finfish catches were most frequent in the third and fourth quarters (Jul – Dec) and lowest from Jan. to June. High finfish catches were most frequent in GB9 (the Framework 13 area within Closed Area I) during the third and fourth quarters.

[83] Included due to the controversiality of cod bycatch, not because it was frequently observed as bycatch on sea sampled trips.
[84] Included due to the controversiality of cod bycatch, not because it was frequently observed as bycatch on sea sampled trips.

Table 197. Occurrence of catches finfish per day-at-sea, per day fished, and per pound of landed scallop in the top 10th percentile for a species on observed trips by region, rotational management area and quarter, averaged over 1991 – 2000. Numbered areas are waters outside of the candidate rotation management areas, summed into a one-degree block (latitude/longitude).

		Disposition Data							
		Discarded				Landed			
Region	Area	Jan - Mar	Apr - Jun	Jul - Sep	Oct - Dec	Jan - Mar	Apr - Jun	Jul - Sep	Oct - Dec
Georges Bank	GB1			2	3			1	
	GB2	2		3	5	3			4
	GB3	2		3				2	
	GB4	3	1				7		3
	GB5	7		3	4	6			1
	GB6	3		6		2			
	GB7		9	8	6			2	6
	GB8			7	6			3	
	GB9			12	5			5	4
	GB10	9	3	2	7		2		6
	GB11	2		2	2				4
	GB12								
	GB13	4	2	7		5	4		4
	GB14	6		5		4			1
	GB15		1				1	3	
	4065			8					
	4066				1				
	4067	5	3	4			3		1
	4068		3	4	5		3	3	3
	4069		2		2		9		3
	4070				27				9
	4166	1	1			2	1		
	4167					1			3
	4170	3	15		13				6
	4171			8	13				3
	4172				3				
	4173								
Georges Bank Total		**47**	**40**	**84**	**102**	**23**	**30**	**19**	**61**

		Disposition Data							
		Discarded				Landed			
Region	Area	Jan - Mar	Apr - Jun	Jul - Sep	Oct - Dec	Jan - Mar	Apr - Jun	Jul - Sep	Oct - Dec
Gulf of Maine	4267			2	3			9	2
	4268			3					
	4269				1				
	4270	1		2					1
Gulf of Maine Total		**1**		**7**	**4**			**9**	**3**
Mid-Atlantic	MA1	2			4	3			
	MA2	2					2		
	MA3	3				3			
	MA4								1
	MA5	2	3						
	MA6	3			0				
	MA7				4	3	1		
	MA8		3	1	6				
	MA9	8	6	3	6				2
	3674								
	3675				3				
	3773								
	3775	3	3			4			
	3870								
	3872								
	3874	2	1	9					
	3974	3		6					
	4071	3			8	5			4
	4072	3	2		1	5			
	4073			3			3		
Mid-Atlantic Total		**34**	**18**	**22**	**32**	**23**	**6**		**7**
Grand Total		**82**	**58**	**113**	**138**	**46**	**36**	**28**	**71**

Table 198. Occurrence of catches finfish per day-at-sea, per day fished, and per pound of landed scallop in the top 10th percentile for a species on observed trips by rotational management area, management status, and quarter, averaged over 1991 – 2000. Numbered areas are waters outside of the candidate rotation management areas, summed into a one-degree block (latitude/longitude).

			Disposition Data							
			Discarded				Landed			
Rotational management area	Status	Area	Jan - Mar	Apr - Jun	Jul - Sep	Oct - Dec	Jan - Mar	Apr - Jun	Jul - Sep	Oct - Dec
Rotation	Closed	GB10	9	3	2	7		2		6
		GB11	2		2	2				4
		GB13	4	2	7		5	4		4
		GB15		1				1	3	
	Closed Total		**15**	**6**	**11**	**9**	**5**	**7**	**3**	**14**
	Framework 13	GB9			12	5			5	4
		GB12								
		GB14	6		5		4			1
	Framework 13 Total		**6**		**17**	**5**	**4**		**5**	**5**
	Open	MA1	2			4	3			
		MA2	2					2		
		MA3	3				3			
		MA4								1
		MA5	2	3						
		MA6	3			0				
		MA7				4	3	1		
		MA8		3	1	6				
		MA9	8	6	3	6				2
		GB1			2	3			1	
		GB2	2		3	5	3			4
		GB3	2		3				2	
		GB4	3	1				7		3
		GB5	7		3	4	6			1
		GB6	3		6		2			
		GB7		9	8	6			2	6
		GB8			7	6			3	
	Open Total		**37**	**22**	**36**	**44**	**20**	**10**	**8**	**17**

			Disposition Data							
			Discarded				Landed			
Rotational management area	Status	Area	Jan - Mar	Apr - Jun	Jul - Sep	Oct - Dec	Jan - Mar	Apr - Jun	Jul - Sep	Oct - Dec
Rotation Total			**58**	**28**	**64**	**58**	**29**	**17**	**16**	**36**

Rotational management area	Status	Area	Discarded Jan - Mar	Discarded Apr - Jun	Discarded Jul - Sep	Discarded Oct - Dec	Landed Jan - Mar	Landed Apr - Jun	Landed Jul - Sep	Landed Oct - Dec
Non-rotation	**Open**	3674								
		3675				3				
		3773								
		3775	3	3			4			
		3870								
		3872								
		3874	2	1	9					
		3974	3		6					
		4065			8					
		4066				1				
		4067	5	3	4			3		1
		4068		3	4	5		3	3	3
		4069		2		2		9		3
		4070				27				9
		4071	3			8	5			4
		4072	3	2		1	5			
		4073			3			3		
		4166	1	1			2	1		
		4167					1			3
		4170	3	15		13				6
		4171			8	13				3
		4172				3				
		4173								
		4267			2	3			9	2
		4268			3					
		4269				1				
		4270	1		2					1
	Open Total		**24**	**30**	**49**	**80**	**17**	**19**	**12**	**35**
Non-rotation			**24**	**30**	**49**	**80**	**17**	**19**	**12**	**35**

			Disposition	Data						
			Discarded				Landed			
Rotational management area	Status	Area	Jan - Mar	Apr - Jun	Jul - Sep	Oct - Dec	Jan - Mar	Apr - Jun	Jul - Sep	Oct - Dec
Total										
Grand Total			82	58	113	138	46	36	28	71

Table 199. Biomass trend adjustments to hail weight observations for sea sampled scallop dredge trips, by year and species. Data from various SARC documents and SAFE Reports showing trends in mid-year biomass, spawning stock biomass, or survey catch per tow.

	1991	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*
ANGLER	1.294	1.074	0.981	0.860	0.911	0.976	0.964	1.044	0.991	0.904
COD	1.804	1.326	0.935	0.737	0.698	0.794	0.902	0.860	0.934	1.010
FLOUNDER, FOURSPOT	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
FLOUNDER, SAND-DAB	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
FLOUNDER, SUMMER	0.510	0.541	0.647	0.887	1.185	1.273	1.149	1.296	1.257	1.257
FLOUNDER, WINTER	0.926	0.750	0.572	0.565	0.880	1.155	1.120	0.976	1.651	1.405
FLOUNDER, WITCH	0.915	0.886	0.729	0.768	0.696	0.746	0.935	1.442	1.442	1.442
FLOUNDER, YELLOWTAIL	0.315	0.378	0.329	0.235	0.284	0.486	0.905	1.738	2.570	2.759
SCALLOP, SEA	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SKATE, BARNDOOR	0.000	0.071	0.177	0.385	0.481	0.730	0.783	1.221	2.426	3.726
SKATE, LITTLE	1.073	1.057	1.007	0.954	0.999	1.011	1.012	0.980	0.973	0.934
SKATE, ROSETTE	2.000	1.253	0.710	0.630	0.833	0.902	0.861	0.799	0.899	1.113
SKATE, SMOOTH	1.165	1.244	1.082	1.232	1.110	1.429	1.043	0.790	0.402	0.503
SKATE, WINTER(BIG)	1.437	1.099	0.954	0.813	1.067	1.019	1.006	0.935	0.930	0.741
SKATES	1.135	0.945	0.786	0.803	0.898	1.018	0.941	0.945	1.126	1.403

8.3.8 Effects on bycatch and bycatch mortality from a proactive protected species program (Alternative 5.3.5.9)

The distributions of sea turtles interacting with scallop fishing gear and finfish species that are vulnerable to capture and discarding as bycatch are somewhat exclusive. It is difficult to anticipate what type of measures would be applied to reduce interactions with sea turtles below PBRs if action becomes necessary, but if they involve seasonal closures the impacts on bycatch and bycatch mortality for finfish species could be negative. If they involve gear modifications, it is impossible at this point to say whether they would have a positive or negative effect on finfish bycatch.

Seasonal area closures, if needed to minimize interactions with protected species could cause a shift in fishing effort to other open fishing areas. This would shift effort north, because the sea turtle distribution in the late summer and early fall overlaps the southern third or half of the resource. Fishing effort might shift to other seasons, or it might shift to other areas. If shifted north, the added effort would increase fishing time and finfish catches in the northern part of the scallop resource which has a greater overlap with monkfish, yellowtail flounder, barndoor skate, and other groundfish species of concern.

8.3.9 Effects on bycatch and bycatch mortality from the status quo overfishing definition (Section 5.1.1)

Compared to the proposed overfishing definition, the status quo overfishing definition would allow more fishing effort in regular, open fishing areas to achieve a stock-wide fishing mortality target, rather than one that applies only to scallops that are available to the fishery. As a result, overall scallop fishing effort is higher, smaller scallops would be available to the fishery, and fishing time would increase overall and on a DAS basis.

Projections show that total area swept by the fleet is likely to be higher with the status quo overfishing definition. Since finfish catches, many that cannot be landed due to possession and/or size limits that apply to scallop fishing, are proportional to the amount of fishing time and area swept, the effect of the status quo overfishing definition is expected to be negative.

8.4 Impacts on Protected Species

8.4.1 Protected Species Impact Summary – Large Whales

Six species of large whales that are listed as endangered under the Endangered Species Act (ESA) are found in the waters fished by scallop vessels. The major known sources of anthropogenic mortality and injury of right, humpback, and fin whales clearly are ship strikes and entanglement in commercial fishing gear. Although these species are known to become entangled in fixed gear, no right, humpback, or fin whale has ever been observed or reported taken in the mobile dredge and bottom trawl gear used to catch scallops. The apparent preference of their prey resources to mid-water or surface zones further makes it unlikely that the scallop fishery will affect either species.

Blue, sei and sperm whales are generally found along the continental shelf margins. Because of this general offshore distribution these species are found at the fringe of the area fished by scallop vessels. In addition, the near-surface feeding habits of blue and sei whales, and the deep diving habits of the sperm whale to depths below those fished by scallop vessels make it further unlikely that they may be affected by mobile gear used in the scallop fishery. See Section 7.2.7 for more detailed information.

8.4.2 Protected Species Impact Summary – Other Marine Mammals

There are several cetaceans protected under the Marine Mammal Protection Act of 1972 (MMPA) that are found within the management unit of the Scallop FMP (Northeast Region waters), namely the minke whale, Risso's dolphin, pilot whale, Atlantic white-sided dolphin, harbor porpoise, common dolphin, spotted and striped dolphins, and the coastal form of Atlantic bottlenose dolphin. These species are common along the continental shelf from the Gulf of Maine to Cape Hatteras, and generally forage for small schooling fish species, zooplankton, or squid that are found either near the surface or in the mid-water levels.

Although these species may occasionally become entangled or otherwise entrapped in bottom tending fixed gear or in mid-water trawls, the low profile and slow speed of the bottom-tending dredge and trawl gear used by the scallop fishery make it unlikely to interact with these species.

8.4.3 Protected Species Impact Summary – Fish Species

The shortnose sturgeon is a benthic fish that mainly occupies the deep channel sections of several Atlantic coast rivers. They can be found in most major river systems from the St. Johns River, Florida to the Saint John River in New Brunswick, Canada. The scallop fishery in the Northeast Region does not extend to shallow water, or into the intertidal zone of major river systems where shortnose sturgeon are likely to be found. Therefore, there appears to be adequate separation between the two species making it highly unlikely that the scallop fisheries will affect shortnose sturgeon.

The wild populations of Atlantic salmon found in rivers and streams from the lower Kennebec River north to the U.S.-Canada border are considered to be endangered. These rivers include the Dennys, East Machias, Machias, Pleasant, Narraguagus, Ducktrap, and Sheepscot Rivers and Cove Brook. No scallop landings have been recorded for the areas adjacent to the Atlantic salmon rivers. In addition, the NMFS fishery research surveys have rarely found scallops in the nearshore regions adjacent to the Atlantic salmon rivers. Therefore, it is unlikely that operation of the scallop fisheries occurs in or near the rivers where concentrations of Atlantic salmon are most likely to be found. Furthermore, bottom-tending gear used in the scallop fishery is not likely to encounter salmon in the open water environment, making it is highly unlikely that the fisheries occurring under the existing Scallop FMP and proposed Amendment 10 will affect the endangered runs of Atlantic salmon in the Gulf of Maine.

Barndoor skate are considered a candidate species under the ESA. The barndoor skate is caught as a bycatch species in scallop dredge fishing operations, although they represent less than 1% of the skate landed in the Northeast. Restoration of the overfished skate species is major goal of the Skate FMP (effective September 18, 2003), and a complete prohibition on possession of barndoor skate is now in effect. This prohibition will extend to scallop vessels, making it unlikely that this species will be further depleted by the proposed actions contained in Amendment 10. See Section 7.2.7.3 for more information on the effects of the fishery on barndoor skate.

8.4.4 Protected Species Impact Summary – Birds

The roseate tern and piping plover inhabit coastal waters and nest on coastal beaches within the Northeast Region. The terns prey on small schooling fishes, and the plovers prey on shoreline invertebrates and other small fauna. Foraging activity for these species occurs either along the shoreline (plovers) or within the top several meters of the water column (terns). Bottom-tending dredge and trawl gear used in the scallop fishery pose no threat to these species or their forage species.

8.4.5 Protected Species Impact Summary – Sea Turtles

Leatherbacks are predominantly a pelagic species that feeds on jellyfish and other soft-body prey, and are susceptible to entanglement in lobster and crab pot gear and trawl gear as described by NMFS in a biological opinion on the Scallop FMP (Framework 15) issued on February 24, 2003.

The status of leatherback sea turtles range-wide is of concern. Leatherback survivability is affected by numerous natural and anthropogenic factors, including various fisheries. However, given that leatherback sea turtle nests in Florida and the U.S. Caribbean have been increasing since the early 1980s and the population of nesting females numbers in the thousands, the anticipated annual loss of leatherback sea turtles from the Atlantic population as a result of scallop trawl fishing is not expected to appreciably reduce the species' likelihood of survival and recovery in the wild.

Hawksbills may occur in the southern range of the scallop management unit (i.e., North Carolina and South Carolina), but their distribution is not known to overlap with those waters fished by vessels that may catch scallops. Therefore, it is unlikely that interactions between hawksbill sea turtles and scallop vessels will occur.

Loggerhead and ridley sea turtles, and to a lesser extent herbivorous green turtles, are vulnerable to takes by bottom trawl and dredge gear. Previous discussions regarding the potential impacts of scallop gear on sea turtles had recognized the overlap of scallop fishing effort with sea turtle distribution in the Mid-Atlantic region. However, the low temperature preference of scallops (<50° F) was thought to provide adequate separation between the mobile bottom gear and sea turtles. The focus at that time was on the scallop trawl effort that concentrates in the North Carolina-Virginia area in the spring and fall. The new takes in dredge gear that occurred off the New Jersey coast in the 2001-2002 summer season (described below) require the Council to look at the cause-effect and impact level of these takes from the Delmarva peninsula to Long Island in the summer months.

Sea turtle distribution data (Map 51) show that the potential for sea turtle interactions with the scallop fishery are likely limited to the Mid-Atlantic continental shelf region from Long Island to Cape Hatteras. Specifically, the North Carolina-Virginia region appears to be a major migration path during the spring and again in the fall although turtles may be found in that region from April 1 to November 30. The remaining Mid-Atlantic region from the Delmarva Peninsula to Long Island is an area of general sea turtle foraging from late May to early November.

A total of 40 sea turtles were reported captured in scallop dredge gear operating in the Mid-Atlantic from 1996 to 2002 (See Section 7.2.7.3 for more information). Of these, 23 were reported alive with no injuries. 6 were reported injured (one subsequently died on deck), 6 were of unknown condition, and 5 were dead, although two of these turtles were decomposed carcasses and thus were not attributed to the scallop dredge fishery.

8.4.6 ESA consultation history and ongoing action

In response to reports of sea turtle takes in the sea scallop fishery, NMFS reinitiated consultation under section 7 of the ESA on December 21, 2001. NMFS completed a Biological Opinion (opinion) for the scallop fishery as a whole, including the measures included in Framework 15, on February 24, 2003[85]. The opinion concluded that the continued implementation of the scallop fishery and the

85 The Biological Opinion is available on request from NMFS, Gloucester, MA or may be downloaded from their web site: http://www.nefsc.noaa.gov/ro/doc/nero.html.

proposed activity may adversely affect but is not likely to jeopardize the continued existence of loggerhead, Kemp's ridley, green, and leatherback sea turtles. No designated critical habitat was likely to be affected by the fishery. In the opinion, NMFS provided an incidental take statement allowing the annual take of 88 loggerhead (up to 25 lethal), 7 Kemp's ridley (2 lethal), and 1 green (lethal or non-lethal) sea turtles in the sea scallop dredge fishery. In addition, the incidental take statement allows the lethal or non-lethal observed annual take of one loggerhead, Kemp's ridley, green, or leatherback sea turtles in the scallop trawl fishery. The extent of incidental take of sea turtles in the scallop fishery may be determined by the number of observed takes, the number of takes calculated to have occurred based on the number of observed takes and the percentage of observer coverage, the number of reported takes, the number of turtles found stranded where the cause of the stranding can be attributed to the scallop fishery, or any combination of the above. Additional observer coverage, monitoring of takes, and additional research to determine the scope and extent of takes is called for the opinion. NMFS is currently evaluating the means to undertake these tasks.

8.4.7 Impacts of Amendment 10 Options

The protected species considered to be adversely affected by the Scallop FMP are the endangered Kemp's ridley; green and leatherback sea turtles, and the threatened loggerhead sea turtle. As described above and in the Protected Species chapter (Section 7.2.7.3), the overlap of known sea turtle distribution and scallop fishing effort is restricted to the Mid-Atlantic shelf area (Cape Hatteras to Long Island) from late May to early November. Barndoor skate are a candidate species found from Nantucket shoals, east to Georges Bank, and extending into the Gulf of Maine that are also included in the following analyses.

The approved scallop management measures contained in Amendment 10 include:

- A status quo overfishing definition with an increase in the minimum biomass threshold from ¼ B_{MSY} to ½ B_{MSY}. The annual mortality target will be 80% of F_{max} and the biomass target will be estimated as before.
- A flexible boundary area rotation scheme will be implemented with closures occurring until annual growth in total biomass declines below 15%.
- A rotation area management closure will be implemented in a 4 X 5 ten-minute square area in the Mid-Atlantic.
- Mechanical rotation of the Framework 13 areas will include certain groundfish closed areas pending approval of Framework 39 of the Multispecies FMP.
- The Hudson Canyon Area controlled access program will continue for 2004 and 2005.
- The VA/NC Area will revert to an open scallop fishing area on March 1, 2004.
- Area-specific DAS allocations will be calculated for controlled access areas, with limited access vessels allowed to make exchanges with limited access vessels with certain conditions.
- The additional habitat alternatives include implementation of 4" rings as of March 1, 2004, and habitat research funded by scallop set-asides.
- A minimum 10" twine top will be required as of March 1, 2004.
- General category requirements are unchanged, but limited access vessel management will be further restricted.
- Framework measures may be implemented for area-specific seasons to avoid bycatch, area-specific TAC's for some finfish species, area-specific possession limits for some finfish species, and other gear modification that may be identified by future research.
- The protected species alternative was approved.
- A 2% set-aside from the TAC and/or DAS allocations was approved for scallop and habitat related research.

- A 1% set-aside from the TAC and/or DAS allocations was approved for mandatory observer coverage on an appropriate sample of scallop trips to characterize protected species and finfish bycatch interactions.

The key management measure that affects scallop fishing effort in many of the specific alternatives discussed below is the overfishing definition. It defines the annual mortality target to be used as well as the minimum biomass thresholds that will be used to establish TAC's and/or DAS allocations. While it appears that the TAC's and DAS allocations may be higher under Amendment 10 than the existing management conditions, Amendment 10 will clearly focus effort on areas where scallop biomass is highest. This management focus is intended to reduce total fishing time overall. Therefore, although total catch may increase, the total fishing time for scallop gear in the water is expected to decrease relative to conditions experienced in 2003.

The specific alternatives chosen are discussed below in regard to the expected impact to the protected species identified above as potentially affected by the scallop fishery.

Alternatives for Improving Yield

The Alternatives for improving yield will establish the general management scheme for scallop management under Amendment 10, following which the subsequent alternatives will be chosen to meet the specific goal described in this alternative.

Mechanical area rotation and fixed area boundaries (Not approved)

Management areas would have been fixed, and would have opened and closed on a set schedule. The amount of closed area in any one year would be in the same proportion as the amount of time an area would be closed. Areas could be open for three years and then closed for three years, or could be closed for five years and open for only one year.

The protected species impact of this alternative depended on the open/close schedule that would have been developed for the sea turtle and barndoor skate concentration areas. If those areas were given a long closure period, the impact would be low. However, a short closure followed by a long open period would have done little to protect those species.

Adaptive closures, for a fixed duration and with fixed area boundaries (Not approved)

This alternative is similar to the mechanical rotation alternative discussed above, with the exception that the closed areas would have been determined by biomass surveys. Closures would have been for a three to five year period, and reopening would have been restricted by TAC or DAS for one to three years to "ramp-up" effort in the area.

The protected species impact of this alternative depended on the areas chosen for closure and would have shifted as biomass surveys indicate new areas requiring protective management measures. The initial analysis suggested that two Mid-Atlantic areas and two Georges Bank areas would have been closed initially. This would provide a three to five year protection for sea turtles and barndoor skate in those areas.

Adaptive area closures and re-openings, with fixed area boundaries (Not approved)

This alternative would have been similar to the alternative in Section 5.3.2.3, except that areas would be opened when survey data indicate adequate recovery had occurred. Reopened areas would undergo a "ramp-up" period as discussed above.

The effects to protected species are similar to those discussed above, except that the closure period is variable. Therefore, an area may be reopened more quickly or remain closed longer depending on the biomass survey data.

Adaptive closures and re-openings, with fixed boundaries and mortality targets or frequency of access that vary by area (Not approved)

Adaptive area closures would have been determined by biomass data as with the alternative in Section 5.3.2.4. TAC and DAS would have been used to control effort in open areas, and habitat bycatch and endangered species sensitivity would have been factored into the management scheme.

Although there would have been fewer complete closures under this alternative, there may have been a more consistent effort reduction in sensitive protected species areas. Since complete closures are more often determined by scallop management needs, the beneficial effects to protected species would have been variable. Consistent effort reduction in sensitive protected species areas would have provided a constant benefit.

Adaptive area closures and re-openings with adaptive boundaries identified by survey when the areas are closed (Approved in final alternative)

Scallop fishing will be allowed in the Georges Bank areas under this option. Changes in scallop biomass will dictate the ten-minute square areas to be closed. The size, configuration, and timing of closed areas will be determined by using the growth rates identified in each area.

The relative protection to protected species (sea turtles and barndoor skate) will depend on the areas determined to be closed and the length of each closure. It is likely that closure areas will shift between northern and Mid-Atlantic areas as fishing effort reduces the scallop biomass in one area, triggering a closure and subsequent shift in effort to open areas. The opening of areas at a time and location where sea turtles or barndoor skate are concentrated may increase the impact to those species until the scallop biomass in the area falls to a level requiring closure. There is no way to predict the potential protected species impact until the actual areas are proposed for opening and/or closing.

Area based management – with area-specific fishing mortality targets without formal area rotation (Not approved)

This alternative would have contained little if any area closures. Vessels would receive area-specific effort allocations (DAS or trips) to reduce localized overfishing.

As in other alternatives, the relative protection to protected species (sea turtles and barndoor skate) depended on the areas where scallop effort is significantly reduced. It is likely that these areas will shift between northern and Mid-Atlantic areas as fishing effort depletes the scallop biomass in one area, triggering an effort reduction and subsequent shift in effort to other areas. However, increased effort allocations at a time and location where sea turtles or barndoor skate are concentrated might increase the impact to those species until the scallop biomass in the area falls to a level requiring effort reduction.

Rotation Area Management Closures (approved in the final alternative)

The concept of area rotation is a new form of management implemented by Amendment 10. Rotation area management will close areas where small sea scallops are prevalent, and maintain the closure until the scallops reach a larger size. The opening and closing of areas will require framework adjustments. Three actions are proposed for consideration in Amendment 10: 1.) a 15 minute square area in the Mid-Atlantic known locally as the "elephant trunk area" will be closed in March 2004 for approximately a three year period; 2.) the current Hudson Canyon Closed Area is scheduled for reopening in 2006; and 3.) the current VA/NC Closed area will reopen in March 2004.

Mid-Atlantic Area Closure

Rotation area management closures in the Mid-Atlantic will, on the face of it, be beneficial to any sea turtles that may forage within a closed area during the spring and summer months. However, sea turtles may be found anywhere in the Mid-Atlantic region from Long Island to Hatteras from May to November. Sea turtle distribution data collected to date has not shown any specific foraging areas that are preferred in successive years. Therefore, closing areas in the Mid-Atlantic is good for sea turtles largely in the sense that the individual turtles utilizing that area will not be subjected to possible capture while they are in a closed area. However, if total scallop fishing effort remains constant throughout the Mid-Atlantic region then the overall impact to turtles may not be reduced as turtles in the open areas may be subjected to increased fishing effort. The reopening of areas closed under the rotation area management program will be subject to controlled access restrictions designed to reduce heavy fishing effort on the reopened scallop resource. In summary, the closing of the "elephant trunk area" will provide a general benefit to sea turtles foraging in that area.

VA/NC Area open area management beginning in 2004

The VA/NC Area will reopen on March 1, 2004. According to recent surveys, the scallop abundance and biomass in the VA/NC Area is not substantially different than the surrounding areas. Since no notable increases in fishing effort are expected to coincide with sea turtle abundance as a result of the planned scallop management of the VA/NC Area, the re-opening of the VA/NC Area in March 2004 is unlikely to pose new adverse effects for sea turtles.

Hudson Canyon Area open area management beginning in 2006

After being closed for 1998 – 2000 and managed under controlled access regulations from 2001 to 2005, Amendment 10 anticipates that, like the VA/NC Area, the Hudson Canyon Area will re-open to customary limited access and other fishing at the beginning of the 2006 fishing year. Sea turtles were observed captured in scallop dredges during two successive years of controlled access trips in the Hudson Canyon Area. However, since similar observer effort was not in place in adjacent open Mid-Atlantic areas, it is not known whether these events could also occur at the same level in the other areas. The broad distribution of sea turtles that has been observed in the Mid-Atlantic makes it likely that similar levels of sea turtle capture occur in other Mid-Atlantic areas during the summer months.

As mentioned above, sea turtle distribution is temperature-dependent and seasonal. Thus opening the Hudson Canyon Area on the regular season opening date of March 1 will precede the movement of turtles into the area by only two months. Recent surveys indicate that the scallop abundance and biomass in the Hudson Canyon Area is substantially higher than surrounding areas. Thus reopening the area is expected to draw scallop effort during the first few months of the 2006 season. This makes the timing of it's reopening an important factor for turtles. If it is reopened earlier in the winter when turtles are not present, the expected surge of fishing effort immediately after reopening will not be detrimental to sea turtles. In addition, any increase in effort from vessels not normally fishing in the Mid-Atlantic area moving into the reopened Hudson Canyon Area could increase the adverse effect to sea turtles if effort is concentrated during the late summer and early fall.

The Council will consider these effects under the next regularly scheduled framework adjustment for setting allocations and area rotation provisions for the 2006 fishing year.

Georges Bank access to groundfish closed areas (Approved in final alternative)

This alternative will allow scallop effort in existing or future closures occurring in the Multispecies FMP where groundfish closures are either in place or may be closed under Amendment 13 to the Multispecies FMP. Current area closures under the Multispecies FMP include Closed Area I and II and the Nantucket Lightship Area.

The benthic-feeding sea turtles species are not known to inhabit the Georges Bank area where these closed areas are found. Therefore, the alternative will not directly affect sea turtles. However, any shifting of scallop effort into these areas may reduce effort in areas where turtles are found. Conversely, these areas are frequented by barndoor skate, an ESA candidate species that will not benefit from an increase of scallop fishing in these areas.

Increasing the minimum ring size to 4-inches in all or selected areas (Approved in final alternative)

This alternative will increase the minimum ring size from 3.5 to 4 inches in all areas.

Ring size is believed to have no direct beneficial impact to protected species. Turtles and skate are too large to be able to escape through a 4-inch ring. However, increasing dredge ring size will increase the efficiency of scallop dredging for large scallops and reduce the dredge weight by 200 to 300 pounds. This would decrease bottom contact time and total area swept by 10 to 15 percent. This would be of some benefit to sea turtles if it were found that they are captured on the bottom.

Gear specific day-at sea (DAS) allocation adjustments based on equal mortality per DAS (Not approved)

Vessels authorized to use trawls would have, under this alternative, received a DAS allocation in proportion to the average number of scallops landed per DAS by dredge vessels.

This alternative might have reduced the DAS allocated to trawl vessels. This may have benefited sea turtles, as there is a general assumption that trawl operations in the Mid-Atlantic from Late May to early November are likely to catch turtles. However, there are few observer data available on sea turtle take in trawl vessels to support this assumption. Therefore, the potential beneficial impact to sea turtles cannot be assessed. Reducing trawl effort will not benefit barndoor skate, as trawls do not operate in the Georges Bank region frequented by that species.

No Action Alternative (Not approved)

Taking no action would have provided no benefit to protected species, and may have resulted in an increased adverse affect as no further closed areas are scheduled to take place.

Status Quo Alternative (Not approved)

The Status Quo Alternative assumed that some further closures might be created through Framework action to protect scallops. However, this alternative would have no benefit to protected species as sea turtle takes and barndoor skate bycatch would have continued to occur at the current levels.

Alternatives for Allocating Effort

The alternatives for allocating effort will establish the effort control mechanism to be employed under Amendment 10. Alternatives such as area-specific Days-at-Sea (DAS), or trip limits would be used within the area management system chosen above to meet the overall scallop allocation set to achieve the overfishing goal of Amendment 10. The allocation scheme used within each area rotational management system will not change the total amount of effort that may occur in any given area. Total effort within areas during the concentration periods for protected species is the important factor in reducing impacts to those species. How that effort is allocated has little, if any affect on impacts to sea turtles or barndoor skate.

Individual DAS allocations by management area (Not approved)

Individual vessels would have received an annual DAS allocation for each rotational area management unit under this alternative. The allocation could have been used in the area as long as it is open to fishing. As described above, individual vessel DAS allocations will not, by themselves, benefit protected species. The allocation of a total DAS for each vessel would have allowed vessels to take their DAS for any areas at any time. This may have relieved the derby-fishing factor for a reopened area, but the level of protection afforded to these species depended on the timing of the area reopening.

Area-specific trip allocations with possession limits and DAS trade-offs (Approved in final alternative)

Under this alternative, individual vessels will receive an annual DAS allocation for all areas. Vessels will also be given a number of trips to be taken in reopened areas where a possession limit will also be set to meet the overall fishing mortality target for the area. As described above, individual vessel DAS allocations and trip limits will not, by themselves, benefit protected species. Trip limits will serve to further relieve the derby-fishing factor in reopened areas, but the level of protection afforded to these species depends on the timing of the area reopening.

One-to-one trades of area-specific allocations (DAS or trips) (Approved in final alternative)

This alternative will allow vessels to exchange area-specific allocations for trips or DAS with other vessels. This alternative will not provide any beneficial impact to protected species unless it results in a shift of effort away from protected species concentration areas. This will have to be analyzed on a case-by-case basis.

Status Quo (Not approved)

Scallop vessels currently receive an annual DAS allocation. This allocation scheme is incompatible with area rotation management and would not have provided any additional benefit to protected species. Development and use of gear or gear operational procedures that reduce sea turtle capture (Section 5.3.5.4) would have been the only way to relieve these impacts under this alternative.

Alternatives for Designating Scallop EFH and HAPC

This section investigates the various methods that may be used to designate scallop EFH and HAPC. Areas that may be designated for scallop EFH and HAPC are usually based on bottom conditions favorable to key scallop life stages. They are not always synonymous with protected species concentration areas that also have an important seasonal migration component not shown by the generally immobile scallop resources. In addition, designating scallop EFH and HAPC will not, by itself, provide any protection to the designated area. Four alternative closure levels to reduce habitat impacts are found in this alternative. Readers will need to compare the alternatives offered in this section in relation to one of the four closure levels described below to get the complete picture on approaches being considered for EFH and HAPC designation. The four closure levels are;

Level 1 – The area is to be closed indefinitely on a year round basis to all fishing gear.

Level 2 – The area will be closed indefinitely on a year round basis to all bottom tending gear (static and mobile).

Level 3 – The area will be closed indefinitely on a year round basis to all bottom tending mobile gear.

Level 4 – The area will be open indefinitely on a year round basis only to gear defined as "reduced impact" gear as determined by the ecological function that would be protected by the closure.

A Level 1 closure would provide the most protection to all protected species. A Level 2 closure would provide nearly the same protection as Level 1, since bottom tending static and mobile gear are known to be involved in the majority of protected species interactions. Only pelagic or mid-water gear would be allowed under Level 2. A Level 3 closure will provide protection to sea turtles and certain pelagic delphinds that have been reported captured in mobile bottom tending gear. Level 4 protection to protected species depends on the ecological function for which the gear is designed, and would have to be assessed on a case-by-case basis.

No additional habitat-related management measures (Status Quo/No Action) (Not approved)

This alternative would have retained the groundfish year round closed areas already in existence during FY 2001 that include the Western Gulf of Maine (WGOM), Closed Areas I and II (CA I and CA II), and the Nantucket Lightship Closed Area (NLCA). Of these, only NLCA would have benefited sea turtles, and CA II would have provided a benefit to barndoor skate.

Incidental benefit of other Amendment 10 Alternatives (Approved in final alternative)

The benefits to protected species provided by each of the Amendment 10 alternatives are discussed in this section. Certain alternatives such as area specific seasons to reduce bycatch (Section 5.3.5.7) and the specific protected species alternative (Section 5.1.7) will have a direct beneficial impact to protected species. However, most of the other alternatives will either provide no additional benefit, or the benefit relies on the timing and area encompassed by the measure.

Habitat closed areas (Not approved)

This alternative would have modified the boundaries of the existing groundfish boundaries to better protect hard bottom or other sensitive habitat. The two options for this alternative involved the existing areas that are closed year round for mobile fishing gear (WGOM, CA I and CA II, and the NLCA). These areas would have provided good overlap with barndoor skate habitat, but did not cover the sea turtle concentration area that runs from Long Island to Cape Hatteras along the Mid-Atlantic continental shelf from late May to early November.

Modified groundfish closed area with habitat subsets identified (Not approved)

This alternative would have provided protection to certain subsets of the groundfish areas mentioned above. There would have been little or no added benefit to protected species since the areas are not high use habitats for sea turtles, and are already restricted for mobile bottom tending gear that often catch barndoor skate.

Closed Areas designed to protect important EFH and balance fishery productivity (Not approved)

This alternative includes habitat closures of the most important and sensitive EFH for scallop and groundfish, as well as the most productive fishing areas for those species. This alternative would have provided a broader area of protection to sensitive scallop and groundfish EFH. It is not clear if scallop EFH would have overlapped with sea turtle concentration areas, as the alternatives for identifying those areas (see the previous section) vary widely. However, groundfish EFH did not overlap with sea turtle concentration areas, but may have covered some barndoor skate habitat.

Closed areas consistent with the Framework 13 scallop closed areas access program (Not approved)

This alternative considered the groundfish closed areas mentioned above to be Habitat Closures except for certain areas opened under the Scallop Framework 13 Closed Area Access Program. These areas were not high use habitat for sea turtles, and the reopened areas would have exposed more barndoor skate to incidental capture.

Habitat closures encompassing areas identified based on EFH designation data and minimizing scallop fishing effort in the less productive scallop fishing areas (Not approved)

This alternative presumes that areas with the highest density of scallops of optimal commercial size represent the areas where scallop fishing effort can occur with the minimum of bottom towing time. Overlap with protected species concentration areas would have varied according to location of EFH areas. However, the general goal of this alternative to reduce bottom-towing time and increase catch per tow would have helped reduce the capture of sea turtles.

Close the designated Habitat Areas of Particular Concern (HAPC) for cod to scallop fishing indefinitely (Not approved)

This alternative would have closed the area designated as an HAPC for cod that runs along the northern edge of Georges Bank. It would have provided good overlap with barndoor skate habitat, but did not cover the sea turtle concentration area that runs from Long Island to Cape Hatteras along the Mid-Atlantic continental shelf from late May to early November.

Existing management boundaries for area closures would be used to protect habitat from harm by scallop fishing gear (Not approved)

The two options for this alternative involved the existing areas that are closed year round for mobile fishing gear, and the recent area access options for those areas. These areas include Western Gulf of Maine closed Area, Closed Areas I and II and the Nantucket Lightship Closed Area. These areas would have provided good overlap with barndoor skate habitat, but did not cover the sea turtle concentration area that runs from Long Island to Cape Hatteras along the Mid-Atlantic continental shelf from late May to early November.

Restrictions on rock chains (Not approved)

Rock chains are seen as a method that allows scallop dredges to be used in hard bottom areas. Limiting rock chains would have been a way to reduce dredge access to these important habitat areas. There have been some indications that additional rock chains may help exclude sea turtles from dredges. However, the Mid-Atlantic area is not known to have a great deal of hard-bottom. Therefore, this alternative would not have conflicted with the potential beneficial effect to protected species if rock chains were found to reduce sea turtle capture.

Increasing dredge ring size to 4-inches in all areas (Approved in final alternative)

Increasing dredge ring size will increase the efficiency of scallop dredging for large scallops and reduce the dredge weight by 200 to 300 pounds. This would decrease bottom contact time and total area swept by 10 to 15 percent. This would be of some benefit to sea turtles if it were found that they are captured on the bottom.

Habitat research funded through scallop TAC set-aside (Approved in final alternative)

Set-asides for habitat research will not by themselves be a benefit to protected species, although they may provide a cumulative benefit when considered along with the research being conducted under the general Scallop research section (Section 5.3.8.1).

Area based management and rotation based on habitat protection (Not Selected)

Area based management and rotation would have reduced the total bottom time and commercial area swept by scallop dredges and trawls. The general goal of this alternative to reduce bottom-towing time and increase catch per tow would have helped reduce the capture of sea turtles.

Alternatives for Reducing Bycatch and Bycatch Mortality

The alternatives being considered under this section are wide ranging as they attempt to address various fish and protected species bycatch issues.

Area rotation (Approved in final alternative)

Area rotation would have reduced fishing in areas with a lower biomass of large scallops. Vessels are expected to target areas with larger scallops thus reducing the amount of fishing per DAS and area swept. This would have been a benefit to protected species if the preferred area for fishing was not in an area of sea turtle concentration. The reduced area swept would also have been a benefit if turtles are captured on the bottom.

Increasing the minimum ring size to 4-inches in all or select areas (Approved in final alternative)

The impact of this alternative on protected species is discussed in bullet 1(h) above.

Increase minimum twine top mesh to 10-inches in all or selected areas (Approved in final alternative)

Increasing the twine top mesh size to 10-inches (from the current 8-inches) is designed to allow escape of fish. However, since barndoor skate are the largest of the skate species, it is unlikely that any significant bycatch reduction for that species will occur. In addition, the average size of sea turtles found along the Mid-Atlantic continental shelf is more than 10-inches. The general premise for sea turtle life stages is that they convert from a pelagic high seas existence to an inshore benthic feeding life style around 10-inches. Therefore, pending gear research observations to the contrary, a 10-inch twine top is not likely to be a benefit to sea turtles.

Gear modifications based on recent research (possible future framework action, but not approved for implementation in Amendment 10)

This alternative will require the use of approved gear modifications through framework measures. It is not clear if this alternative will be used for gear that is shown to reduce capture of protected species. If this is true, then it can serve as the mechanism to implement gear modifications that are developed under Section 5.3.5.4.

Area-specific possession limits for some finfish species (Approved for implementation by framework action)

This alternative is similar to the alternative in Section 5.3.5.7, but will use possession limits for reopened areas to reduce bycatch. Possession limits will reduce the trip length in an area, but not the overall effort that may take place. Therefore, it will not be as effective as the alternative in Section 5.3.5.7 for reducing impacts to protected species.

Area-specific TACs for some finfish species (Approved for implementation by framework action)

This alternative will establish an area-specific TAC for groundfish bycatch in reopened scallop rotational area management areas. This alternative will provide no direct benefit to protected species unless it results in a reduction in fishing effort in a sea turtle high use area.

Area-specific seasons to avoid bycatch (Approved for implementation by framework action)

This alternative will establish specific seasons for reopened scallop rotational management areas that will minimize interactions with sensitive species (undefined in the alternative) that migrate through the area. This will provide a direct benefit to protected species as long as the migration and foraging patterns of sea turtles and barndoor skate are factored into the analysis. If this alternative were meant to be applied only to fish species, then any direct benefit to sea turtles would be accidental.

Long-term, indefinite closures to avoid areas with high bycatch levels (Not approved)

This alternative would have involved long-term closure of areas where high bycatch occurs. This would have provided the best protection for fish species such as barndoor skate. However, unless sea turtle high use areas were to be factored into this alternative, then the direct benefit to turtles would have to have relied on an overlap with a high use area for a sensitive fish species.

Develop a proactive protected species program (Approved in final alternative)

This alternative is specifically designed to develop a protected species program within the Scallop FMP management scheme that will reduce adverse impacts to protected species. It is based on collection of adequate data; identifying the scope and specific mechanics of the capture events; investigating the effectiveness of all reasonable gear modifications and/or operational procedures in reducing sea turtle capture; and developing and testing of the promising gear or operational procedures. Until those data collection and gear development tasks are completed, the Council will rely on developing area specific seasons for reopened areas to avoid sea turtle high-use periods (as discussed in Section 5.3.5.7) and the combined beneficial impacts gained in selection of other alternatives described above, to reduce scallop fishing effort in the Mid-Atlantic sea turtle concentration areas from late May through early November. The alternative also includes framework measures for specific time/area closures to protect sea turtles if the level of sea turtle mortalities and serious injuries warrant such action.

Protected species data collection needs will require increased coverage of the dredge and trawl vessels fishing in the Mid-Atlantic area from April through November. It is important that these observers, unlike those deployed in 2001, be trained in collection of protected species data. The gear research component of this program should involve determining how the gear may pose a threat to sea turtles during all phases of operation (towing on bottom, retrieving gear to surface, and towing at surface). The scallop research set-aside program has been used, and is currently proposed to be used to fund adequate observer coverage in the fleet (Section **5.3.5.7**), as well as studies aimed at collecting scallop catch data and other scallop research (Section 5.3.8.1).

Status Quo (Not approved)

The status quo option would not have provided any additional direct benefit to protected species. Current levels of sea turtle capture would have continued to be a negative impact on those species. The adverse affect of those takes on the endangered/threatened sea turtle species was described by NMFS in a Biological opinion on Framework 15 of the Scallop FMP dated February 24, 2003.

Alternatives for managing scallop fishing by vessels with a General Category permit or fishing for scallops when not on DAS

This section considers several alternatives for managing vessels fishing under General Category Permits and limited access vessels not on DAS. Selection of alternative (c) will prevent limited access vessels from targeting sea scallops when not on a General Category day-at-sea trip. This will serve to prevent additional impacts to protected species that may have occurred under the Status Quo alternative.

Incidental catch permit with a reduced possession limit (Not approved)

Open access for vessels to obtain either an incidental or general category scallop permit (Not approved)

Prohibiting limited access scallop vessels from targeting sea scallops under general category rules when not on a scallop day-at-sea (Approved in final alternative)

Status Quo (Not approved)

Alternatives for Improving Data Collection and Monitoring

As noted above in Section 5.1.7, improving data collection and monitoring in the scallop fishery is important to implement a proactive program to reduce capture of protected species, especially sea turtles. The data collected will help managers determine where and how interactions with protected species occur, provided the data collection and monitoring system are designed to collect protected species information.

Adequate observer coverage and funding by DAS or TAC set-aside (Approved in final alternative)

Providing adequate observer coverage in both the dredge and trawl components of the scallop fishery is important to understanding the protected species issues. This alternative will ultimately provide managers with some level of information to reduce the capture of protected species provided the observers are properly trained in collection of the necessary protected species data. However, it should be noted that the Council selected a 1% level of DAS and or TAC set-aside for this alternative. It is unclear at this point whether or not that will provide an adequate sampling level for the dredge and trawl fishery effort to meet the sampling specifications found in the biological opinion issued by NMFS on February 24, 2003.

Bag tags and standard bags (Alternative 1 and 2) (Not approved)

Implementation of a bag tag system or requirement for a standard bag size would not have provided any direct benefit for protected species. However, providing an adequate enforcement tool for controlling key effort reduction measures such as possession limits is important in assuring the expected effort reduction is occurring.

Require vessels to make daily reports of vessel trip report (VTR) data through VMS (Not approved)

Requiring real-time reporting through VMS would not have been a direct benefit to protected species. However, as in the alternatives above, providing an adequate enforcement tool for controlling key effort reduction measures is important in assuring the expected effort reduction is occurring.

Replacement of VTR with effort reporting via VMS, real-time landings reporting by dealers, and discard characterization by enhanced observer coverage (Not approved)

This alternative is identical to the alternative above except that discard data would have been collected through observers. The potential impacts to protected species are identical to that alternative as discussed in bullet 6(c) above.

Require all limited access vessel to operate a VMS (Not approved)

This alternative would have required all limited access vessels to obtain and operate VMS equipment. Although this requirement would have no direct benefit to protected species, it would have provided consistent real-time data reporting that would have enhanced the effectiveness of effort-reducing measures that would have benefited those species.

Scientific resource surveys conducted with industry vessels and crew, funded by the TAC/DAS set-aside and authorized as scientific research (Not approved)

This alternative would not have provided any direct benefit to protected species.

Status Quo (Not approved)

Maintaining the existing reporting and monitoring requirements would have provided no benefit to protected species, and may have reduced the effectiveness of other proposed measures that would otherwise provide protection to those species.

Alternatives for enabling Scallop Research

As noted above in Section 5.1.7, additional research on the scallop fishery is important to implement a proactive program to reduce capture of protected species, especially sea turtles.

Process for managing research through scallop TAC or DAS set-aside (Approved in final alternative)

Using DAS or TAC set-aside to fund scallop research is a method that has worked in past years. This alternative will set the funding level at 2% of the TAC and/or DAS. The research funded will include cooperative industry surveys as well as habitat and protected species research. This alternative will serve to fund the protected species research listed in the Protected Species alternative located in Section 5.3.5.9.

Alternative process for setting research priorities (Not approved)

Research priorities would have been set on an annual, bi-annual or other period of adjustments under a framework procedure. It is unclear how the protected species research would have fared under this process.

Other considerations and definitions (Not approved)

This alternative identified several research issues that need to be addressed to facilitate research under Amendment 10. Protected species research issues were not mentioned in this alternative.

Research activities that have impacts and mortality no greater than and similar to those caused by a conventional commercial fishing trip using the associated DAS and TAC for normal fishing activities (Approved in final alternative)

This alternative will limit the use of DAS or TAC set-asides to those trips that are conducting research that is outside normal fishing operations.

Research funded through grants and contracts (Not approved)

This alternative would have required research that increases fishing mortality or result in effects that go beyond those analyzed in the DSEIS and would have to be funded through grants and contracts where their impacts would have been analyzed separately under NEPA. This alternative would have had an indirect benefit to protected species, as the impact of specific research to those species would have to be conducted before the work is approved. Most of the research important to protected species issues is related to normal fishing operations.

Status Quo (Not approved)

No additional research would have been a detriment to protected species, as understanding the level of existing interactions is key to guiding future management measures toward reducing these impacts. The Status Quo would also have limited the funding of key research identified in the NMFS Biological opinion to other sources.

Alternatives for Adjusting Management Measures

The method and timing for implementing management measures may have an affect on protected species.

Scallop harvest area action notice to close areas (Not approved)

This alternative would have used a formal procedure to provide relatively rapid action to close scallop areas. The timing for actions would have been initiated on March 1 and October 1, with closures occurring on May 1 and December 1, respectively. Closing on those dates would not have affected protected species. However, the timing for reopening areas may be more important to sea turtles, especially if it were to occur when they are concentrated in an area.

Annual specifications during non-framework years (Not approved)

This alternative assumes the two-year cycle for framework adjustments found in the alternative below is in place. It would have allowed annual specifications to be set by standard rule-making procedures. This would not have affected protected species.

Two-year cycle framework adjustment process (Approved in final alternative)

This alternative will put the framework adjustment process on a two-year cycle, and will not affect protected species.

Scallop fishing year (Not approved)

Selection of the Status Quo alternative to leave the start of the fishing year at March 1 will mean that there will be no additional impact to protected species beyond what has been described by NMFS in the recent Biological opinion mentioned above.

Increase the carry over day limit to between 10 and 30 days (Not approved)

Increasing the carry over DAS limit from 10 days to between 10 and 30 days would not have affected protected species.

Adjustments for broken trips (Approved in final alternative)

This alternative will provide adjustments to the loss of 10 DAS that now is incurred if a broken trip occurs in a closed area. The alternative may increase the number of trips in certain closed areas. However, the additional DAS allowed is limited to two, and adjustments will be made to the possession limit and trip allocation for that trip. Therefore, the overall potential increase in effort is minimal if it increases at all, as the running time to and from the fishing areas is likely to equal the additional DAS allowed.

Status Quo (Not Selected)

Maintaining the annual framework adjustment process would not adversely affect protected species.

8.4.8 Conclusion

The recent Biological Opinion issued by the NMFS on February 24, 2003, concluded that the fishing operations being carried out under the Scallop FMP as defined through Framework 15, was not likely to adversely affect the endangered large whales (right, humpback, fin, blue, sei, and sperm whales), hawksbill sea turtle, Atlantic salmon, shortnose sturgeon, or the two right whale critical habitat areas found in the Northeast Region. The opinion did conclude that the fishing activities may affect the remaining sea turtle species (loggerhead, leatherback, Kemp's ridley, and green), but was not likely to jeopardize the continued existence of those species. The document went on to establish an incidental take statement for those species with required measures that must be implemented in order to allow the takes to be legal under the ESA. The opinion also provided several recommended conservation measures to further protect sea turtles. Amendment 10 contains actions that address several of these required and recommended measures.

As stated at the beginning of this section, the main goal of Amendment 10 is to focus scallop fishing effort in areas where biomass is greatest. Therefore, although the overfishing definition may result in an increase in landings over levels discussed in the extant biological opinion, the actual fishing time is likely to be reduced, as the overall catch per tow is expected to increase.

However, assessing the potential impacts of the various area management alternatives on sea turtles is impossible to predict at this time. Scallop management areas will be monitored through annual scallop surveys for scallop biomass and growth rates, so that when biomass in a closed area gets high and the growth rate drops off (i.e. the scallop resources are at maximum levels in the area) it would be opened. Conversely, closings will occur when the reverse situation is occurring (low biomass and high growth rate indicating a depleted scallop resource in the area). Therefore, until the annual scallop surveys are conducted, we do not know which areas may be candidates for closing or reopening.

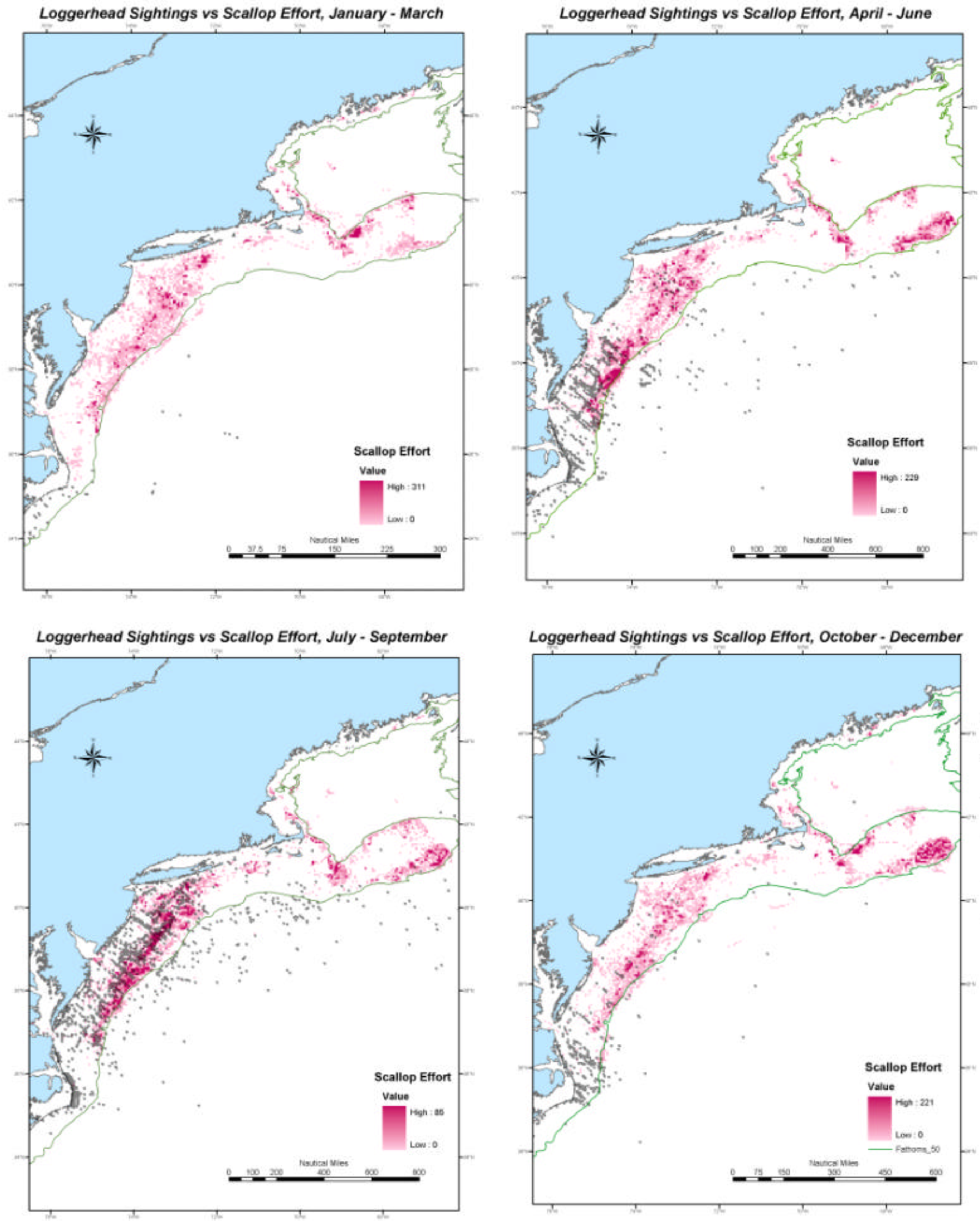
Certain general statements may be made regarding areas encompassing several scallop management units. For example, sea turtles do not frequent the Georges Bank area where several closed areas are currently in effect under the Multispecies FMP. Scallop resources in those closed areas are known to be at maximum levels. Opening those areas would have no effect on sea turtles, and could shift effort out of the high use sea turtle areas in the Mid-Atlantic. (Note - This is not a certainty as vessels from Mid-Atlantic ports may not want to make the longer trips). To further complicate matters, reopening these areas requires new framework actions under both the Multispecies (Framework 39) and Scallop (Framework 16) FMP's, which may modify some parameters for the Georges Bank area controlled access program in Amendment 10, however the measures in these alternatives will focus on minimizing finfish bycatch which could alter the timing of access, but not necessarily the boundaries or the amount of effort that Amendment 10 predicts there.

It also must be realized that a reverse shifting of effort from a low sea turtle area such as Georges Bank, to a high use area like the Mid-Atlantic will likely occur at some future time when the Georges Bank scallop resources decline and the Mid-Atlantic areas increase due to natural fluctuations and/or fishing effort distributions. Therefore, the impact assessment for protected species is likely to shift back and forth over the years under the management scheme being implemented under Amendment 10. The turtle takes seen now are likely to shift down as the industry moves to the east and north, but are also likely to shift back up at some point in the future as scallop resource levels change.

Therefore, the specific area management issues are going to have to be addressed as the openings and closings are proposed. Since they will be conducted under Framework actions, they will undergo individual ESA scrutiny where the latest scallop survey data will be available to give the best resource management picture at that time.

The barndoor skate is a candidate species under the ESA and is considered an overfished species under the MSFCMA. The Skate FMP has implemented a prohibition on possession of barndoor skate, thus providing adequate protection to the species in the scallop fishery as well.

The capture of loggerhead, ridley and green sea turtles is likely higher than was believed in previous ESA consultations on the Scallop FMP. The NMFS has reinitiated their ESA Section 7 consultation on the Scallop FMP to assess the level of impact of current scallop fishing activities on these species. Many of the alternatives being considered by the Council may reduce the current impacts of the fishing effort conducted under the Scallop FMP on sea turtles. In addition, the definition of overfishing being considered under this Amendment is likely to reduce the overall scallop fishing effort by as much as 50%. Depending on where this effort reduction takes place, the potential impact on sea turtles is, at a minimum, unlikely to increase, and may be reduced pending selection of certain alternatives.



Map 51. **Quarterly distribution of loggerhead sea turtles (large dots) compared with 1998-2000 sea scallop limited access fishing effort (hours per nm^2, gray scale or red).**

8.5 *Effects Of Alternatives On Essential Fish Habitat (L. McGee, D. Boelke)*

Since it has been determined that there are potentially adverse effects to EFH from bottom tending mobile gear, the Council has identified a range of alternatives to minimize adverse impacts to EFH pursuant to Section 600.815(a)2ii of the Magnuson Act. Those alternatives are described in Section 5.3

8.5.1 Methods and Analytical Results of Habitat Closed Area Alternatives.

The alternatives in Amendment 10 contain measures designed to satisfy multiple objectives such as improving scallop yield, reducing bycatch and minimizing impacts on EFH. Analyses of these alternatives frequently rely on common metrics and methods of analysis. Analysis of long-term area closures for the purpose of minimizing impacts on EFH, for example, utilize different metrics and methods than do the analysis of alternatives for improving scallop yield. Section 8.5.1.2 describes the methods used for analyzing the habitat closed area alternatives, while Section 8.5.3.2 describes the methods and results used for analysis of the non-closed area habitat alternatives. See Appendix IV for a complete description of the methods used in the habitat analysis.

NEPA requires that the potential impacts of an action on the environment be described. The habitat metric analysis does just that; it describes the sediment type, EFH, and biomass contained within each of the closed area alternatives, as well as the no action alternative. Therefore, based on the best available sediment, EFH, and biomass data, the impacts of closing certain areas can be evaluated. However, the Sustainable Fisheries Act requires that if fishing activities have been determined to have adverse impacts on EFH then measures should be taken to minimize these impacts when practicable. Therefore, when comparing the overall EFH benefits of the range of habitat closed area alternatives, it is appropriate to focus on the EFH component of this analysis. Thus, the EFH component of this metric analysis has been extracted from the overall matrix, and Section 8.5.3.1.1 highlights the alternatives that contain the most essential fish habitat for species that have been identified to have EFH vulnerable to bottom tending gear. In summary, the habitat metric analysis describes the areas from a NEPA standpoint, and the EFH evaluation in Section 8.5.3.1.1 provides a decision making tool to help identify which alternatives contain the most EFH area for species identified as having EFH vulnerable to bottom tending gear.

8.5.1.1 Level of closure analysis for habitat alternatives 3-9

Four levels of Habitat Closures were approved by the Council as a basis for determining appropriate gear types for habitat closure areas. These levels apply to the closed area alternatives that follow. It is possible that a closure level could be applied to all closed areas, or that closure levels be assigned specifically to each habitat closed area.

Level 1 Habitat Closure: The area will be closed indefinitely on a year round basis to all fishing gear.

This is the most restrictive option. This level would essentially establish a no-take marine protected area and would prohibit the use of all types of fishing gear in these closures. This level of closure would close the area to all fishing gear, both commercial and recreational.

Level 2 Habitat Closure: The area will be closed indefinitely on a year round basis to all bottom tending gear (static and mobile).

This option is slightly less restrictive than the Level 1 closure because it allows non-bottom-tending gear to operate in the habitat closures (for example, longlines and pelagic gear). Because is does prohibit all bottom tending gear, it will protect EFH for benthic species and life stages to the same degree as a Level 1 closure. The differences between Level 1 and Level 2 closures are primarily social and economic. Refer to Section 7.2.6.2 for a discussion of the impacts of both mobile and static gear on benthic habitats.

Level 3 Habitat Closure: The area will be closed indefinitely on a year round basis to all bottom tending mobile gear.

This level of closure is less restrictive because it allows static bottom tending gear to operate in these closures, but prohibits bottom tending mobile gears. Although less restrictive than Levels 1 and 2, the effects of this level of closure on benthic habitats do not differ significantly from the effects of Level 1 or 2 closures since static gear is generally considered to have minimal adverse impacts on benthic habitat (Section 7.2.6.2).

Level 4 Habitat Closure: The area will be open indefinitely on a year round basis only to gear defined as "reduced impact" gear.

Currently there are no reduced impact gear types defined by the Council. The identification of "reduced impact gear" would begin by first defining the ecological function served by the closure, with the advice from the Habitat Technical Team.

The analysis of this option is difficult because it requires knowledge of the individual ecological functions or features that the Council intends to protect. It is feasible that a Level 4 closure could apply to subsets of habitat closures depending on the intention of the closure. The implementation of this option will require a scientific and technical review procedure that includes, at a minimum, the Habitat Committee and the EFH Technical Team. If this level of closure is recommended, a process similar to the Council's HAPC designation process (See the Council's Habitat Annual Review and Report of 2000 for details) is recommended.

Summary of Level of Closures:

Because the effects of fishing on benthic habitats are caused primarily by mobile bottom-tending gears (bottom trawls and dredges), much less so by static bottom-tending gear (*e.g.*, pots, bottom longlines and gill nets), and not at all by pelagic gears (*e.g.*, mid-water trawls), the habitat metric analyses performed in this amendment/DEIS would apply equally well to Level 1 and Level 2 closures and nearly as well to Level 3 closures. Analysis of Level 4 closures would have to be tailored to the effects of specific "reduced impact" gears on specific habitat types. Economic and social impact assessments that were performed as part of the Practicability Analysis (Section 5.6), as well as assessments of enforcement feasibility and cumulative impacts were conducted for Level 1 and Level 3 closures in order to better distinguish between the impacts of these two closure levels.

None of the proposed habitat closures in this amendment specify which gear types would be prohibited. In implementing a habitat closed area alternative, the Council could prohibit the use of mobile, bottom-tending gear types while allowing the use of pelagic gears (Level 2) or pelagic and fixed bottom-tending gear (Level 3) based on practicability issues. If future closure alternatives are proposed for reasons other than the minimization of fishing impacts identified in this document (e.g. research areas, coral protection, etc.), other closure levels may be appropriate.

8.5.1.2 Habitat metrics

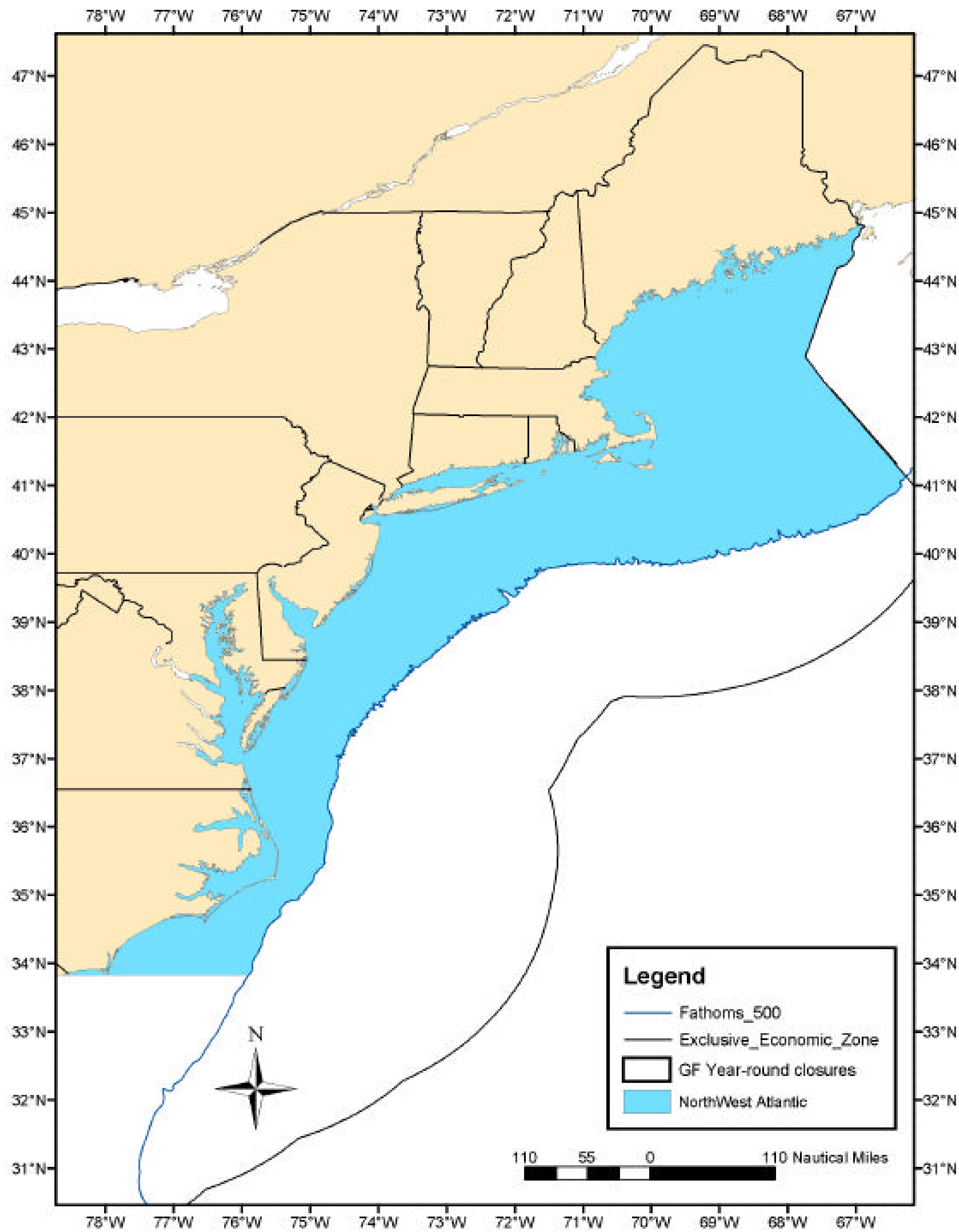
This analysis focuses on a comparison of the Habitat year-round closure scenarios from a habitat perspective. The primary purpose of this metric is to describe the areas quantitatively and enable decision makers and the public to compare the environments of each proposed closure. The analysis includes five metrics to describe the alternatives. The EFH evaluation (Section 8.5.3.1.1) determines the relative success of the alternatives in minimizing adverse impacts as defined in the adverse impact determination section of Amendment 10. The metrics include:

1) SEDIMENT –Area of each sediment type contained within each proposed closure.
2) EFH – The amount of vulnerable species' EFH encompassed by each proposed closure.
3) TROPHIC GUILD –Biomass encompassed by each closure for five guilds: planktivores, amphipod eaters, shrimp and fish eaters, benthivores, and piscivores.
4) SPECIES ASSEMBLAGE - Biomass encompassed by each closure for three species aggregations: elasmobranchs, demersal species, and pelagic species.
5) BENTHIC SPECIES - Biomass encompassed by each closure for six species (longhorn sculpin, sea raven, redfish, ocean pout, jonah crab and American lobster) with high levels of association to benthic habitats.

The Habitat Technical Team made no decisions regarding the relative importance or effectiveness of habitat protection for each of the metrics. Therefore, the variables within each metric have been weighted equally; for example, the percentages of bedrock, gravel, sand, and mud contained within each alternative each receive equal importance. No decisions have been made about which sediment types, guilds, or species' EFH are more critical to protect. However, a more detailed analysis has been completed to highlight some components of the metric analysis that may be more important to evaluate when analyzing the impacts of alternatives on EFH (see Section 8.5.2). Please refer to Appendix 4 for a complete description of the methods used for analysis of the habitat closed area alternatives.

In order to determine the percent of sediment, EFH, or biomass contained within an alternative, a denominator had to be identified. For this analysis, the Northwest Atlantic Analysis Area was defined as the area within the 500 fathom line to the East, the coastline (including internal waters) to the West, the Hague line to the North, and the North Carolina/ South Carolina border to the South. Although this fishery management plan does not have the jurisdiction to close areas in internal waters, it is important to describe the sediments and species that live in these areas and identify their importance in EFH protection. Map 52 depicts what the spatial areas defined as the Northwest Atlantic Analysis Area (NAAA). Note these areas have been determined for analysis purposes only. Within these boundaries, the total area of the Northwest Atlantic Analysis Area was determined to be 83,550 nm^2.

The EFH area values for each closed area alternative were adjusted to account for differences in closed area size. This was done by dividing EFH area values for each species and life stage with EFH that was determined to be vulnerable to mobile bottom tending gear (See Section 7.2.6.2.2) and total EFH area for all species and life stages encompassed by the area of each closure.



Map 52 – Boundaries of the Northwest Atlantic Analysis Area used in the habitat metric analysis

8.5.2 Results Of Closed Area Habitat Metric Analysis

The size of each closed area habitat alternative is described in Table 200 for reference. The percent of the total Northwest Atlantic Analysis Area is provided as well. The size of the habitat closed area alternatives range from 186 square nautical miles to 65,503 square nautical miles.

Table 200 **- Area of each habitat closed area alternative in square nautical miles, as well as the percent of the total Northwest Atlantic Analysis Area closed under each option**

	AREA in nm2	Percent of NAAA Closed
Total NAAA	83550	
NoAction	5853	7.0%
3(a)	2913	3.5%
3(b)	2821	3.4%
4	2241	2.7%
5(a)	3032	3.6%
5(b)	3073	3.7%
5(c)	3022	3.6%
5(d)	3098	3.7%
6	4041	4.8%
7	65503	78.4%
8a	186	0.2%
8b	732	0.9%
9	6254	7.5%

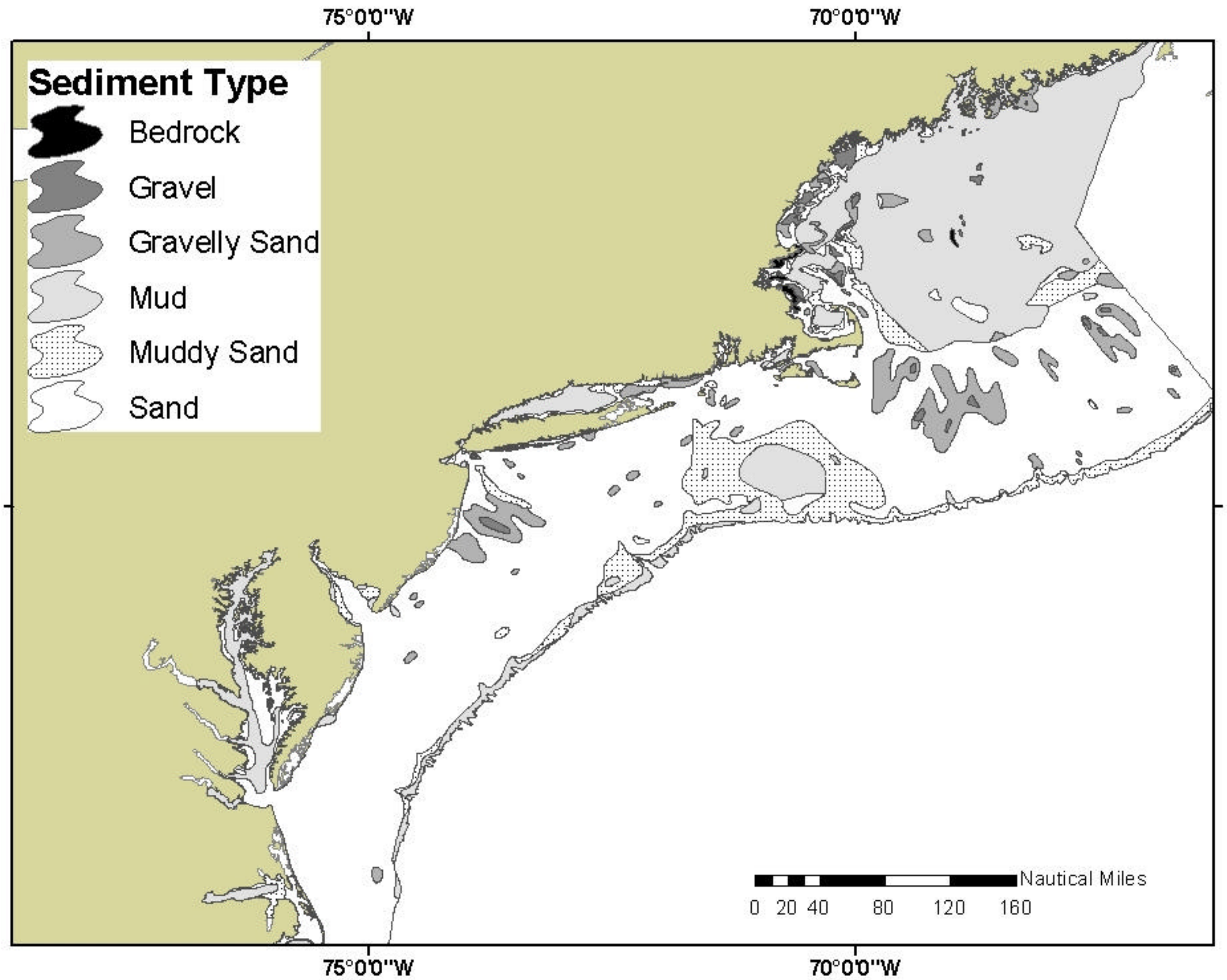
8.5.2.1 Sediment analysis

Methodology

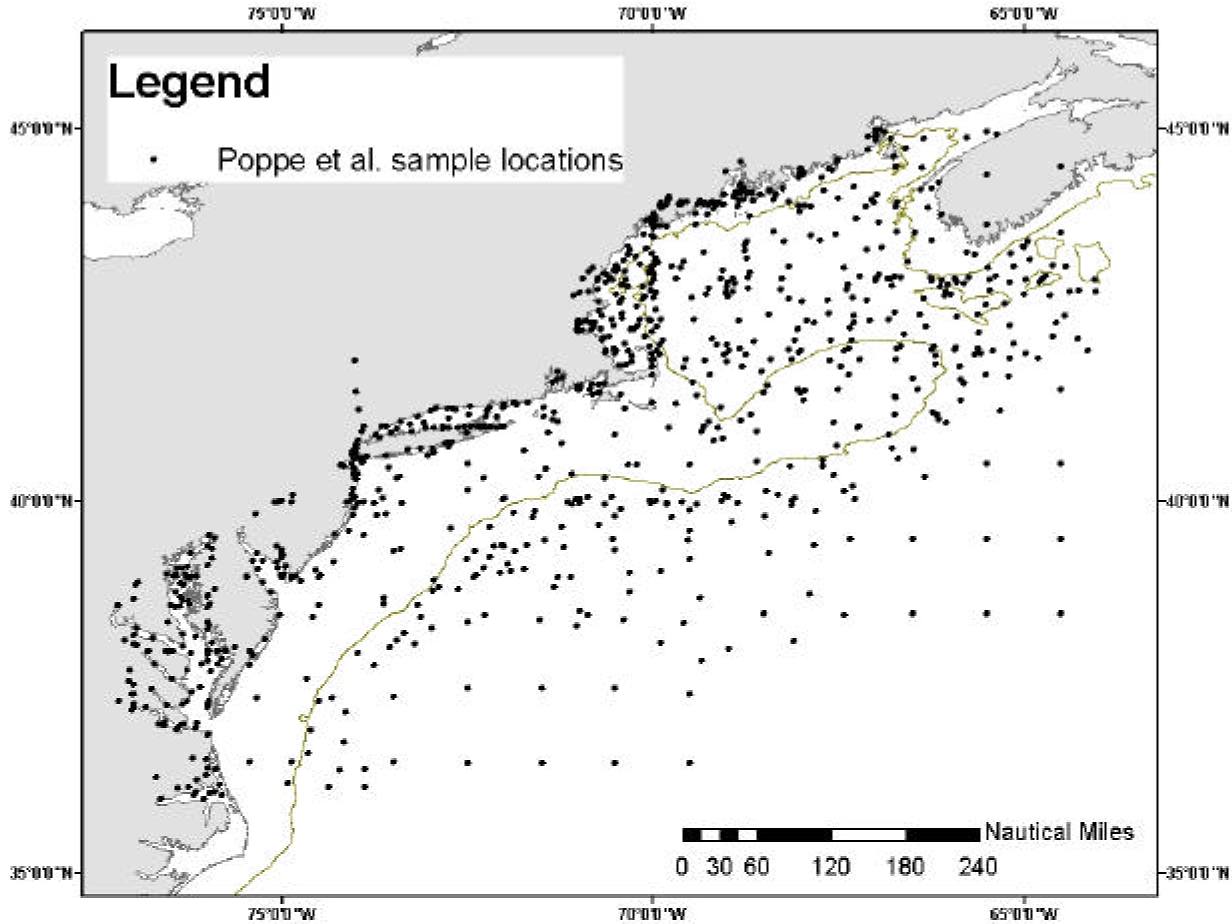
To establish the sedimentary composition of the various closure options, the Poppe *et al.* 1989 dataset is used (Map 53). (For more information, see Appendix IV). This dataset contains sediment data for a large portion of the Northwest Atlantic, based on 975 sampling locations (Map 54). Higher-resolution data sets, such as that based on the work of Stokesbury and Harris (Substrate in the sea scallop beds on Georges Bank 1999-2002, Stokesbury and Harris 2002), have been made available to the Council but do not cover a sufficiently large geographic area to be useful for a comprehensive evaluation of closure options. These high-resolution data do, however, point out the limitations of the Poppe *et al.* dataset when employed at a small scale. Map 55 demonstrates that, at small scales, the Poppe *et al.* maps fail to capture the variety of substrates on a scale at which changes in substrates tend to occur. In the absence of similar datasets covering the range of the Northwest Atlantic Analysis Area (NAAA), however, the Poppe *et al.* substrate maps will serve as the best available data for the purposes of description and analysis. The area of each sediment type that is contained within each alternative is presented in **Table 201**.

The term "gravel", as used in substrate maps and analyses, is collective and comprises granules, pebbles, cobbles, and boulders in order of increasing size. Therefore, the term "gravel" refers to particles larger than sand. Granules are slightly coarser than coarse sand and are only 2mm in diameter maximum. Granules are difficult to identify from video imagery and occur mixed with sand and/or with larger gravel. Granule/pebble bottom may be mostly pebbles. Pebbles range in size from granules up to 64mm (2.5 inches) in diameter. Cobbles range in size from pebbles up to 256mm (10 inches) in diameter. Boulders are larger than cobbles. Common gravel bottom types occurring offshore are pebble gravel (pebble pavements); pebble/cobble gravel; and pebble/cobble/boulder mixtures. They all can support attached epifauna and can be vulnerable to disturbance by mobile bottom gear. Pebble gravel and pebble/cobble gravel often overlie sand, and if the gravel has been disturbed, the sand will be visible between pebbles and cobbles.

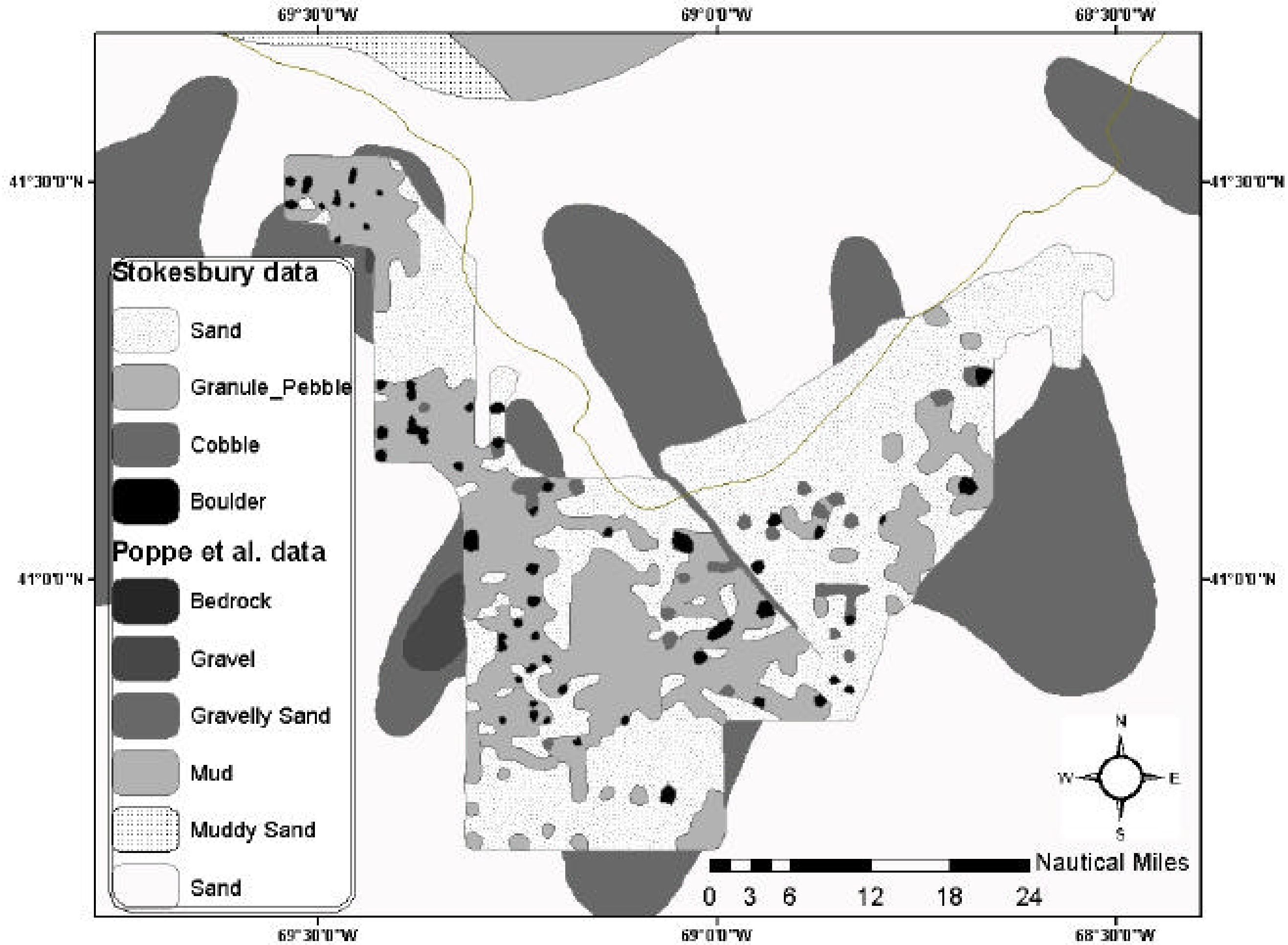
Map 53 – **Sediment map of the Northwest Atlantic Analysis Area (NAAA) based on Poppe *et al.* data (1989)**



Map 54 – **Poppe *et al.* (1989) sampling locations**



Map 55 **– Stokesbury and Harris (2002) substrate data for areas on Nantucket Shoals from Asia Rip north to Davis Bank and extending west into Closed Area I.**



Results

The first aspect of the sediment analysis describes the distribution of sediment types within an alternative in square nautical miles (nmi²) and as a percentage of the total NAAA (**Table 201**). The total Northwest Atlantic Analysis Area was defined as the portion of the continental shelf between the NC/SC border and the US/Canada border in the Gulf of Maine was calculated to be 83,550 square nautical miles (See **Map 52**). The percent composition data in Table 202 is incorporated into the EFH specific habitat metric analysis in Section 8.5.3.1.1.3.

Table 201. Total and percent of total sediment type contained inside each closed area alterantive, as compared to the total Northwest Atlantic Analysis Area.

	AREA		Bedrock		Gravel		Gravelly Sand		Sand		Muddy Sand		Mud	
Total	83550		150		556		4263		49620		7141		20378	
No Action	5853	7.0%	0	0%	106	19%	1041	25%	3875	8%	413	6%	413	2%
3(a)	2913	3.5%	19	13%	177	32%	915	22%	985	2%	90	1%	540	3%

3(b)	2821	3.4%	19	13%	177	32%	916	22%	958	2%	88	1%	479	2%
4	2241	2.7%	15	10%	139	25%	778	18%	885	2%	83	1%	342	2%
5(a)	3032	3.6%	0	0%	21	4%	126	3%	1226	2%	507	7%	991	5%
5(b)	3073	3.7%	0	0%	15	3%	313	7%	1879	4%	188	3%	576	3%
5(c)	3022	3.6%	5	3%	27	5%	107	3%	1526	3%	356	5%	783	4%
5(d)	3098	3.7%	0	0%	38	7%	101	2%	1049	2%	668	9%	511	3%
6	4041	4.8%	0	0%	92	17%	666	16%	2454	5%	413	6%	413	2%
7	65503	78.4%	139	93%	403	72%	2580	61%	35243	71%	6704	94%	19250	94%
8a	186	0.2%	0	0%	0	0%	62	1%	124	0%	0	0%	0	0%
8b	732	0.9%	0	0%	35	6%	204	5%	495	1%	0	0%	0	0%
9	6254	7.5%	15	10%	114	21%	1077	25%	3872	8%	413	6%	753	4%

Table 202. Sediment composition of each closed area alternative (Note: percents of each sediment type add up to approximately 100% for each alternative).

	Bedrock	**Gravel**	**Gravelly Sand**	**Sand**	**Muddy Sand**	**Mud**
NoAction	0%	2%	18%	66%	7%	7%
3(a)	1%	6%	34%	36%	3%	20%
3(b)	1%	7%	35%	36%	3%	18%
4	1%	6%	35%	39%	4%	15%
5(a)	0%	1%	4%	43%	18%	35%
5(b)	0%	1%	11%	63%	6%	19%
5(c)	0%	1%	4%	54%	13%	28%
5(d)	0%	2%	4%	44%	28%	22%
6	0%	2%	16%	61%	10%	10%
7	0%	1%	4%	55%	10%	30%
8a	0%	0%	33%	67%	0%	0%
8b	0%	5%	28%	67%	0%	0%
9	0%	2%	17%	62%	7%	12%

Alternatives 3 (a), 3(b), 4, 5c, 7 and 9 are the only alternatives to contain areas of bedrock as defined by the Poppe *et al.* data. Alternatives 3a, 3b, 4, 6, 7, and 9 contain a significant amount of gravel and gravelly sand. For example, 16% of the gravelly sand in the NAAA and 17% of the gravel in the NAAA are contained within Alternative 6. Most of the alternatives are primarily made up of sandy bottom, and a significant portion of Alternatives 5a, 5c, and 7 are mud.

8.5.2.2 Essential Fish Habitat analysis

Methodology

A list of 23 species have been identified as having EFH for at least one life stage moderately or highly vulnerable to the effects of bottom-tending mobile gear (see Gear Effects Evaluation and Adverse Impact Determination Section 7.2.6.3). Closed areas provide habitat protection for these species and life stages. The EFH area contained in a closure is calculated by summing the geographic area (in square nautical miles) of the ten minute squares of latitude and longitude (or portions thereof) that are designated as EFH for each species and life stages that is bounded by each proposed closure. Geographic EFH designations are contained in the Omnibus EFH Amendment (NEFMC 1998) and in several species FMPs adopted by the NEFMC and MAFMC. **Table 203** is a summary of the total and percent-of-total EFH area in the Northwest Atlantic Analysis Area. The total EFH area for each of the vulnerable species and life stages (A= Adults, J=Juveniles and E= Eggs) is in column one. The sum and percent of EFH area values for all species and life stages with vulnerable EFH is shown at the bottom of the table for each closed area alternative.

Description of EFH components of proposed area closures

Table 203 is a summary of the total and percent-of-total EFH for each of the vulnerable species encompassed by each of the closed area alternatives and can be used to evaluate how the different alternatives rank in terms of EFH protection for the species that are moderately or highly vulnerable to bottom tending gear. The total EFH area contained in each option is in boldface, and the percent of EFH contained in each area is expressed as a percentage. The percent of EFH for each species and life stage with vulnerable EFH contained in an area is calculated by dividing the amount of EFH in that area by the total EFH in the region. The summed EFH areas for each alternative were divided by the total vulnerable EFH in the NAAA, to describe the overall EFH value for each closure option.

Table 203. Total and percent of total EFH area for species with EFH identified as vulnerable to bottom-tending mobile gear. (Note the total EFH value for the entire species is provided as well in column 1). ***Values are NOT scaled for area.*

Total EFH	SPECIES	No Action		3a		3b		4		5a		5b		5c		5d	
AREA		5853		2913		2821		2241		3032		3073		3022		3098	
nm2		nm2	%	nm2	%	nm2	%	nm2	%	nm2	%	nm2	%	nm2	%	nm2	%
13449	Black sea bass_A	150	1.1	0	0.0	0	0.0	0	0.0	547	4.1	306	2.3	695	5.2	346	2.6
13503	Black sea bass_J	154	1.1	0	0.0	0	0.0	0	0.0	1199	8.9	823	6.1	1188	8.8	957	7.1
22076	Cod_A	3874	17.5	2688	12.2	2598	11.8	2203	10.0	1641	7.4	1992	9.0	1773	8.0	1197	5.4
12968	Cod_J	2974	22.9	2163	16.7	2072	16.0	1706	13.2	821	6.3	1318	10.2	1026	7.9	1048	8.1
15664	Haddock_A	3717	23.7	2421	15.5	2337	14.9	1940	12.4	1388	8.9	1269	8.1	1095	7.0	1093	7.0
13746	Haddock_J	3135	22.8	2127	15.5	2044	14.9	1667	12.1	827	6.0	1408	10.2	959	7.0	1206	8.8
5625	Halibut_A	1048	18.6	1059	18.8	1061	18.9	958	17.0	424	7.5	374	6.7	424	7.5	274	4.9
5625	Halibut_J	1048	18.6	1059	18.8	1061	18.9	958	17.0	424	7.5	374	6.7	424	7.5	274	4.9
17891	American plaice_A	1820	10.2	1209	6.8	1120	6.3	921	5.1	1707	9.5	1465	8.2	1688	9.4	1112	6.2
15427	American plaice_J	1440	9.3	1149	7.4	1060	6.9	861	5.6	1707	11.1	1465	9.5	1688	10.9	1112	7.2
14624	Pollock_A	1533	10.5	1469	10.0	1392	9.5	1129	7.7	1411	9.6	1271	8.7	1044	7.1	741	5.1
28685	Ocean Pout A	4618	16.1	1919	6.7	1827	6.4	1582	5.5	2173	7.6	2614	9.1	2298	8.0	2262	7.9
32867	Ocean pout_E	2	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
18435	Ocean pout_J	1820	9.9	1070	5.8	979	5.3	845	4.6	1870	10.1	1864	10.1	1997	10.8	1506	8.2
21241	Redfish_A	1757	8.3	1610	7.6	1522	7.2	1322	6.2	1715	8.1	1465	6.9	1696	8.0	1194	5.6
22009	Redfish_J	1759	8.0	1559	7.1	1468	6.7	1258	5.7	1758	8.0	1465	6.7	1739	7.9	1163	5.3
37038	Red hake_A	3274	8.8	1418	3.8	1330	3.6	1130	3.1	2474	6.7	2536	6.8	2378	6.4	2189	5.9
43285	Red hake_J	4653	10.7	2318	5.4	2259	5.2	1898	4.4	2917	6.7	2458	5.7	2969	6.9	2426	5.6
15906	Scup_J	523	3.3	0	0.0	0	0.0	0	0.0	1206	7.6	1031	6.5	1555	9.8	871	5.5
2345	SkateBarndoor_A	522	22.3	178	7.6	178	7.6	105	4.5	0	0.0	75	3.2	0	0.0	76	3.2
11264	SkateBarndoor_J	3026	26.9	851	7.6	848	7.5	759	6.7	377	3.3	679	6.0	450	4.0	835	7.4
14232	SkateClearnose_A	332	2.3	0	0.0	0	0.0	0	0.0	436	3.1	225	1.6	436	3.1	491	3.5
16449	SkateClearnose_J	540	3.3	274	1.7	231	1.4	231	1.4	656	4.0	521	3.2	730	4.4	788	4.8
36449	SkateLittle_A	4702	12.9	1810	5.0	1805	5.0	1523	4.2	1356	3.7	2171	6.0	1702	4.7	1448	4.0
50044	SkateLittle_J	5086	10.2	1837	3.7	1837	3.7	1641	3.3	1951	3.9	2395	4.8	1929	3.9	1596	3.2
624	SkateRosette_A	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
7903	SkateRosette_J	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	327	4.1
11039	SkateSmooth_A	1588	14.4	1249	11.3	1157	10.5	1062	9.6	1558	14.1	1185	10.7	1407	12.7	1037	9.4
20929	SkateSmooth_J	1947	9.3	1667	8.0	1575	7.5	1374	6.6	1683	8.0	1633	7.8	1682	8.0	1163	5.6
18193	SkateThorny_A	1660	9.1	1528	8.4	1468	8.1	1200	6.6	1716	9.4	1690	9.3	1770	9.7	1196	6.6
26586	SkateThorny_J	3444	13.0	2328	8.8	2237	8.4	1891	7.1	1866	7.0	1916	7.2	1846	6.9	1498	5.6
25769	SkateWinter_A	4345	16.9	1993	7.7	1959	7.6	1689	6.6	1501	5.8	1723	6.7	1866	7.2	1136	4.4
39452	SkateWinter_J	5283	13.4	2063	5.2	2058	5.2	1822	4.6	2027	5.1	2841	7.2	2450	6.2	1901	4.8
1466	Tilefish_A	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

2852	Tilefish_J	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
47268	Silver hake_J	4750	10.0	2134	4.5	2044	4.3	1772	3.7	2990	6.3	2535	5.4	2969	6.3	2506	5.3
21884	White hake_J	2616	12.0	1464	6.7	1406	6.4	1163	5.3	1643	7.5	1621	7.4	1697	7.8	1656	7.6
19285	Winter flounder_A	2977	15.4	1750	9.1	1701	8.8	1392	7.2	1424	7.4	1701	8.8	1851	9.6	830	4.3
19847	Witch flounder_A	1442	7.3	993	5.0	904	4.6	705	3.5	1785	9.0	1108	5.6	1556	7.8	1417	7.1
15489	Witch flounder_J	440	2.8	592	3.8	545	3.5	382	2.5	963	6.2	717	4.6	1091	7.0	756	4.9
23102	Yellowtail flounder_A	4629	20.0	1476	6.4	1461	6.3	1224	5.3	1518	6.6	2017	8.7	1792	7.8	1667	7.2
20199	Yellowtail flounder_J	3584	17.7	1028	5.1	1015	5.0	825	4.1	990	4.9	1795	8.9	1488	7.4	1139	5.6
822734	SUM of vul. EFH	92211		50455		48556		41135		52651		54050		55350		44435	
	Sum of Vul. EFH in closure / sum of total Vul. EFH	**11.2%**		**6.1%**		**5.9%**		**5.0%**		**6.4%**		**6.6%**		**6.7%**		**5.4%**	

Table Continued: Total and percent of total EFH area for species with EFH identified as vulnerable to bottom-tending mobile gear. (Note the total EFH value for the entire species is provided as well in column 1). ***Values are NOT scaled for area.*

Total EFH	SPECIES	6		7		8a		8b		9	
AREA		4041		65503		186		732		6254	
nm2		nm2	%	nm2	%	nm2	%	nm2	%	nm2	%
13449	Black sea bass_A	152	1.1	8948	66.5	0	0.0	0	0.0	151	1.1
13503	Black sea bass_J	154	1.1	9666	71.6	0	0.0	0	0.0	154	1.1
22076	Cod_A	2545	11.5	16696	75.6	186	0.8	733	3.3	4270	19.3
12968	Cod_J	2254	17.4	8699	67.1	186	1.4	658	5.1	3064	23.6
15664	Haddock_A	2339	14.9	11933	76.2	186	1.2	658	4.2	3843	24.5
13746	Haddock_J	1661	12.1	7327	53.3	186	1.4	621	4.5	3365	24.5
5625	Halibut_A	862	15.3	3394	60.3	112	2.0	371	6.6	1105	19.6
5625	Halibut_J	862	15.3	3394	60.3	112	2.0	371	6.6	1105	19.6
17891	American plaice_A	1545	8.6	16074	89.8	0	0.0	84	0.5	2221	12.4
15427	American plaice_J	1240	8.0	13633	88.4	0	0.0	46	0.3	1840	11.9
14624	Pollock_A	1255	8.6	13030	89.1	37	0.3	222	1.5	1822	12.5
28685	Ocean Pout A	3174	11.1	17136	59.7	112	0.4	434	1.5	4724	16.5
32867	**Ocean pout_E**	1	**0.0**	20587	**62.6**	112	**0.3**	434	**1.3**	2	**0.0**
18435	**Ocean pout_J**	1427	**7.7**	10907	**59.2**	0	**0.0**	35	**0.2**	2009	**10.9**
21241	**Redfish_A**	1465	**6.9**	18426	**86.7**	75	**0.4**	335	**1.6**	2157	**10.2**
22009	**Redfish_J**	1593	**7.2**	18672	**84.8**	112	0.5	296	1.3	2160	9.8
37038	Red hake_A	2431	6.6	27612	74.6	0	0.0	112	0.3	3675	9.9
43285	Red hake_J	3324	7.7	29563	68.3	186	0.4	632	1.5	4984	11.5
15906	Scup_J	523	3.3	12157	76.4	0	0.0	0	0.0	523	3.3
2345	SkateBarndoor_A	331	14.1	1887	80.5	75	3.2	74	3.2	522	22.3
11264	SkateBarndoor_J	1823	16.2	7302	64.8	112	1.0	311	2.8	3027	26.9

14232	SkateClearnose_A	**244**	1.7	**11999**	84.3	**0**	0.0	**0**	0.0	**332**	2.3
16449	SkateClearnose_J	**452**	2.7	**13240**	80.5	**0**	0.0	**0**	0.0	**548**	3.3
36449	SkateLittle_A	**2900**	8.0	**23240**	63.8	**186**	0.5	**733**	2.0	**4711**	12.9
50044	SkateLittle_J	**3286**	6.6	**32628**	65.2	**186**	0.4	**733**	1.5	**5087**	10.2
624	SkateRosette_A	**0**	0.0	**624**	100.0	**0**	0.0	**0**	0.0	**0**	0.0
7903	SkateRosette_J	**0**	0.0	**4708**	59.6	**0**	0.0	**0**	0.0	**0**	0.0
11039	SkateSmooth_A	**1252**	11.3	**9197**	83.3	**112**	1.0	**248**	2.2	**1864**	16.9
20929	SkateSmooth_J	**1551**	7.4	**17786**	85.0	**112**	0.5	**248**	1.2	**2339**	11.2
18193	SkateThorny_A	**1333**	7.3	**15517**	85.3	**112**	0.6	**221**	1.2	**2060**	11.3
26586	SkateThorny_J	**2453**	9.2	**21259**	80.0	**186**	0.7	**546**	2.1	**3845**	14.5
25769	SkateWinter_A	**2572**	10.0	**16145**	62.7	**186**	0.7	**733**	2.8	**4444**	17.2
39452	SkateWinter_J	**3475**	8.8	**26292**	66.6	**186**	0.5	**733**	1.9	**5336**	13.5
1466	Tilefish_A	**0**	0.0	**1412**	96.3	**0**	0.0	**0**	0.0	**0**	0.0
2852	Tilefish_J	**0**	0.0	**2631**	92.3	**0**	0.0	**0**	0.0	**0**	0.0
47268	Silver hake_J	**3336**	7.1	**33739**	71.4	**186**	0.4	**696**	1.5	**5151**	10.9
21884	White hake_J	**1815**	8.3	**17932**	81.9	**0**	0.0	**296**	1.4	**2967**	13.6
19285	Winter flounder_A	**2361**	12.2	**12224**	63.4	**186**	1.0	**621**	3.2	**2978**	15.4
19847	Witch flounder_A	**1445**	7.3	**17616**	88.8	**0**	0.0	**46**	0.2	**1842**	9.3
15489	Witch flounder_J	**440**	2.8	**13300**	85.9	**0**	0.0	**0**	0.0	**835**	5.4
23102	Yellowtail flounder_A	**2838**	12.3	**12075**	52.3	**37**	0.2	**322**	1.4	**4630**	20.0
20199	Yellowtail flounder_J	**1945**	9.6	**9172**	45.4	**0**	0.0	**140**	0.7	**3585**	17.7
822734	SUM of Vul. EFH	**64661**		**589778**		**3464**		**12745**		**99274**	
	Sum of Vul. EFH in closure / sum of total Vul. EFH	**7.9%**		**71.7%**		**0.4%**		**1.5%**		**12.1%**	

Results of EFH Component

Table 203 describes the area of vulnerable EFH contained in each habitat closed area in square nautical miles and percent. For example, of the 12,968 square nautical miles that are designated as juvenile Cod EFH in the region, 2,254 or 17.4% is contained within alternative 6, while only 821 square nautical miles or 6.3% is contained within alternative 5a. Since the amount of EFH in each alternative varies depending on the size of the closure, the EFH values for each alternative have been further divided by the area of each option. This value is an indicator of the amount of vulnerable EFH per nautical mile (See Section 8.5.3.1.1 for the EFH analysis that incorporates the size of each habitat closed area alternative). Aside from Alternative 7 that would close a substantially large portion of the NAAA (78%), the summed EFH values for the remaining alternatives range from 0.4% (Alternative 8a) to 12.1% (Alternative 9), with most values between 5.0% (Alternative 4) and 7.9% (Alternative 6). Overall, less than ten percent of the total EFH for the majority of species and life stages with vulnerable EFH are within the habitat closures. Species with high percentages of EFH area are cod (A, J), haddock (A,J), and halibut (A,J). Alternatives 3, 4, 6, and 9 contain relatively high percentages of EFH area for these species (10-25%). For example, Alternative 9 contains 23.6% of juvenile cod EFH and 24.5% of juvenile haddock EFH. Note, because Alternative 7 is so much larger than the other alternatives, it contains the most EFH area for all species with vulnerable EFH (over 50%).

8.5.2.3 Trophic guild analysis

Methodology

Cluster analysis (based on Garrison 2000) was used to define trophic guilds found in the Northwest Atlantic Analysis Area (NAAA) analysis area. The general guild structure and levels of dietary overlap are consistent across both temporal and spatial scales. Complimentary analyses to the current study within the Georges Bank region identified similar trophic guilds and general stability in the trophic guild structure over the last three decades. Despite the notable changes in species composition in the Northeast shelf fish community, the patterns of trophic resource use and guild structure have remained remarkably consistent. Five trophic guilds were identified for this analysis: benthivores, amphipod eaters, planktivores, piscivores, and shrimp and fish eaters. The species and size ranges used to define these guilds are identified in Appendix IV.

Results

Table 204 describes the biomass and percent of total biomass for each guild that is contained within each closure alternative. Biomass is measured as the sum of the mean wt (kg) per tow from the 1995-2001 bottom trawl surveys for each ten minute square (or fraction thereof) included within each closure area. Table 205 describes the composition of each closure.

Table 204. **Total and percent-of-total biomass for each guild within each closed area scenarios.** ***Benthic = benthivore; Ampshr = amphipod-shrimp eater; Plankt = planktivore; Pisc = piscivore; Shrfis = shrimp/fish eater(based on a mean wt per tow value from the bottom trawl survey, 1995-2001).***

	Benthic		Ampshr		Plankt		Pisc		Shrfis	
Total	9,128		2,681		11,836		4,921		6,509	
No Action	**2,423**	26.5%	**1,052**	39.2%	**1,204**	10.2%	**492**	10.0%	**1,206**	18.5%
3(a)	**976**	10.7%	**254**	9.5%	**413**	3.5%	**125**	2.5%	**549**	8.4%
3(b)	**908**	9.9%	**245**	9.1%	**407**	3.4%	**121**	2.4%	**498**	7.6%
4	**859**	9.4%	**223**	8.3%	**356**	3.0%	**104**	2.1%	**464**	7.1%

5(a)	**541**	5.9%	**284**	10.6%	**708**	6.0%	**156**	3.2%	**354**	5.4%
5(b)	**778**	8.5%	**333**	12.4%	**947**	8.0%	**178**	3.6%	**152**	2.3%
5(c)	**634**	6.9%	**291**	10.8%	**731**	6.2%	**148**	3.0%	**189**	2.9%
5(d)	**589**	6.5%	**168**	6.3%	**933**	7.9%	**162**	3.3%	**247**	3.8%
6	**1,296**	14.2%	**489**	18.2%	**653**	5.5%	**190**	3.9%	**935**	14.4%
7	**6086**	66%	**1657**	62%	**8444**	71%	**3599**	73%	**6023**	93%
8a	**58**	1%	**20**	1%	**25**	0%	**19**	0%	**2**	0%
8b	**171**	6%	**77**	6%	**101**	8%	**39**	3%	**7**	4%
9	**1953**	21%	**860**	32%	**980**	8%	**294**	6%	**1305**	20%

Table 205 **- Guild composition of each closure alternative**
Benthic = benthivore; Ampshr = amphipod-shrimp eater; Plankt = planktivore; Pisc = piscivore; Shrfis = shrimp/fish eater(based on a mean wt per tow value from the bottom trawl survey, 1995-2001).

	Benthic	**Ampshr**	**Plankt**	**Pisc**	**Shrfis**
NoAction	38%	17%	19%	6%	19%
3(a)	42%	11%	18%	5%	24%
3(b)	42%	11%	19%	6%	23%
4	43%	11%	18%	5%	23%
5(a)	26%	14%	35%	8%	17%
5(b)	33%	14%	40%	7%	6%
5(c)	32%	15%	37%	7%	9%
5(d)	28%	8%	44%	8%	12%
6	36%	14%	18%	5%	26%
7	24%	6%	33%	14%	23%
8a	46%	16%	20%	15%	2%
8b	43%	19%	26%	10%	2%
9	36%	16%	18%	5%	24%

Closed area alternatives 7, 9 and 6 contain the highest biomass values for benthivores and shrimp-and-fish eaters, followed closely by 3a, 3b and 4. A significant portion of amphipod-eaters biomass is contained in alternatives 7, 9, and 6 as well. Alternatives 5a, 5b, and 5c contain a larger percentage of biomass of the amphipod-shrimp guild than the other guilds. Planktivores and piscivores are most abundant in alternatives 7, 9, 5b and 5d. Alternatives 3a, 3b, 4, 6, and 9 guild biomass is dominated by benthivores and shrimp-fish-eaters, while alternatives 5a-5d are more dominated by the planktivore guild.

8.5.2.4 Species assemblages

Methodology

Cluster analysis (based on Garrison 2000, Gabriel 1992) was used to define spatial-temporal assemblages for major taxonomic aggregates (i.e., principal groundfish, principal pelagics, demersals, pelagics and elasmobranchs) found in the NAAA analysis area. Species that were assigned to these assemblages are identified in Appendix IV.

Results

Results of the habitat closed area alternatives in their stand-alone form are summarized below. Table 206 contains the biomass of each assemblage contained within each alternative, and describes the percent of each assemblage biomass that is contained within each alternative as compared to the total Northwest Atlantic Analysis Area. Biomass is measured in mean wt (kg) per tow from the 1995-2001 bottom trawl surveys. Table 207 describes the species composition of each closure option.

Table 206 - Total and percent-of-total biomass for each assemblage within each closed area alternative.

	Elasmo		Pringrd		Prinpel		Demersal		Pelagic	
Total	92,990		22,140		6,742		129,171		13,841	
NoAction	**12,539**	13.5%	**6,192**	28.0%	**763**	11.3%	**20,117**	15.6%	**1,262**	9.1%
3(a)	**2,264**	2.4%	**2,242**	10.1%	**216**	3.2%	**4,968**	3.8%	**441**	3.2%
3(b)	**2,257**	2.4%	**2,089**	9.4%	**210**	3.1%	**4,784**	3.7%	**435**	3.1%
4	**1,990**	2.1%	**1,932**	8.7%	**181**	2.7%	**4,309**	3.3%	**378**	2.7%
5(a)	**3,880**	4.2%	**1,413**	6.4%	**522**	7.7%	**5,965**	4.6%	**800**	5.8%
5(b)	**6,133**	6.6%	**1,567**	7.1%	**680**	10.1%	**8,404**	6.5%	**1,004**	7.3%
5(c)	**3,801**	4.1%	**1,306**	5.9%	**525**	7.8%	**5,807**	4.5%	**825**	6.0%
5(d)	**3,478**	3.7%	**1,298**	5.9%	**784**	11.6%	**5,325**	4.1%	**952**	6.9%
6	**6,529**	7.0%	**3,243**	14.6%	**416**	6.2%	**10,374**	8.0%	**687**	5.0%
7	**54681**	59%	**16615**	75%	**4758**	71%	**81267**	63%	**10080**	73%
8a	**184**	0%	**93**	0%	**14**	0%	**311**	0%	**30**	0%
8b	**457**	4%	**286**	6%	**22**	12%	**856**	4%	**107**	7%
9	**9002**	10%	**5329**	24%	**619**	9%	**15309**	12%	**1027**	7%

Table 207 – **Species Assemblage composition of each closure alternative**

	Elasmo	Pringrd	Prinpel	Demersal	Pelagic
NoAction	30%	16%	2%	49%	3%
3(a)	22%	22%	2%	49%	4%
3(b)	23%	21%	2%	49%	4%
4	23%	22%	2%	49%	4%
5(a)	31%	11%	4%	47%	6%
5(b)	34%	9%	4%	47%	6%
5(c)	31%	11%	4%	47%	7%
5(d)	29%	11%	7%	45%	8%
6	31%	15%	2%	49%	3%
7	33%	10%	3%	49%	6%
8a	29%	15%	2%	49%	5%
8b	26%	17%	1%	50%	6%
9	29%	17%	2%	49%	3%

High elasmobranch biomass values occur in alternatives 7, 9, 6, and 5b. Relative to the size of the alternatives, alternatives 8b, 5d, and 5b contain a significant amount of pelagic biomass. Alternatives 7, 9, and 6 contain significantly more demersal finfish biomass than the other alternatives; the same is true for the principal groundfish assemblage. The most abundant species assemblage in all twelve closed area alternatives is the demersal finfish group (See Table 207).

8.5.2.5 Individual benthic species

Methodology

Six species (longhorn sculpin, sea raven, redfish, ocean pout, jonah crab and American lobster) were chosen for their close association with benthic habitats for both feeding and protection from predators (see Appendix IV for spatial distribution of these species).

Results

Table 208 describes the total and percent-of-total biomass for each species that is contained within each closure alternative. Biomass is measured as the sum of the mean wt (kg) per tow from the 1995-2001 bottom trawl surveys for each ten minute square (or fraction there) included within each closure area. Table 209 shows the percent composition of individual benthic species by closure.

Table 208 **- Total and Percentage of total biomass for each species within each closed area alternative. (LhnScpn= longhorn sculpin, SeaRvn= Sea raven, Redfish= Redfish, OcPout= Ocean pout, JonCrab= Jonah crab, and Lobster= Lobster)**

	LhnScpn		SeaRvn		Redfish		OcPout		JonCrab		Lobster	
Total	1504.2		533.4		5870.6		1527.9		199.7		1179.8	
NoAction	**558**	37.1%	**162**	30.3%	**1,077**	18.3%	**173**	11.3%	**18**	9.2%	**103**	8.7%
3(a)	**187**	12.4%	**75**	14.1%	**452**	7.7%	**52**	3.4%	**3**	1.4%	**39**	3.3%
3(b)	**177**	11.8%	**72**	13.5%	**418**	7.1%	**48**	3.2%	**3**	1.3%	**37**	3.1%
4	**165**	11.0%	**67**	12.5%	**391**	6.7%	**39**	2.5%	**1**	0.6%	**34**	2.9%
5(a)	**239**	15.9%	**50**	9.4%	**266**	4.5%	**156**	10.2%	**15**	7.4%	**42**	3.5%
5(b)	**317**	21.1%	**78**	14.5%	**93**	1.6%	**88**	5.7%	**3**	1.6%	**90**	7.7%
5(c)	**271**	18.0%	**54**	10.0%	**116**	2.0%	**172**	11.3%	**3**	1.7%	**100**	8.5%
5(d)	**95**	6.3%	**61**	11.4%	**177**	3.0%	**209**	13.7%	**14**	7.1%	**28**	2.3%
6	**245**	16.3%	**73**	13.6%	**835**	14.2%	**63**	4.1%	**11**	5.3%	**47**	3.9%
7	**829**	55%	**294**	55%	**5437**	93%	**542**	35%	**175**	87%	**822**	70%
8a	**15**	1%	**16**	3%	**0**	0%	**1**	0%	**0**	0%	**5**	0%
8b	**60**	6%	**30**	11%	**1**	3%	**5**	14%	**0**	7%	**18**	2%
9	**384**	26%	**133**	25%	**1183**	20%	**143**	9%	**12**	6%	**75**	6%

Table 209 – **Percent composition of each species within each closed area alternative**

	LhnScpn	SeaRvn	Redfish	OcPout	JonCrab	Lobster
NoAction	24%	8%	53%	9%	1%	5%
3(a)	23%	9%	56%	6%	0%	5%
3(b)	23%	10%	55%	6%	0%	5%
4	24%	10%	56%	6%	0%	5%
5(a)	31%	7%	35%	20%	2%	5%
5(b)	47%	12%	14%	13%	0%	14%
5(c)	38%	7%	16%	24%	0%	14%
5(d)	16%	10%	30%	36%	2%	5%
6	19%	6%	66%	5%	1%	4%
7	10%	4%	67%	7%	2%	10%
8a	42%	42%	0%	2%	0%	14%

8b	53%	26%	1%	5%	0%	16%
9	20%	7%	61%	7%	1%	4%

This metric is particularly sensitive to the spatial distribution of the individual species. For example, there is no area closed in the central Gulf of Maine for Habitat Alternatives 5(a-d) and, therefore, these alternatives contain very small percentages of redfish biomass. On the other hand, Alternatives 5a and 5d contain a much higher percentage of Jonah crab than the other alternatives. Alternative 7 contains a large proportion of each species, but it is important to keep in mind that Alternative 7 is much larger in size than all the other alternatives. Longhorn sculpin biomass is high in alternatives 9, 5b and 5c; sea ravens in 9, 3a, 5b, and 6; redfish in 9 and 6; ocean pout in 8b, 5d, 5a, 5c and 5d; jonah crab in 5a and 5d; and lobsters in 5b and 5c.

8.5.3 EFH benefits of habitat alternatives

8.5.3.1 Closed area habitat alternatives (1, 3a, 3b, 4, 5a-d, 6, 7, 8a, 8b,9)

The previous sections (Sections 8.5.2.1 through 8.5.2.5) describe the results of the habitat metric analysis that was designed to comply with the requirement of NEPA to describe and analyze the potential impacts of an action on the environment. However, when comparing alternatives for EFH benefit it is important to focus primarily on EFH and the benthic communities. Therefore, the overall EFH analysis of the closed area habitat alternatives is based on two parts: 1) Section8.5.3.1.1.1, which focuses on the EFH component of the habitat metric analysis for species with vulnerable EFH, and 2) Section 8.5.3.1.1.3 prioritizes the habitat analysis to focus only on the components that support the species with EFH vulnerable to bottom tending gear (i.e. focus the assemblage analysis only on demersal species because this group of species is the primary assemblage that species with vulnerable EFH belong to). The first part of the EFH evaluation provides a mechanism to compare alternatives based on which ones potentially provide the most "protection" for species with the most vulnerable EFH to bottom tending gear. The second part helps to focus the metric analysis to incorporate other aspects of the metric analysis, but only those components that support the species with EFH vulnerable to bottom tending gear.

8.5.3.1.1 Summary of the EFH component of the habitat metric analysis

The M-S Act states that Councils are required to minimize, to the extent practicable, the adverse effects of fishing on EFH. It was concluded in Gear Effects Evaluation and Adverse Impacts Determination Section that mobile bottom tending gears (otter trawls, scallop dredges and clam dredges) potentially had a moderate or high adverse impact on the essential fish habitat of 23 species at various life stages. The purpose of this section is to present the results of an EFH-specific analyses for each of the twelve area closure alternatives that indicates how well each closure option will benefit EFH for these species. It also includes a summary of the substrate, trophic guild, and species assemblage characteristics of these species and life stages in each closed area alternative. The analyses are applied to the moderately and highly vulnerable species, to the highly vulnerable species, the highly vulnerable and overfished species, and the highly vulnerable species that are managed by the New England Fishery Management Council.

8.5.3.1.1.1 Evaluation of EFH highly or moderately impacted from bottom tending gear

The following three sections summarize results of habitat metric analyses in more detail for those species that have been defined as adversely impacted by mobile, bottom tending gears, i.e., in a manner than is more than minimal and not temporary in nature (Gear Effects Evaluation and Adverse Impact Determination Section). This analysis begins with a list of the species and life stages with EFH that has been determined to be either moderately or highly vulnerable to mobile, bottom tending gears (Table 210). The analysis evaluates the EFH protection afforded from each alternative on a per-unit-area basis (relative effectiveness indices) (See Table 211 and Table 214).

Table 210 **- Species and life stages with EFH that is moderately or highly vulnerable to mobile, bottom-tending gears.**

Species	Lifestage	Otter Trawl Vuln.	Scallop Dredge Vuln.	Clam Dredge Vuln.
American Plaice	A	High	High	None
American Plaice	J	Mod	Mod	None
Atlantic Cod	A	Mod	Mod	Mod
Atlantic Cod	J	High	High	None
Atlantic Halibut	A	Mod	Mod	None
Atlantic Halibut	J	Mod	Mod	None
Barndoor Skate	A	Mod	Mod	Low
Barndoor Skate	J	Mod	Mod	Low
Black Sea Bass	A	High	High	High
Black Sea Bass	J	High	High	High
Clearnose Skate	A	Mod	Mod	Mod
Clearnose Skate	J	Mod	Mod	Mod
Haddock	A	High	High	Low
Haddock	J	High	High	Low
Little Skate	A	Mod	Mod	Mod
Little Skate	J	Mod	Mod	Mod
Ocean Pout	A	High	High	High
Ocean Pout	J	High	High	High
Ocean Pout	L	High	High	High
Ocean Pout	E	High	High	High
Pollock	A	Mod	Mod	Low
Red Hake	A	Mod	Mod	Low
Red Hake	J	High	High	High
Redfish	A	Mod	Mod	None
Redfish	J	High	High	None
Rosette Skate	A	Mod	Mod	Mod
Rosette Skate	J	Mod	Mod	Mod
Scup	J	Mod	Mod	Mod
Silver Hake	J	Mod	Mod	Mod
Smooth Skate	A	High	High	None
Smooth Skate	J	Mod	Mod	None
Thorny Skate	A	Mod	Mod	None
Thorny Skate	J	Mod	Mod	None
Tilefish	A	High	Low	None
Tilefish	J	High	Low	None
White Hake	J	Mod	Mod	None
Winter Flounder	A	Mod	Mod	Mod
Winter Skate	A	Mod	Mod	Mod
Winter Skate	J	Mod	Mod	Mod
Witch Flounder	A	Mod	Low	Low
Witch Flounder	J	Mod	Low	None
Yellowtail Flounder	A	Mod	Mod	Mod

Yellowtail Flounder	J	Mod	Mod	Mod

Table 211 **– Relative Effectiveness of Habitat Closed Area Alternatives in Protecting EFH for Two Categories of Species and Life Stages**
**Values are EFH area (in square nautical miles) per 100 square nautical miles in each closed area summed for all species and life stages with moderately and highly vulnerable EFH, and for the species and life stages with only highly vulnerable EFH.*

Alternatives	Species with Medium/Highly Vulnerable EFH	Species with Highly Vulnerable EFH
	Sum*	**Sum***
NoAction	15.8	4.4
3a	17.3	5.3
3b	17.2	5.3
4	18.4	5.6
5a	17.4	5.2
5b	17.6	4.9
5c	18.3	5.2
5d	14.3	4.1
6	16.0	4.4
7	9.0	2.6
8a	18.6	6.4
8b	17.4	5.7
9	15.9	4.4

All of the alternatives with the exception of alternatives 7 are relatively effective at protecting moderately and highly vulnerable EFH on a per-unit-area basis. Alternative 4, 5c and 8a score slightly higher than some of the other alternatives in this category. Alternative 8a scores the highest when comparing the alternatives effectiveness of protecting highly vulnerable EFH. Alternative 7 ranks the lowest for both categories.

8.5.3.1.1.2 EFH-specific analysis: highly vulnerable New England-managed and overfished species

This analysis highlights area scaled EFH values for all species and life stages with EFH that is highly vulnerable to mobile bottom-tending gears that are managed by the New England Council, and for species and life stages with vulnerable EFH that are also overfished.

Table 212 – Summary of those species managed by the New England Fishery Management Council with EFH deemed highly vulnerable to mobile bottom tending gears.

Species	Lifestage	OT Vuln.	SD Vuln.
American Plaice	A	High	High
Atlantic Cod	J	High	High
Haddock	A	High	High
Haddock	J	High	High
Ocean Pout	A	High	High
Ocean Pout	J	High	High

Ocean Pout	L	High	High
Ocean Pout	E	High	High
Red Hake	J	High	High
Redfish	J	High	High
Smooth Skate	A	High	High

Table 213 – Summary of overfished species in the Northeast region with EFH that is highly vulnerable to mobile bottom tending gears.

Species	Lifestage	OT Vuln.	SD Vuln.
Atlantic Cod	J	High	High
Black Sea Bass	A	High	High
Black Sea Bass	J	High	High
Tilefish	A	High	Low
Tilefish	J	High	Low

Table 214 **- Relative Effectiveness of Habitat Closed Area Alternatives in Protecting EFH for Two Categories of Species and Life Stages.**
*Values are EFH area (in square nautical miles) per 100 square nautical miles in each closed area summed for all New England species and life stages with highly vulnerable EFH, and for overfished species and life stages in the Northeast region with highly vulnerable EFH.

Alternatives	New England species with Highly Vulnerable EFH	Overfished Species with Highly Vulnerable EFH
	Sum*	Sum*
NoAction	4.5	0.6
3a	5.5	0.7
3b	5.4	0.7
4	5.7	0.8
5a	5.0	0.8
5b	4.9	0.8
5c	5.0	1.0
5d	4.1	0.8
6	4.6	0.6
7	2.3	0.5
8a	6.4	1.0
8b	5.6	0.9
9	4.5	0.5

Alternative 8a ranks the highest in terms of relative effectiveness of protecting New England species with highly vulnerable EFH, alternatives 3, 4, and 8b also score relatively high. The rest score between four and five percent, except Alternative 7 ranks much lower (2.3%). Alternatives 8a and 5c rank the highest for protecting overfished speices and life stages with highly vulnerable EFH with the rest of the alternatives scoring between 0.5 and 0.9.

8.5.3.1.1.3 Metric components indicated by analysis

Table 215 summarizes the ecological characteristics of all species with EFH determined to have been highly vulnerable to mobile bottom tending gears. Based upon the analysis contained in the Gear Effects Evaluation / Types of Gear Effects, metric components may be targeted to identify those species with impacted EFH where the affects are likely to be not minimal or temporary in nature.

Table 215 – Summary of habitat and ecological characteristics of species/lifestages with EFH that is highly vulnerable to mobile, bottom-tending gear.

Species	Lifestage	OT Vuln.	SD Vuln.	Depth	Sediments	Guild it belongs to	Assemblage it belongs to
American Plaice	A	High	High	45-150	sand or gravel	Benthivore	Principle groundfish, Demersal
Atlantic Cod	J	High	High	10-150	rocks, pebble, gravel	Amphipod eater	Principle groundfish, Demersal
Black Sea Bass	A	High	High	20-50	structures, sand and shell		Demersal
Black Sea Bass	J	High	High	1-38	rough bottom, shell and eelgrass beds, structures and offshore clam beds in winter		Demersal
Haddock	A	High	High	35-100	pebble gravel	Benthivore	Principle groundfish, Demersal
Haddock	J	High	High	40-150	broken ground, pebbles, smooth hard sand, smooth areas between rocky patches	Benthivore	Principle groundfish, Demersal
Ocean Pout	A	High	High	<110	soft sediments	Benthivore	Demersal
Ocean Pout	J	High	High	<80	smooth bottom near rocks or algae	Benthivore	Demersal
Ocean Pout	L	High	High	<50	close to hard bottom nesting areas	Benthivore	Demersal
Ocean Pout	E	High	High	<50	hard bottom, sheltered holes	Benthivore	Demersal
Red Hake	J	High	High	<100	shell and live scallops	Amphipod eater	Demersal
Redfish	J	High	High	25-400	silt, mud, or hard bottom	Shrimp and Fish eater	Principle groundfish, Demersal
Smooth Skate	A	High	High	31-874 mostly 110-457	soft mud, sand, broken shells, gravel and pebbles	Shrimp and Fish eater	Elasmobranch, Demersal

Tilefish	A	High	Low	76-365	rough, sheltered bottom		Demersal
Tilefish	J	High	Low	76-365	rough, sheltered bottom		Demersal

Of the 15 species and life stages listed above, 12 are associated with rough, sheltered, hard, pebbled or broken bottom. The list includes 7 benthivores, 2 shrimp-fish eaters and 2 amphipod eaters. Every species and life stages listed falls under the demersal and, in five cases, also the principle groundfish assemblage. These groupings allow for an analysis of other metric components (Table 216 through Table 218).

Sediment

Table 216 – Percent composition of sediment types associated with species with highly vulnerable EFH within each closed area

	Bedrock	Gravel	Gravelly Sand	Sum
3(a)	1%	6%	34%	41%
3(b)	1%	7%	35%	43%
4	1%	6%	35%	42%
5(a)	0%	1%	4%	5%
5(b)	0%	1%	11%	12%
5(c)	0%	1%	4%	5%
5(d)	0%	2%	4%	6%
6	0%	2%	16%	18%
7	0%	1%	4%	5%
8a	0%	0%	33%	33%
8b	0%	5%	28%	33%
9	0%	2%	17%	19%

Guild

Table 217 – Percent composition of trophic guilds associated with species with highly vulnerable EFH within each closed area

	Benthic	Ampshr	Shrfis	Sum
3(a)	42%	11%	24%	77%
3(b)	42%	11%	23%	76%
4	43%	11%	23%	77%
5(a)	26%	14%	17%	58%
5(b)	33%	14%	6%	53%
5(c)	32%	15%	9%	56%
5(d)	28%	8%	12%	48%
6	36%	14%	26%	76%
7	24%	6%	23%	53%
8a	46%	16%	2%	64%
8b	43%	19%	2%	65%
9	36%	16%	24%	76%

Assemblage

Table 218 – Percent composition of species assemblages associated with species with highly vulnerable EFH within each closed area

	Pringrd	Demersal	Sum
3(a)	22%	49%	71%
3(b)	21%	49%	70%
4	22%	49%	71%
5(a)	11%	47%	59%
5(b)	9%	47%	56%
5(c)	11%	47%	58%
5(d)	11%	45%	56%
6*	15%	49%	64%
7	10%	49%	58%
8a	15%	49%	64%
8b	17%	50%	66%
9	17%	49%	66%

8.5.3.2 Non-closed area habitat alternatives (10,11,12,and 13)

The following table summarizes the potential habitat impacts of Alternatives 10-13. The Alternatives are ranked on a scale from 2 to –2, with 2/-2 representing a serious impact (positive or negative) to habitats, 1/-1 a minimal impact and zero a neutral impact anticipated.

Table 219. Potential habitat impacts of non-area closure alternatives

	Potential Impact
Alternative 10 (Restrictions on rock chains)	0
Alternative 11 (Option 1 - 4in dredge rings everywhere)	1
Alternative 11 (Option 2 - 4in dredge rings in recently re-opened areas)	1
Alternative 12 (Habitat research funded through TAC set-aside)	N/A
Alternative 13 (Area-based management/habitat protection)	1

Alternative 10 was determined to have a neutral impact, as it was not anticipated to reduce the footprint of the scallop fishery. Alternative 11 (both incarnations) had a modest benefit to habitat through reductions in bycatch and epifaunal displacement, and in the case of Option 2, reductions in area swept by the fishery. Option 1 may result in increases in area swept, particularly within the first year of implementation, as dredge efficiency decreases and previously recruitable scallops are no longer retained. This is only expected to last approximately one year, at which point those same scallops will be recruitable and, as the average size of recruited scallops increases, area swept is projected to decrease due to the increased efficiency of 4-in. dredge rings on large scallops. Alternative 12 had no specific mechanism for evaluating or even proposing research and therefore no conclusions may be reached on potential habitat impacts. Alternative 13 is likely to reduce the area swept by the scallop fishery as the resource density in fished areas increases. Areas of potentially sensitive habitat, though not identified, will be provided with longer closed periods through which they are assumed to recover. This alternative applies only to scallop gears, and the periodic area closures will have no impact whatsoever on trawl or clam dredge fishing activities.

8.5.4 Environmental Consequences of Habitat Alternatives Under Consideration

8.5.4.1 Habitat Alternative 1

The differences between the No Action and Status Quo are described in Section 5.2. The year-round closures for both alternatives are the same because future area access through *ad hoc* framework adjustment under status quo cannot be predicted. Since the habitat metric analysis focuses on year-round closures only, the assumptions and results for No Action and Status Quo analysis are therefore identical. Under status quo, the scallop fleet may have future access to portions of the closed areas, but this access cannot be quantitatively analyzed. Therefore, it is important to note that if the scallop fleet is given access the habitat impacts will be greater in these areas.

Furthermore, it is important to note that the groundfish closures were not established to protect habitat. They were established to reduce fishing mortality rates on groundfish species regulated under the NEFMC Multi-Species FMP and prohibit the use of all gears capable of catching groundfish, either as targeted species or by-catch. Therefore, not all gears that could potentially affect benthic habitat have been excluded from these areas during the past 5-8 years (Closed Area I, Closed Area II, and the Nantucket Lightship Closed Area were established in December 1994, and the Western Gulf of Maine Closed Area in May 1998). Clam dredges and shrimp otter trawls are used in some closed areas and scallop dredge vessels have been given temporary access to portions of the Georges Bank closed areas in recent years. A variety of bottom-tending fixed gear types are used in all four areas. Even though this makes it difficult to assess to what degree benthic habitat quality in the groundfish closed areas has improved during the last 5-8 years, bottom habitats have been well protected from mobile, bottom-tending gear in the 80% of the Georges Bank closed areas that wasn't opened to scallop dredging in 1999 and 2000, and in the WGOM closed area. It's also true that a lot of the area on Georges Bank is a high-energy sand environment that is less vulnerable to the effects of trawling and dredging than deeper areas with immobile sand substrates, gravel or rocky bottom, or mud bottom (see Gear Effects Evaluation, **Section 7.2.6.2**).

Despite the fact that the quality of some benthic habitats in the four groundfish closed areas that constitute the NAA has probably improved since these closures were implemented, there is no guarantee that these areas, as currently defined, will remain in place once groundfish stocks improve. They were intended to be temporary closures. Therefore, if the Council fails to adopt any of the habitat management alternatives and defaults to the NAA, any incidental habitat benefits that have accrued within the groundfish closed areas would be reduced or lost all together, depending on how much of the existing closed area is opened up to mobile, bottom-tending gear.

Information on the abundance and distribution of sediment types, EFH area, and three biomass indices contained within the no action/status quo alternative is described in Section 8.5.2. Because the features of the groundfish closed areas have not been, and would not be protected as effectively as the features of the proposed habitat closed areas (see above), results of the metric analyses for the NoAction Alternative are shown in the tables for comparison, but should not be included in the evaluation of closed area alternatives for habitat. Therefore, the results are not discussed further in this document.

Within the Status quo alternative there is the potential to add, adjust, or remove *ad hoc* area closures to protect small scallops and harvest large ones. For example, the Hudson Canyon and Virginia Beach closures could be implemented, adjusted, or removed through supplemental framework action.

Since the future status of these areas is not defined, the potential habitat benefits that would be achieved by closing these areas cannot be analyzed. For descriptive purposes only, Table 220 characterizes the sediment types within the areas. They are composed almost entirely of sand.

Table 220. Distribution of sediment type within the two scallop closures in the Mid-Atlantic region

	Area	**Bedrock**	**Gravel**	**Gravelly Sand**	**Sand**	**Sandy Mud**	**Mud**
Hudson Canyon	*1,478*	0%	0%	0%	98.0%	2.0%	0%
Virginia Beach	*424*	0%	0%	0%	91.5%	4.8%	3.7%

8.5.4.2 Habitat Alternative 2

There may be some benefits to essential fish habitat resulting from the measures considered by the Council under Amendment 10. This alternative identifies and assesses the habitat benefits that are attributed to non-habitat-specific measures in Amendment 10 and relies on these benefits to comply with the EFH provisions of the Magnuson-Stevens Act. **Table 221** describes the impacts to habitat of Amendment 10 non-habitat alternatives, see Section 8.5.4.14 for a more detailed discussion of the habitat impacts of Alternative 2.

Table 221 Characterization and summary of potential impacts of Amendment 10 management measures on EFH.

Management Measure	**Impact**[86]	**Explanation**
Status quo overfishing definition	– w/o access + with access	Use of SQ definition will increase scallop fishing effort in open access areas, which could lead to resource depletion, reduced catch rates and increase in bottom time, but not if fleet has access to closed areas; with access, total bottom time will probably decrease because of high catch rates in closed areas.
Flexible boundary (adaptive) area rotation based on survey data	unk	Opening and closing criteria are based solely on scallop biomass and growth parameters, not habitat values. Impacts of area rotation will vary depending on the type and vulnerability of habitat types present in the area, its size, the intensity of scallop fishing prior to closure, recovery times for critical habitat features, etc. Habitat impacts will have to be evaluated on a case-by-case basis.
Controlled access to Framework 13 areas in Closed Area I and Nantucket Lightship Area in 2004 and Closed Area II in 2005-2007[87]	–	These areas were closed to groundfish gear (including scallop dredges) in 1995 and opened to scallop dredging on a limited basis in 1999 and 2000. Opening them to scallop dredging will negatively affect EFH, particularly in Closed Area I because hard bottom habitat in this area is more vulnerable to fishing than sandy bottom in other areas.[3]
Continue controlled access to Hudson Canyon Area in 2004/2005	0 (-)	On one hand, continuing controlled access in the Hudson Canyon Area will reduce bottom contact time and allow fishing effort to be more concentrated than outside the area. This may reduce EFH impacts where EFH is more complex outside of the Hudson Canyon Area. Relative to the no action alternative where the Hudson Canyon Area would open to general scallop fishing, however, this action decreases scallop fishing effort. Effort therefore would be higher elsewhere than without controlled access, potentially increasing effort where more complex EFH exists.

86 Impacts are evaluated for juvenile scallops and other federally-managed species relative to the status quo as positive (+), negative (-), none (0), or unknown (unk). Ranks in parentheses indicate impacts relative to the no action alternative, i.e., the provisions of Amendment 7 to the Scallop FMP, which was implemented in 1998.

87 Georges Bank area access alternatives will be implemented in a later management action (Framework Adjustment 16/39).

Open VA/NC Area closed area to regular scallop fishing in 2004	0 (-)	This area has been open to controlled access scallop fishing since 2001; Amendment 10 will open it to regular scallop fishing in 2004. Relative to the status quo, this change in status will have no habitat impact because scallops are not currently being harvested there. Relative to no action, the impacts, may be positive if the effort would have occurred in areas with more complex EFH.
Initial area rotation area closure in Mid-Atlantic in 2004 for three years	0	Closure will benefit EFH in this area, but benefits will be negligible due to high energy nature of the environment and because effort will be displaced into other areas[88]
Area-specific DAS allocations	unk	Effects may be both positive or negative, depending on the area. Positive impacts occur when the result is to reduce fishing effort by lower bottom contact time, while negative impacts may occur from access in areas with more sensitive habitat.
Exchange of DAS and trips between vessels	0	No predictable effect on EFH.
Broken trip DAS and trip adjustments	+	Could reduce effort in controlled access areas. Under a broken trip adjustment, vessels will actually loose some controlled access DAS allocations as part of the penalty. They would not be able to finish the trip, unless they had sufficient days remaining.
Four inch rings and 10 inch twine tops	+	Four inch rings will slightly increase dredge efficiency for larger scallops, thus reducing bottom contact time in recently-opened areas where large scallops are abundant, but will reduce catch rates and increase bottom time in areas where medium-small sized scallops are prevalent. Ten-inch twine tops will reduce by-catch, but have no direct habitat effects.
Reduced possession limit for limited access vessels fishing outside of scallop DAS	+	Vessels with limited access permits are currently allowed to possess and land up to 400 lbs per trip of shucked scallop meats when not required to use allocated DAS; this measure will reduce possession limit to 40 lbs/trip) and reduce fishing effort by vessels that have been targeting scallops under the higher general category possession limit. Scallops harvested under this provision cannot be sold.
Access for general category vessels to controlled access areas	0	General category vessels will be allowed to fish in controlled access areas, subject to a 400 lbs/trip possession limit. Previously, the limit was 100 lbs. for the Hudson Canyon and VA/NC Areas and zero for the Georges Bank area access programs in past framework actions. This measure will increase fishing effort in certain areas that are accessible to general category vessels, but the incremental effect on EFH will probably be negligible given much higher effort by limited access vessels.
Framework measures for controlled access	0	Do not include adjustable habitat management measures.
2% set-aside from TAC and/or DAS allocations to fund research and surveys	+	Could indirectly benefit habitat when habitat research is funded and provides better information for future management decisions
Mandatory observer coverage on a suitable number of trips	0	Objective is to monitor by-catch and capture of protected resources, not assess or monitor habitat effects that would be difficult to do without special expensive equipment.
Bi-annual framework mechanism for setting DAS allocations and making other management adjustments	0	No habitat effects; Council can take action under a framework action to protect EFH.

88 There is no analysis of habitat attributes in the EIS to support a quantitative evaluation of the habitat impacts of this management measure.

8.5.4.3 Habitat Alternative 3

Alternative 3 was intended to protect complex hard-bottom and other sensitive and complex habitats. This alternative was approved by the Council with two versions of the Western Gulf of Maine closed area. Therefore this alternative contains two closed area scenarios: 1) Alternative 3(a) with a larger extension of the WGOM to the west, and 2) Alternative 3(b) which has a smaller extension of the WGOM closure to the west (See Map 16 and Map 17). The extensions of the western boundary of the WGOM Closed Area is the predominate difference between these two alternatives. These extensions were explicitly designed by the EFH Tech team in 1999 to capture additional seafloor habitats inside the closed area. Alternative 3(b) includes two angular extensions from the western boundary to encompass additional gravel habitat on Stellwagen Bank as well as piled boulder features on Tillies Bank to the North. Alternative 3(a) extends the entire southwestern boundary of the closed area to include the aforementioned features as well as the deep mud basins east, west and north of Tillies Bank. These alternatives originate from an analysis of the USGS multibeam map of the area (using ROVs, occupied submersibles, and video bottom cameras), as well as the accumulated field experience of the Tech Team members.

Alternative 3(a) is slightly larger than Alternative 3(b) and both closed area options are intermediate in size compared to the other closed area alternatives (Table 200). The sediment compositions of the two alternatives are essentially the same. Relative to the total amount of each sediment type in the NAAA, this alternative – like alternative 4 – would close a higher percentage of bedrock, gravel, and gravelly sand than the other proposed habitat closures, but not much sand or mud (**Table 201**). **Table 203** shows that the percent of total vulnerable EFH in Alternatives 3a and 3b score slightly lower than most of the other alternatives (6.1% and 5.9%). Because the footprints of these two alternatives are so similar, the percentages of EFH area inside them are also very similar for virtually all species analyzed. Species and life stages with vulnerable EFH with high amounts of EFH (over 10 percent), in this area are: cod (A, J), haddock (A,J), halibut (A,J), pollock (A), and smooth skate (A) (**Table 203**). After scaling for area, the EFH values do not rank very high for Alternatives 3a and 3b (Table 211). However, they do rank higher than the larger alternatives, Alternatives 6, 7, and 9. However, for New England species with highly vulnerable EFH, Alternatives 3a and 3b rank higher than most of the other alternatives (Table 214).

Considering that Alternatives 3a and 3b are smaller than Alternative 6 and 9, 3a and 3b contain a high percentage of total benthivore guild biomass, and principle groundfish (Table 204 and **Table 206**). Alternatives 3a and 3b also scored high for redfish biomass (still lower than Alternatives 6, 7 and 9).

8.5.4.4 Habitat Alternative 4

Alternative 4 identifies habitat subsets contained within a proposed (but rejected) groundfish rebuilding closed area option in Amendment 13 (Rebuilding Alternative 1). This alternative was included in Amendment 10 primarily to remain consistent with habitat alternatives proposed in Amendment 13. Much of the habitat closed area specified in Alternative 3 would be included in this alternative. However, this alternative excludes an area between Closed Area I and the Nantucket Lightship Closed Area that was recommended by the Habitat Technical Team for habitat protection purposes (Map 18). Also, an area in the northern Gulf of Maine (Jeffreys Bank) and areas west of the existing Western Gulf of Maine Closed Area that are included in Alternative 3 are not included in Alternative 4. The proposed Cashes Ledge Closed Area is also shaped a little differently.

The total area included in Habitat Alternative 4 comprises 2,241 nm² slightly less that alternatives 3a and b (Table 200). In fact, the only habitat closure that would close less area is the Georges Bank

HAPC Alternative 8. Relative to the total amount of each sediment type in the NAAA, this alternative – like alternative 3 – would close a higher percentage of bedrock, gravel, and gravelly sand than the other proposed habitat closures, but not much sand or mud (**Table 201**). Because the total area that would be closed is fairly small, the total EFH value of this alternative is lower than the other habitat alternatives (**Table 203**). But after the EFH data are scaled for differences in area, this alternative ranks high in terms of EFH value for the species and life stages identified as having EFH vulnerable to bottom tending gear (Table 211). Species and life stages with vulnerable EFH with high amounts of EFH (over 10 percent), in this area are: cod (A, J), haddock (A,J), halibut (A,J), pollock (A), and smooth skate (A) (**Table 203**). For New England species with highly vulnerable EFH, Alternative 4 ranks higher than all the other alternatives except for Alternative 8a (Table 214). Therefore, this alternative is very effective for protecting EFH for species in New England that have EFH highly vulnerable to bottom tending gear, as compared to the other closed area alterantives.

The distribution of biomass among trophic guilds in Alternative 4 is very similar to Alternatives 3a and 4, i.e., >40% benthivores and about 20% shrimp and fish-eating fish and planktivores (Table 204). Alternative 4 contains a slightly lower percentage of total benthivore and shrimp and fish-eaters biomass in the NAAA than Alternatives 3a/b (Table 204). The biomass values and percentages for the other three trophic guilds were fairly low in Alternatives 3a/b and 4 compared to the other alternatives.

The composition of the five species assemblages in Alternative 4 is also very similar to what it is in Alternatives 3a and b. The demersal finfish assemblage accounts for almost 50% of the total assemblage biomass in Alternative 4, with principal groundfish and elasmobranchs each making up >20% (Table 206). As is the case in Alternatives 3a and 3b, redfish accounted for >50% of the total individual species biomass in Alternative 4, and longhorn sculpins for >20% (Table 209). The percentage of total redfish biomass in Alternative 4 (and 3a/b) is higher than in most of the alternatives, but lower than 6, 7, and 9 (Table 208).

Alternatives 3a and 3b and 4 rank high in terms of all the environmental characteristics that are associated with the 15 species and life stages with EFH that were determined to be highly (H) vulnerable to the adverse effects of mobile, bottom-tending fishing gear (see Section 7.2.6.2.5). This conclusion is based on the high rankings for hard bottom and coarse sediments (Table 216), the benthivore, amphipod-eating, and shrimp and fish-eating trophic guilds (Table 217), and the principal groundfish and demersal finfish species assemblages (Table 218).

8.5.4.5 Habitat Alternative 5

Alternative 5A: EFH/Productivity tradeoffs using the original working group species EFH weights with equal emphasis given to scallop productivity and the combined weighted productivity of 37 other managed species (Appendix IV).

Alternative 5B: Total EFH value only, using revised species EFH weights (omitting relative importance to the fishery as a factor), with no productivity tradeoff.

Alternative 5C. EFH/Productivity tradeoffs using the revised species EFH weights with equal emphasis given to scallop productivity and the combined weighted productivity of the other 37 managed species.

Alternative 5D. EFH/Productivity tradeoffs using the revised species EFH weights and productivity for each of the 37 managed species, considered individually.

A distinguishing characteristic of the proposed habitat closed areas in Alternative 5 is the fact that they are empirically derived from 30 years of trawl survey data for a large number of species (37) throughout the Northwest Atlantic Analysis Area (see Appendix IV). Each alternative proposes to close five areas of similar size, one in each of five "eco-regions" (see Appendix IV). The total area that would be closed is very similar, ranging from 3,022 to 3,098 nmi². Because these four closure options were developed without any reference to existing closed areas, only a small fraction of these proposed closed areas overlap with the existing groundfish closed areas. All four alternatives include a closed area in the Mid-Atlantic Bight: all of the other habitat closed area alternatives (except 7) are restricted to Georges Bank and the Gulf of Maine.

The sediment compositions of the four alternatives vary to some extent, although none of them include very much coarse sediment. The predominant sediment types in all four options are sand and mud (Table 202). Alternative 5(b) would close two areas in southern New England and the Mid-Atlantic and contains more gravelly sand and sand while Alternatives 5(c) and 5(d) contain slightly more gravel than Alternatives 5(a) and 5(b).

The total (unscaled) EFH values of these four alternatives range from 5.4% to 6.7% (Table 203). Species and life stages with vulnerable EFH with high amounts of EFH (over 10 percent), in this area are: cod (A, J), haddock (A,J), halibut (A,J), pollock (A), and smooth skate (A) (Table 203). Alternatives 5a-d do not contain as much EFH area for these species as most of the other alternatives under consideration. Total EFH values for Alternatives 5a,b, and 5c are higher than for Alternatives 3 and 4 (5.9 – 6.1%). After scaling for area, the EFH value of 5c is slightly higher than 5a, 5b, and 5d ranks lower than all the alternatives, except for Alternative 7(Table 211). The results are very similar for the H vulnerable species/life stages (Table 211). For species with highly vulnerable EFH in New England only, total scaled EFH values rank fairly high in Alternatives 5a, 5b, and 5c, but lower in 5d (Table 214). For overfished species with highly vulnerable EFH, all the Alternative 5 options rank higher than the other alternatives, especially 5(c).

The dominant trophic guilds in the four Alternative 5 options are benthivores and planktivores (Table 205). Planktivore biomass in these four alternatives is higher than in the other closed area options. Shrimp and fish-eater biomass is very low. Relative to the total biomass of each trophic guild in the NAAA analysis area, the Alternative 5 options contain higher percentages of planktivore biomass than most of the other alternatives (Table 204). Percent-of-total biomass values are also relatively high for amphipod-eaters in 5a-c and for piscivores in 5b.

Elasmobranchs and demersal finfish species account for most of the species assemblage biomass in the four Alternative 5 closed area options (Table 207). Principal groundfish species only make up 9-11% of the total assemblage biomass (compared to 21-22% in Alternatives 3). Pelagic species are more abundant in the Alternative 5 area closures.

Of the six individual benthic species that were analyzed, redfish, ocean pout, and longhorn sculpins account for most of the total biomass in Alternative 5(a), sculpins in 5(b), sculpins, and ocean pout in 5(c), and redfish and ocean pout in 5(d) (Table 209). Lobsters were more abundant in 5b and c than in any of the other alternatives, except for 8a and 8b. Relative to total biomass of each species in the NAAA analysis area, the biomass of sculpins in 5b and 5c is higher than in any of the other alternatives, after alternatives 7 and 9.

None of the Alternative 5 closed area options rank as high as the other habitat closed area alternatives in terms of the environmental characteristics that are associated with the 15 species and life stages that have EFH highly (H) vulnerable to the adverse effects of mobile, bottom-tending fishing gear (See Gear Effects Evaluation and Adverse Impacts Determination Sections). Alternative 5(b) ranks higher for sediments and slightly less than 5(a) for guilds and assemblages (**Table 216 - Table 218**). Assemblage scores for all four Alternative 5 options were very similar.

8.5.4.6 Habitat Alternative 6

This alternative is consistent with the controlled area access program under Framework 13 to the Scallop FMP. Since these areas have already been identified as bottom where scallop gear was permitted under Framework 13 to the Scallop FMP the impacts to habitat have already been analyzed and considered non-significant. However, since the analysis of Framework 13 was completed, habitat studies have been conducted in these access areas and preliminary results show that these areas contain more complex habitat than originally thought. By including these areas as a management alternative, the Council will be able to integrate scallop and groundfish management more effectively. However, these areas were not originally identified as areas with high habitat importance, thus they may minimize the habitat effects of fishing as effectively as other habitat closure alternatives.

This alternative is larger (4,041 nm²) than any of the other habitat alternatives except #7 and #9 (Table 200). Alternative 6 is defined to be the portion of the three groundfish closures (five discrete areas) on Georges Bank that have remained closed to scallop dredging since December 1994. However, these closures would be temporary, only lasting as long as they remain in place as groundfish closures. Over 60% of this area is sand. Even though only 2.3% of this area is made up of gravel, 17% of all the gravel in the Northwest Atlantic Analysis Area is contained within this alternative (**Table 201**). However, since this proposed closed area is fairly large and contains so much sand, the proportion of coarse sediment in this area is less than in alternatives 3, 4, or 9 (**Table 202**). According to **Table 203**, the percent of total vulnerable EFH in this alternative ranks high compared to the other alternatives. The sum of vulnerable EFH area inside Alterantive 6 is 7.9% of the total; only Alternatives 7 and 9 rank higher. When the total EFH value for vulnerable species is scaled for area, this Alternative ranks lower, *i.e.*, less than alternatives 3, 4, 8, and 5a-c, much higher than alternative 7, and about the same as alternatives 5d and 9 (Table 211). According to Table 214, this alternative is not as effective at protecting EFH for New England species with EFH highly vulnerable to bottom tending gear.

The amphipod-eaters guild is well represented in the proposed Alternative 6 closed area (Table 204). The percent-of-total biomass values for the piscivore and shrimp/fish eater's biomass is slightly higher than in any of the other alternatives, and benthivore biomass is high in Alternative 6 (Table 204).

Elasmobranchs and demersal finfish species account for most of the species assemblage biomass in Alternative 6 (Table 207). Principal groundfish species make up 15% of the total assemblage biomass (compared to 21-22% in Alternatives 3 and 4) and pelagic species are not abundant. Again, due to its large size, this alternative accounts for the highest percent-of-total biomass values for the elasmobranchs, principal groundfish, and demersal finfish species (**Table 206**).

Of the six individual benthic species that were analyzed, redfish account for 66% of the total biomass in Alternative 6 (Table 209). Relative to the total biomass of each species in the Northwest Atlantic analysis area, the biomass values for redfish, longhorn sculpins, and sea ravens are fairly high (Table 208).

The Alternative 6 closed area option ranks below Alternatives 3, 4 and 8 in terms of the substrates that are associated with the 15 species and life stages with EFH that are highly (H) vulnerable to the adverse effects of mobile, bottom-tending fishing gear (**Table 216**). This alternative ranks fairly high for trophic guilds (**Table 217**), and an intermediate rank for species assemblages (**Table 218**).

This alternative ranks high for biomass of the three bottom-feeding trophic guilds and low for planktivores and piscivores (Table 217). This alternative also ranks high for three of the five species assemblages – elasmobranchs, principal groundfish, and demersal finfish (Table 218). The only one of the six benthic species that were analyzed separately that scores high is redfish (Table 209).

8.5.4.7 Habitat Alternative 7

Potential habitat closures were identified from the 1) the prevalence of EFH designations, and 2) areas with low scallop productivity. This alternative specifically states where scallop fishing can and cannot occur. Scallop fishing would be prohibited in areas with low scallop productivity and high EFH importance as defined by the same model that was used to generate closed area alternatives 5a-d. Other types of fishing would be allowed to continue in these areas.

Alternative 7 is very large and would close 65,503 nmi² or 78% of the total Northwest Atlantic Analysis Area (Map 24). Most of the sediment in Alternative 7 is sand and mud (Table 201). Because this area is so large, the percentage of EFH area for all 23 vulnerable species that it contains is very high (Table 203), but the total scaled EFH value is very low (Table 211). Because this is the only alternative that would close deep water habitats along the edge of the continental shelf, it is also the only proposed closure that includes EFH for tilefish and rosette skates – two deep-water species. This alternative ranks last in all the scaled for area EFH values (Table 211 and Table 214). Alternative 7 ranks last in the percent composition of sediment types associated with highly vulnerable EFH (Table 216). It is lower that most of the other alternatives for the guild and assemblage values associated with species with highly vulnerable EFH as well (Table 217 and Table 218).

8.5.4.8 Habitat Alternative 8

Alternative 8(a) - Current Cod HAPC on George's Bank

The Cod HAPC on Georges Bank (Map 25) would be closed to all gear capable of catching scallops that are identified through the Scallop FMP that are determined to adversely affect scallop EFH, or EFH for other federally-managed species in the Northeast region. This area is deemed critical to the sustainability of the Georges Bank cod stock. Significant portions of the area contain gravel pavement and cobble bottom, believed to be the most sensitive to the effects of scallop dredging and bottom trawling because it provides structured, three-dimensional habitat for juvenile cod. The Cod HAPC is inside groundfish Closed Area II and was established in 1997.

This area is very small (only 186 nmi^2). It is composed entirely of sand and gravelly sand (**Table 202**) and contains small amounts of EFH area for cod, halibut, scallops, haddock, ocean pout, red hake, redfish, four species of skates, and winter flounder (**Table 203**). The total scaled EFH area value for species with moderately and higly vulnerable EFH is relateively high for this alternative (Table 211). Alterantive 8a does the most effective job of protecting New England managed species with highly vulnerable EFH (Table 214).

Alternative 8(b) -Cod HAPC plus additional area west and inside of CAII

This alternative would create a habitat closed area that includes the existing HAPC on Georges Bank and an area west of the current western boundary of Closed Area II and area within CAII that is contiguous to the HAPC, in all an additional 546 nmi^2 that is not included in alternative 8a (Map 26).

The total area that would be closed is 732 nmi^2 and is the same area that is included as part of habitat closed area alternatives 3 and 4. This alternative would NOT expand the existing HAPC designation. The area is composed primarily of sand and gravelly sand (Table 202) and contains EFH area for the same species that are designated in 8a, plus silver and white hake (Table 203). The scaled EFH values for most of these species are high, but the total scaled EFH value for this alternative is quite a bit lower than for alternative 8a (Table 211). Relative to its size, alternative 8b scores high for planktivore biomass, but not for any of the other guilds (Table 204). The two pelagic species assemblages score high in 8b, but not any of the benthic finfish species groups (Table 206). Ocean pout and jonah crabs also are abundant in this area (Table 208). A significant portion of alternative 8b is comprised of gravelly sand (Table 216).

8.5.4.9 Habitat Alternative 9

The existing year round groundfish closed areas (per the CLF vs. Daley settlement agreement) on Georges Bank and in the Gulf of Maine would continue to be closed to fishing gear that is capable of catching scallops and gear that adversely impacts scallop EFH or EFH of other species. These areas include Closed Area I, Closed Area II, the Western Gulf of Maine Closed Area, the Nantucket Lightship Closed Area and the new Cashes Ledge Closed Area (Map 27). There are three important differences between this alternative and the No Action alternative: 1) the inclusion of the Cashes Ledge closure on a year round basis, and 2) the additional habitat protection that would result from the exclusion of bottom-tending gears that are known to disturb benthic habitats, *i.e.*, gears like shrimp trawls and clam dredges that are currently allowed access to the groundfish closed areas, and 3) the fact that areas that are currently closed to reduce groundfish mortality rates are subject to modification as depleted groundfish stocks recover, but habitat closures would not be**.**

This alternative would close approximately 6,254 nmi^2 of ocean bottom, slightly more than is included within the No Action alternative (Table 200). This proposed closure is composed of almost 80% sand and gravelly sand (**Table 202**). A significant proportion (10-25%) of gravelly sand, gravel, and bedrock in the Northwest Atlantic analysis area is contained within the five areas that make up this alternative (**Table 202**).

Species and life stages with vulnerable EFH with high amounts of EFH (over 10 percent), in this area are: cod (A, J), haddock (A,J), halibut (A,J), pollock (A), and smooth skate (A) (**Table 203**). Alternative 9 contains a significant portion of these species EFH as compared to the other alternatives. Total EFH values for Alternative 9 is ranked the highest (12.1%) after Alternative 7. After scaling for area, alternative 9 has a moderately high total EFH value – about the same as alternatives 6 and 5d (Table 211).

Alternative 9, like alternative 6, contains a high biomass value of all three benthic-feeding trophic guilds and a low biomass value of pelagic-feeding species (Table 204). Alternatives 6 and 9 are also similar with regard to the biomass of the five species groups. Alternative 9 scores high for principal groundfish and demersal species, moderate for elasmobranchs, and low for pelagic species (**Table 206**). Sculpins, sea ravens, and redfish were also fairly abundant in this area (Table 208).

8.5.4.10 Habitat Alternative 10

This alternative proposes to limit the amount, and possibly the configuration, of rock chains for limited access and general category scallop vessels. The intention is that such restrictions will prevent scallop vessels from operating in certain high-relief bottom areas where dredges are likely to pick up large rocks.

It is not clear if this will actually be the case. The prohibition of rock chains will not, per se, make rocky bottom areas un-suitable for scallop dredging. Rather, the addition of rock chains decreases to some extent the amount of damage to scallop gear caused by contact with boulders, rocks or other high-relief bottom. Rock chains may also reduce the habitat impact of scallop dredges in these areas by reducing the displacement of rocks and boulders. Damage to bottom habitats caused by dredges without rock chains may be greater than it would otherwise have been.

This alternative will not likely have a positive impact on the habitat of the region. The presence/absence of rock chains (or alterations in their configuration) is not likely to have the intended effect of reducing the amount of bottom that is dredged.

8.5.4.11 Habitat Alternative 11

Option 1: Scallop dredge ring size would be required to be 4-inches everywhere

The impacts of increasing dredge ring size to 4 inches are twofold. First, it has been observed that the bycatch of benthic organisms such as finfish, sponges, crabs, and starfish is reduced in dredges with larger rings. Reduced damage and mortality of bottom dwelling species that are returned to the bottom instead of being crushed in the dredge and brought to the surface enhances biodiversity and reduces the impact of dredging on benthic communities. The magnitude of this bycatch reduction has not been studied and cannot be quantified at this time.

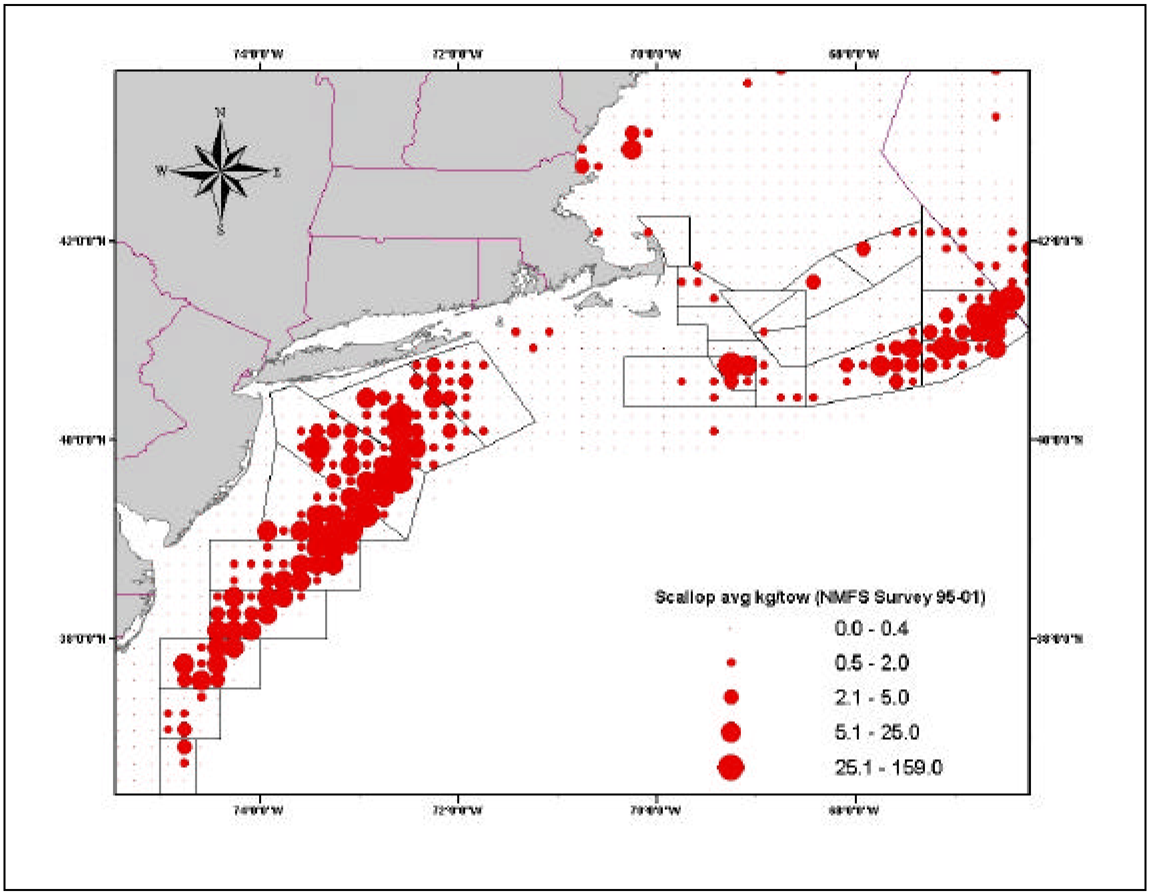
The second impact of increasing dredge ring size to 4 inches is the effect this will have on fishing patterns in general and swept area in particular. 4-inch dredge rings appear to be more efficient harvesters of larger (110+ mm) scallops, on the order of 4 to 5%. Long-term projections (fishing at a constant mortality rate of F = 0.2) translate this improved efficiency into a roughly 15% decrease in swept area (Table 222).

Table 222. Long-term projections of scalloping impacts, 3.5 inch vs. 4 inch dredge rings.

Strategy	Rings	Bms-mean	Ctch-mean	LPUE	DAS	ArSwpt
Non-rotational options	inches	g/tow	MT	lbs/d		nm^2
F=0.2	3.5	13732	14945	2314	14559	2334
F=0.2	4	14237	15561	2397	14267	1996

These are long-term projections. Initially, the 4 inch dredge ring will lead to an unquantified increase in swept area as scallop vessels attempt to compensate for reduced catches of small (90-95 mm) scallops which will escape through the larger rings. The short-term effect is expected to last for one year, the time it takes for scallops of this size to grow large enough to be retained by the dredge. As the average size of scallops throughout the range of the fishery increases, the area swept will decrease. However, depending on management options selected for implementation in Amendment 10, the potential exists that scallop vessels will continue to fish, albeit with reduced efficiency, on beds of smaller scallops. This will lead to an overall increase in swept area and bottom contact time for the fishery. It is not possible to quantify the magnitude of this effect. It will likely be most prominently felt in areas where the density of scallops is lower, and where abundances of smaller scallops occur.

Map 56. Scallop abundance (1995-2001 averaged).



Option 2: Scallop dredge ring size would be required to be 4 inches in a "re-opened" status, including groundfish closed areas if an access program is active

This alternative is highly likely to mitigate any of the potential short-term adverse impacts to habitat associated with an increase in ring size because areas would be re-opened after most of the scallops had grown to larger sizes. The benefits of both the reduction in bycatch and swept area are likely to be felt, without the potential negative impacts associated with fishing on smaller scallops with the larger dredge rings.

8.5.4.12 Habitat Alternative 12

This alternative would directly benefit the habitats of the region. There are large gaps in the understanding of fishery impacts on EFH, and much research is needed. Valuable research that is currently being conducted would also likely benefit from additional funding. This alternative does not quantify the funds available, nor does it provide a mechanism to ensure that available funds are allocated in a manner consistent with the recommendations of the Habitat Technical Team or the Council.

8.5.4.13 Habitat Alternative 13

There are two Alternatives to Improve Scallop Yield which utilize habitat benefits as a criteria for determining the closed, recently re-opened or open status for the RMA's (Alternative 5.2.1.5 – Adaptive closures and re-openings, with fixed boundaries and mortality targets or frequency of access that vary by area; and, Alternative 5.2.1.7 – Area-based management with area-specific fishing mortality targets without formal area rotation). These alternatives propose to include habitat concerns (HAPC areas, areas of "above average sensitivity") as criteria for defining area closure and/or limiting scalloping effort in certain areas based on similar concerns.

Specific areas of "above average sensitivity" are not defined, nor are areas in which reduced area-specific mortality targets would be recommended. The concept of including habitat concerns such as anticipated bottom recovery time for the areas in question is clearly of some benefit to habitat, but this benefit is reduced by the fact that these area closures apply only to scallop gears and not to all gears deemed to adversely affect scallop EFH. Furthermore, no specific procedures for incorporating habitat protection objectives into either of these area rotation alternatives have been proposed, so no analysis of their environmental consequences can be made.

8.5.4.14 Impacts on scallop management and bycatch.

8.5.4.14.1 Effects on future scallop management and potential yield

8.5.4.14.1.1 Movement and other assumptions

Unlike finfish and other mobile living marine resources, management closures tend to have higher costs associated with the Atlantic sea scallop fishery because the adult scallops in the closures do not directly contribute to yield and may not improve productivity through spawning activity when the scallop populations are at the plan's biomass target. Because of these life history characteristics, large area closures to improve habitat quality appear to have fewer benefits for scallop productivity than may occur for other species. Although scallop movements tend to be localized and random, small area closures on the scale of observed scallop movement would be less costly than larger areas.

The scallops that occur in the proposed areas would furthermore become unavailable for harvest, perhaps for the remaining life of the scallop, with little benefit to future spawning success. Also, unlike many other species of marine life, there is no passive fishing technology (e.g. hook and line, longline, traps, gill net) that is capable of catching scallops in areas that might be closed to bottom-tending, mobile fishing gear. Other species, for comparison, grow while residing in a closed area and later swim to areas where they can be caught at a larger size. Depleted stocks of some finfish with moderate or strong stock-recruitment relationships may also benefit from the closure, especially when the species forms seasonal spawning aggregations.

Although scallops 'swim' in response to predation (Baird 1954) and commercial dredging (Caddy 1972), larger scallops (> 110 mm, 5-6 years old) tend to be more sedentary than young pre-recruit scallops (Baird 1954, Dickie 1953, Naidu 1970, Schick 1979). Even though the movements are often localized and random, scallop movement may cause scallops to migrate over time out of areas that have a high perimeter to area ratio. Sometimes these movements can be oriented along the axis of the primary current, like ones that occur around Georges Bank. Posgay (1981) reported that 80 percent of tagged scallops moved less than 3 km when recaptured, while 97 percent had traveled less than 16 km. A few individuals were recaptured more than 48 km from their release locations in two or more years at large. Melvin et al. (1985) reported down current movements of sea scallops along the clockwise gyre around Georges Bank, but 85 percent of the tagged scallops moved less than 15 km. Several recaptured scallops moved more than 50 km. Although individual scallop movement appeared to be random and each swimming movement of adult, large scallops covered short distances, Posgay (1981) and Melvin et al. (1985) thought that the longer migration distances they observed were related to the prevailing direction and strong currents that are uniquely characteristic of their study areas.

In contrast with Posgay (1981) and Melvin *et al.* (1985) , who observed the migration of tagged scallops on Georges Bank over several kilometers, Stokesbury and Himmelman (1996) found tagged scallop movement to be very limited with random orientation. Over a 10 to 51 day period of observations, scallops from 40 – 115 mm shell height moved a mean distance of about a meter at seven out of nine stations in Port Daniel Bay (Gulf of St. Lawrence, CA). Movement seemed to be unrelated to substrate (based on both laboratory experiments and field observations) or scallop density and weakly correlated with only the rock crab, *Cancer irroratus,* even though other predators (Homarus americanus and asteroids) were abundant. At one of the nine stations, mean scallop movement was over 10 m. Scallop movement was slightly greater at two stations characterized by sand substrate, low scallop density, and high *C. irroratus* abundance.

Although conducted in a different area (Port Daniel Bay, Gulf of St. Lawrence, CA), at lower temperatures (5.9 to 9º C), with depths ranging from 16 to 23 m and currents ranging from 6.3 to 10.2 cm/s, Stokesbury and Himmelman (1996) corroborate the generalization that scallop movement is limited and generally random. This experiment was conducted near shore with a general southwestward current. In contrast, the tagged scallop movements observed by Posgay (1981) and Melvin *et al.* (1985) were observed on Georges Bank, where there is a prevailing counterclockwise circulation pattern around Georges Bank.

It appears that sea scallops do not exhibit sustained migratory swimming of even short distances, but scallops probably swim in response to the presence of certain predators (Manuel and Dadswell 1991, Peterson et al. 1982, Barbeau and Scheibling 1994) and other tactile stimulation. Caddy (1968) found that swimming in larger scallops consisted of a rapid ascent at a 30-50º angle for two to three meters, followed by a passive descent. Stokesbury and Himmelman (1996) noted the weak correlation of scallop movement with predator abundance and the presence of re-suspended sand at two stations with the largest observed movements.

If movement is related to suspended sediments settling on scallops, causing a swimming response to the tactile stimulation, it is possible that scallops could randomly move away from areas with sand substrate and move less frequently from areas with gravel or cobble substrates. If true and the habitat closures favor bottom substrates with cobble and gravel bottom, then adult scallop movement away from habitat closure areas is less likely. It would therefore reduce the potential for even smaller habitat closure areas to serve as a source for larger scallops to gradually become available to the scallop fishery. Except in areas with strong currents having a persistent direction, there is a compelling argument that scallop productivity in permanent closure areas would be lost to the fishery, except possibly when scallop abundance is very low and year class strength suffers from insufficient spawning activity.

Relative to other species, sea scallops are highly fecund, producing 1 to 270 million eggs per individual over its lifespan (Langton et al. 1987). By age 4, a female scallop releases about two million eggs. More important to the effects of habitat closures that overlap the scallop resource, the influence of spawning stock biomass to future recruitment success is weak or non-existent. Strong Georges Bank scallop year classes in 1957, 1972, 1977, 1982, and 1989 have contributed to landings of adult scallops, but this year class variability has not been correlated with spawning stock biomass (Naidu 1991). Although recent recruitment has been above average (with a strong year class of Georges Bank scallops in 1996 and 1998) while the groundfish area closures existed, these events may be environmentally driven but have not been studied in detail (Clark and O'Boyle 2001). Preliminary analysis of recruitment effects, NMFS (2001) found little evidence that the Georges Bank closed areas enhanced recruitment within the closed areas, although the high spawning biomass in the closures may have contributed to recruitment success elsewhere. SARC 32 (NMFS 2001b) concluded that, "More years of data, and combination of the U.S. and Canadian Georges Bank data re required to reach definitive conclusions about a stock-recruitment relationship on Georges Bank" [scallops].

Given these considerations and the FMPs target biomass, it seems unlikely that long-term, indefinite habitat closures would be beneficial to scallop recruitment and productivity. The effect of the proposed habitat and groundfish closures on scallop predation is unknown, but closures could increase the biomass of predators (crabs, starfish, yellowtail flounder and American plaice). The practicality of habitat closures is of course the combination of the derived benefits and the accumulated costs. In terms of costs to scallop management, however, it may be more practical to conserve habitat by minimizing and distributing the total amount of bottom contact, while seeking ways to harvest scallops using gear with fewer habitat impacts. The following sections estimate and compare the relative costs to scallop management (i.e. changes in long-term yield), the short term effects and practicality with regard to rotational management, to vessel and permit classes, and to communities that depend on scallop fishing activity and landings.

8.5.4.14.1.2 Long-term, steady state effects on scallop management and yield

The effect of the proposed habitat closures on long-term potential yield and rotation management area can be estimated from the distribution of recruitment in the survey time series. The proportion of recruits by ten-minute square, compared to the average recruitment estimates by rotation management area, was multiplied by the rotation management area long-term potential yield and summed over the proportion of a ten-minute square within the boundaries of the proposed habitat closures. These data, summed over the Georges Bank and Mid-Atlantic shelf and compared with the total long-term potential yield without habitat closures (base run having a 30% biomass closure criteria, a 25% biomass closure maximum, and a 3 year closure duration) estimates the potential reduction in average yield from the resource. Since no scallop displacement or enhanced recruitment is assumed, the total amount of fishing effort (days-at-sea) would have similar reductions.

Even over the long term (presumably when the existing high scallop biomass in the groundfish areas are fished), the alternatives (Alternative 1 and GF Mort1) that would include much of the existing area closures would have the highest impact to the scallop yield (29 and 18 percent, respectively), increasing cost and reducing practicality. This is followed by Alternative 7 (15%), because it would close the greatest amount of area to scallop fishing (over 65,000 nm2). The next most costly choice is Alternative 5b (13%) because one of the blocks includes a very productive scallop area near Hudson Canyon. Less costly, would be Alternatives 3a (7%), and 5a, 5c, and 5d (< 1%). The latter three alternatives have low effects on long-term scallop yield because fishery productivity was included as a factor in determining potential habitat closure areas. Finally, Alternatives 8a and 8b would also have relatively low cost (higher practicality) because of their small size, even though they include parts of the Northern Edge which typically has high scallop catch rates.

Table 223. Proportion of total productivity effected by various habitat alternatives, assuming no displacement. Scallop productivity estimated from recruitment distributions and long-term potential yield estimates; groundfish and monkfish productivity estimated from adult abundance distributions over the survey time series.

Habitat label	Analytic method	Total EFH designations included	EFH Density (designations/nm^2)	Number of ten-minute squares	Area (nm^2)	Proportion of total productivity		
						Groundfish	Scallop	Monkfish
Alternative 5c	EFH/Productivity Tradeoff No relative fishery value	959	0.317	41	3,020.6	5.5%	0.4%	6.7%
Alternative 5a	EFH/Productivity Tradeoff Groundfish & Scallop	905	0.299	41	3,030.8	5.3%	0.4%	7.6%
Alternative 3a	Ad hoc - Adjacent complex habitats	701	0.267	71	2,622.9	4.2%	6.7%	2.7%
Alternative 5b	Aggregate EFH value only	814	0.265	41	3,073.4	5.5%	13.0%	5.9%
Alternative 5d	EFH/Productivity Tradeoff Combined Productivity	768	0.249	41	3,087.9	4.0%	0.4%	5.5%
Alternative 1	Ad hoc - Status quo groundfish areas	1,344	0.230	98	5,835.9	8.3%	29.0%	6.0%
Alternative 8b	Ad hoc - Alternative groundfish HAPC	167	0.229	14	730.8	0.8%	3.0%	0.2%
Alternative 8a	Ad hoc - Cod HAPC only	42	0.226	3	186.2	0.1%	1.6%	0.1%
GF Mort1	Ad hoc - Revised groundfish closures	1,154	0.225	98	5,123.7	6.9%	18.7%	4.1%
Alternative 7	Model EFH & low scallop productivity	9,528	0.146	880	65,465.2	78.4%	15.0%	88.6%

If site- and size-specific diffusion coefficients and directional movement estimates were available, it would be possible to decrement the above estimates to estimate the effects of closure location and size on scallop yield. Such estimates would need to account for natural mortality and growth while scallops remain in an area closure, distance from the closure boundary, fine scale fishing effort distributions and dredge efficiency, and seasonal factors. These estimates are beyond the scope of the analysis, however, because site- and size-specific movements have not been measured.

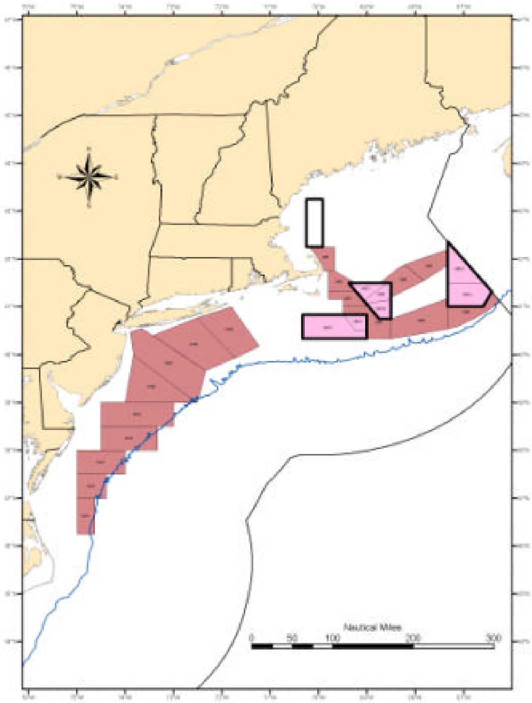
8.5.4.14.1.3 Short-term effects on rotation area management and Georges Bank closed area access alternatives

Short term effects differ from those above, mainly due to the interactions between the proposed habitat closures and Georges Bank area access alternatives. The projected landings and allowable day-at-sea use were reduced by the estimated fraction of scallop biomass within a proposed habitat closure, compared to the amount of scallop biomass in each rotation area that would remain open. Estimates of the fraction of current biomass that would remain available to the fishery (Table 224) were applied to the rotation management area annual projections from 2004 to 2011.

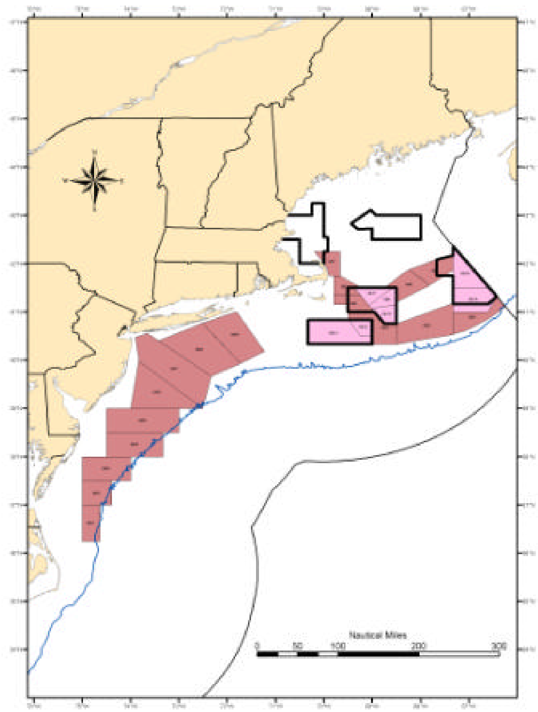
Table 224. Approximate proportion of current rotation management area biomass that would be available for fishing under various habitat alternatives. Shaded table cells represent the rotation management areas whose predicted yield were reduced to account for the inaccessibility of scallops within proposed habitat area closure boundaries.

Habitat alternatives	Rotation management areas (see Figure 111 to Figure 114)																						
	MA01	MA02	MA03	MA04	MA05	MA06	MA07	MA08	MA09	GB01	GB02	GB03	GB04	GB05	GB06	GB07	GB08	GB09	GB10 & GB11	GB12	GB13	GB14	GB15
Alternative 1 (GFMort2 and SQ)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	0%	0%	0%	0%	0%
No habitat closures	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
GFMort 1	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	25%	100%	0%	0%	0%	0%	50%	0%
Habitat alternative 3a	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	25%	50%	100%	100%	25%	100%	33%	25%	33%	100%	100%	0%
Habitat alternative 3b	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	25%	50%	100%	100%	25%	100%	33%	25%	33%	100%	100%	0%
Habitat alternative 4	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	25%	100%	100%	100%	25%	100%	33%	25%	33%	100%	100%	0%
Habitat alternative 5a	100%	100%	100%	100%	100%	100%	90%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Habitat alternative 5b	100%	100%	100%	100%	100%	100%	60%	100%	100%	100%	0%	100%	100%	100%	100%	100%	100%	90%	100%	100%	100%	100%	100%
Habitat alternative 5c	100%	100%	100%	100%	100%	100%	90%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Habitat alternative 5d	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	100%	100%	90%	70%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Habitat alternative 6	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	100%	30%	100%	100%	100%	100%	100%	0%	100%	0%	100%	0%
Habitat alternative 7	90%	90%	90%	90%	90%	90%	60%	100%	100%	90%	0%	60%	75%	75%	80%	100%	90%	50%	40%	60%	80%	80%	60%
Habitat alternative 8a	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	40%
Habitat alternative 8b	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	25%	100%	100%	100%	100%	100%	100%	0%
Habitat alternative 9	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	0%	0%	0%	0%	0%

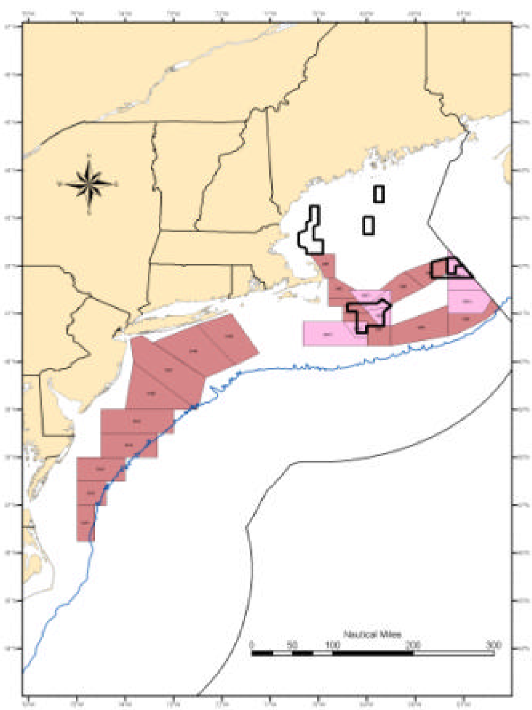
Alternative 1



Multispecies Amendment 13 Mortality Alternative 2



Alternative 3a



Alternative 3b

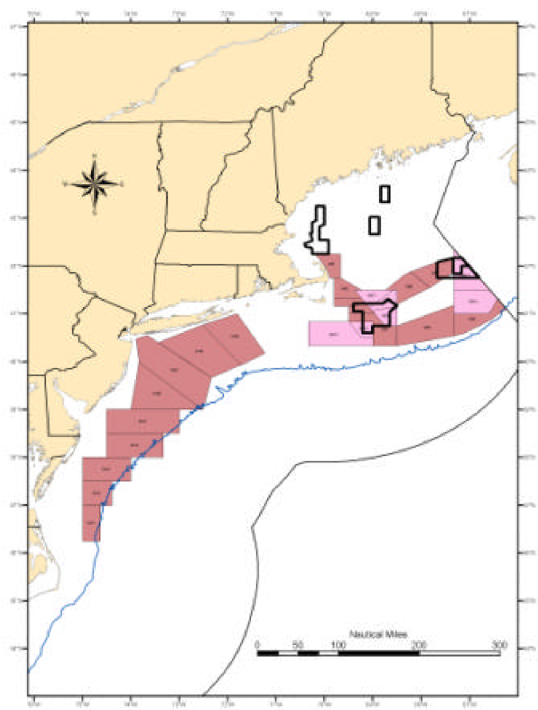


Figure 111. **Comparison of habitat closure alternatives and fixed rotation management area boundaries.**

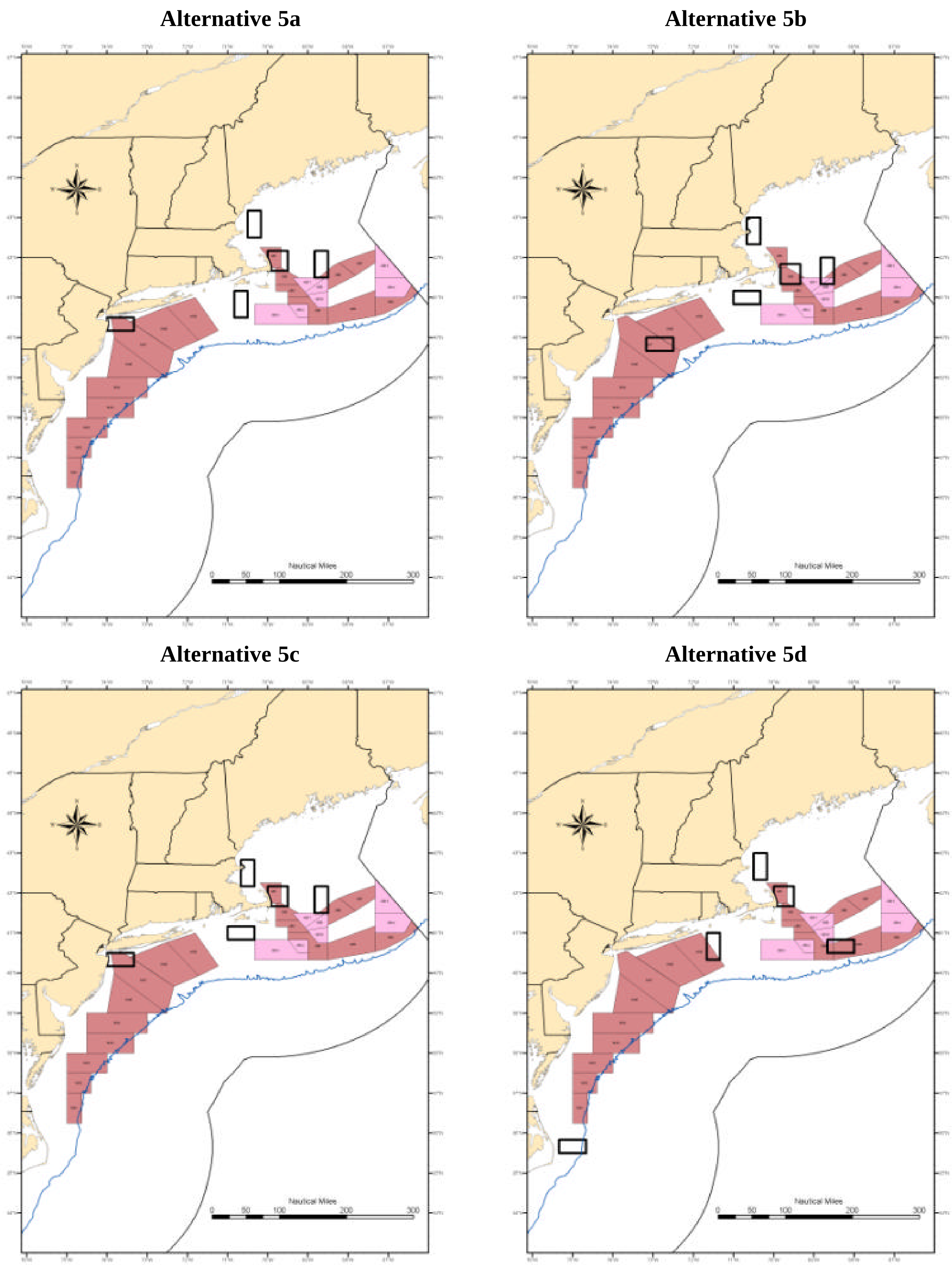


Figure 112. **Comparison of habitat closure alternatives and fixed rotation management area boundaries.**

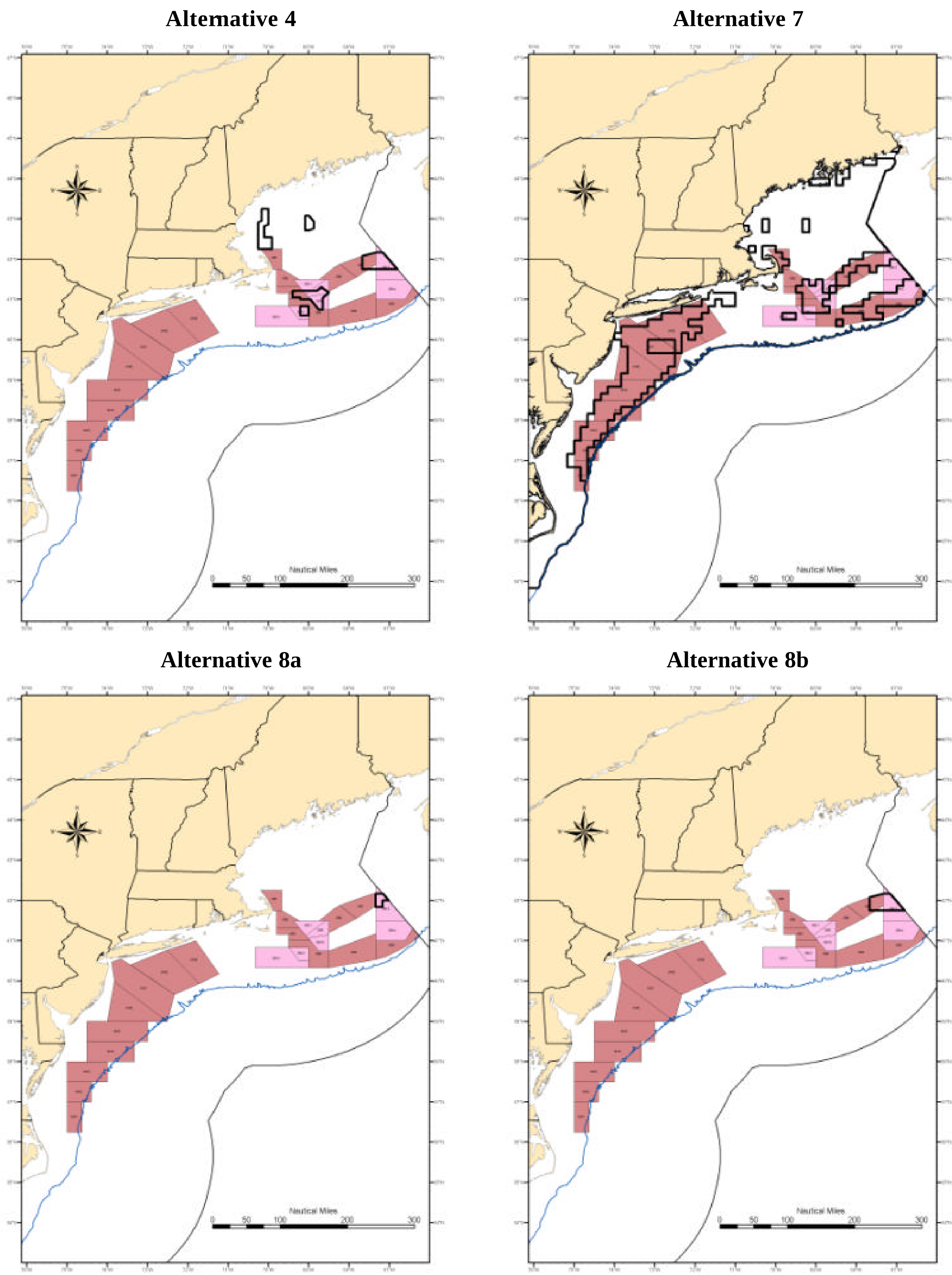


Figure 113. **Comparison of habitat closure alternatives and fixed rotation management area boundaries.**

Alternative 6 **Alternative 9**

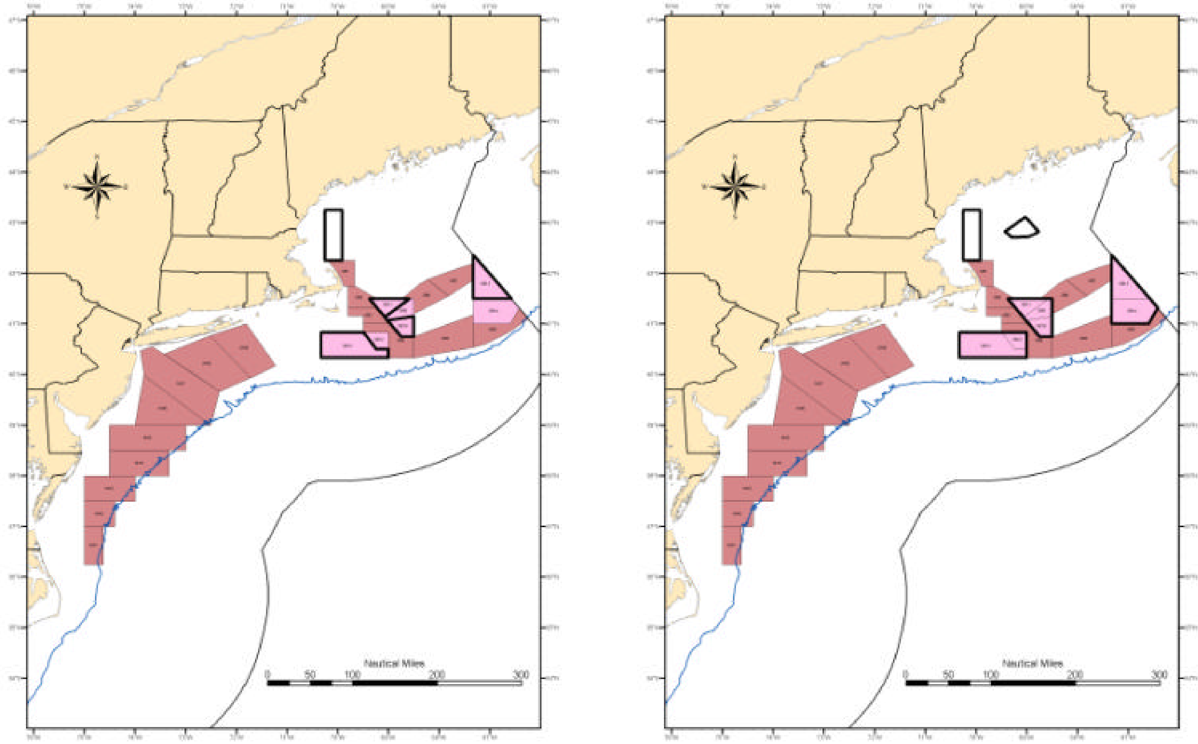


Figure 114. **Comparison of habitat closure alternatives and fixed rotation management area boundaries.**

Estimates of landings and allowable day-at-sea use with effects of habitat closures were made with the four mechanical rotation options for the Georges Bank closed areas, combined projections with and without rotation area management elsewhere. The area access projection with Habitat Alternative 1 is essentially scallop rotation area management with no access to the Georges Bank closed areas, resulting the lowest yield and day-at-sea estimates. Other options suggest landings ranging from 15,000 to 25,000 mt and day-at-sea use ranging from 15,000 to 20,000 days-at-sea used. These results are shown in the tables and figures below.

Table 225. Projected 2004 total landings and allowable limited access day-at-sea use with interim area rotation closures and Georges Bank area access options. PDT Option 1 would set a target 2004 TAC at F=0.4 for the Nantucket Lightship Area and Closed Area I and a target 2005-2006 TAC at F=0.2 for the Closed Area II South. PDT Option 2 would set a target 2004-2006 TAC at F=0.2 for Closed Area II South only.

	PDT Option 1		PDT Option 2	
Habitat alternative	**Total landings (mt)**	**Limited access day-at-sea use.**	**Total landings (mt)**	**Limited access day-at-sea use.**
Alternative 1 (GFMort2 and SQ)	12,757	11,696	12,757	11,696
GFMort 1	12,509	11,405	16,743	14,695
Habitat alternative 3a	14,251	12,675	20,916	17,899
Habitat alternative 3b	14,251	12,675	20,916	17,899
Habitat alternative 4	14,297	12,737	20,962	17,961
Habitat alternative 5a	15,671	13,817	21,026	18,037
Habitat alternative 5b	14,934	13,017	20,456	17,369
Habitat alternative 5c	15,671	13,817	21,026	18,037
Habitat alternative 5d	15,829	13,981	21,184	18,201
Habitat alternative 6	15,805	13,970	21,160	18,190
Habitat alternative 7	12,672	11,135	17,745	15,115
Habitat alternative 8a	15,870	14,057	21,225	18,276
Habitat alternative 8b	15,622	13,765	20,977	17,985
Habitat alternative 9	12,757	11,696	12,757	11,696
Maximum	15,870	14,057	21,225	18,276
Average	14,492	12,889	19,275	16,647
Minimum	12,509	11,135	12,757	11,696

Table 226. Projected 2004 total landings and allowable limited access day-at-sea use with interim area rotation closures and Georges Bank area access options. PDT Option 3 would set a target 2004 TAC at F=0.2 for portions of the Nantucket Lightship Area, Closed Area I and Closed Area II South that were open to fishing in 2000. PDT Option 4 would set a target 2004-2006 TAC at F=0.2 for all of the Groundfish closed areas that were not otherwise closed to protect sensitive habitat.

	PDT Option 3		PDT Option 4	
Habitat alternative	Total landings (mt)	Limited access day-at-sea use.	Total landings (mt)	Limited access day-at-sea use.
Alternative 1 (GFMort2 and SQ)	12,757	11,696	12,757	11,696
GFMort 1	16,743	14,695	16,743	14,695
Habitat alternative 3a	21,904	18,625	23,487	19,929
Habitat alternative 3b	21,904	18,625	23,487	19,929
Habitat alternative 4	21,950	18,687	23,533	19,991
Habitat alternative 5a	22,732	19,300	26,759	22,616
Habitat alternative 5b	22,070	18,562	26,098	21,878
Habitat alternative 5c	22,732	19,300	26,759	22,616
Habitat alternative 5d	22,890	19,463	26,917	22,780
Habitat alternative 6	22,866	19,453	22,866	19,453
Habitat alternative 7	18,678	15,803	20,906	17,674
Habitat alternative 8a	22,930	19,539	26,399	22,331
Habitat alternative 8b	22,683	19,248	25,779	21,689
Habitat alternative 9	12,757	11,696	12,757	11,696
Maximum	22,930	19,539	26,917	22,780
Average	20,400	17,478	22,518	19,212
Minimum	12,757	11,696	12,757	11,696

Table 227. Projected 2004 total landings and allowable limited access day-at-sea use without area rotation or habitat closures comparing Georges Bank area access options.

Closed area access alternative	Total landings (mt)	Limited access day-at-sea use.
PDT Option 1	18,360	16,804
PDT Option 2	23,715	21,024
PDT Option 3	25,421	22,287
PDT Option 4	29,449	25,603

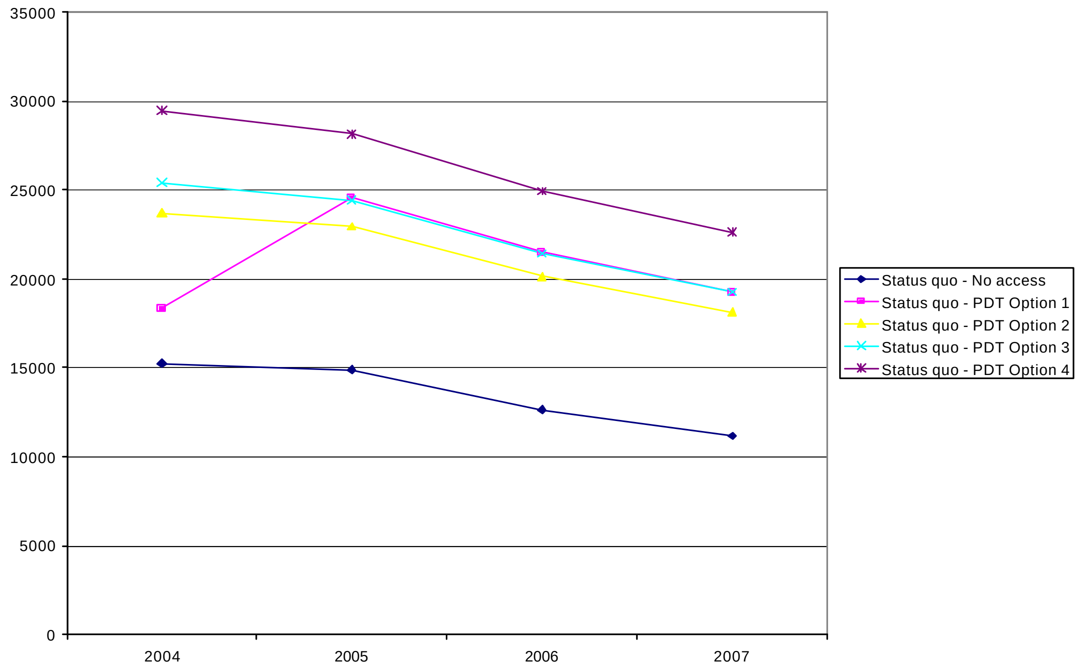


Figure 115. **Comparison of projected landings (mt) versus Georges Bank area access options with no rotation management or habitat closures.**

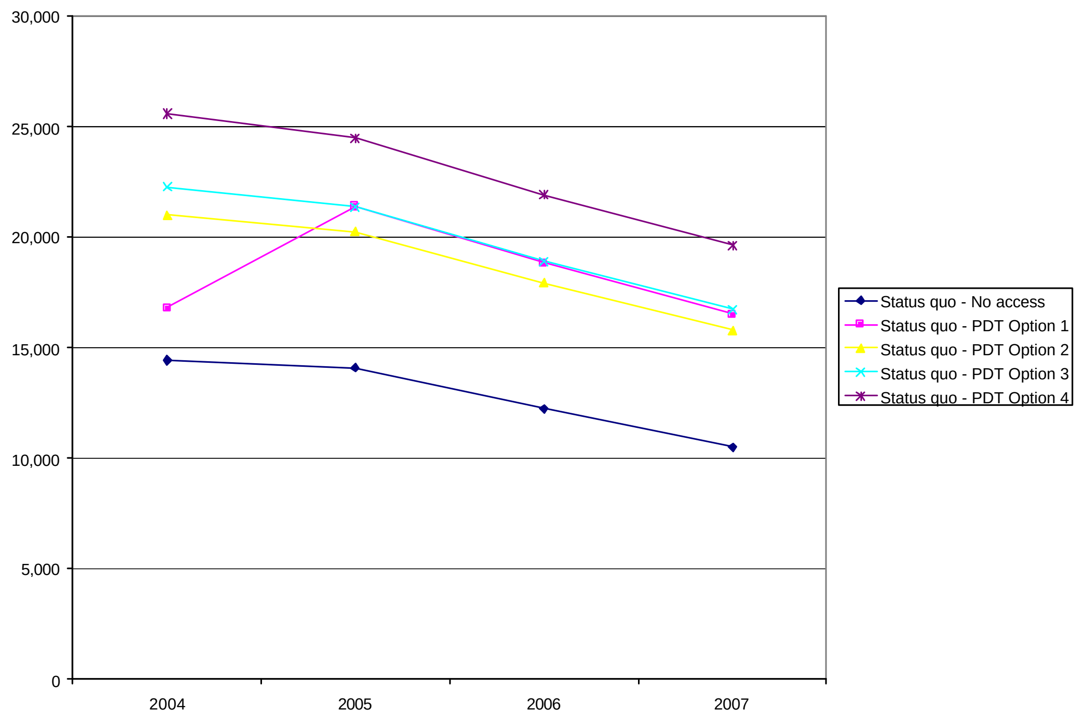


Figure 116. **Comparison of allowable limited access day-at-sea use versus Georges Bank area access options with no rotation management or habitat closures.**

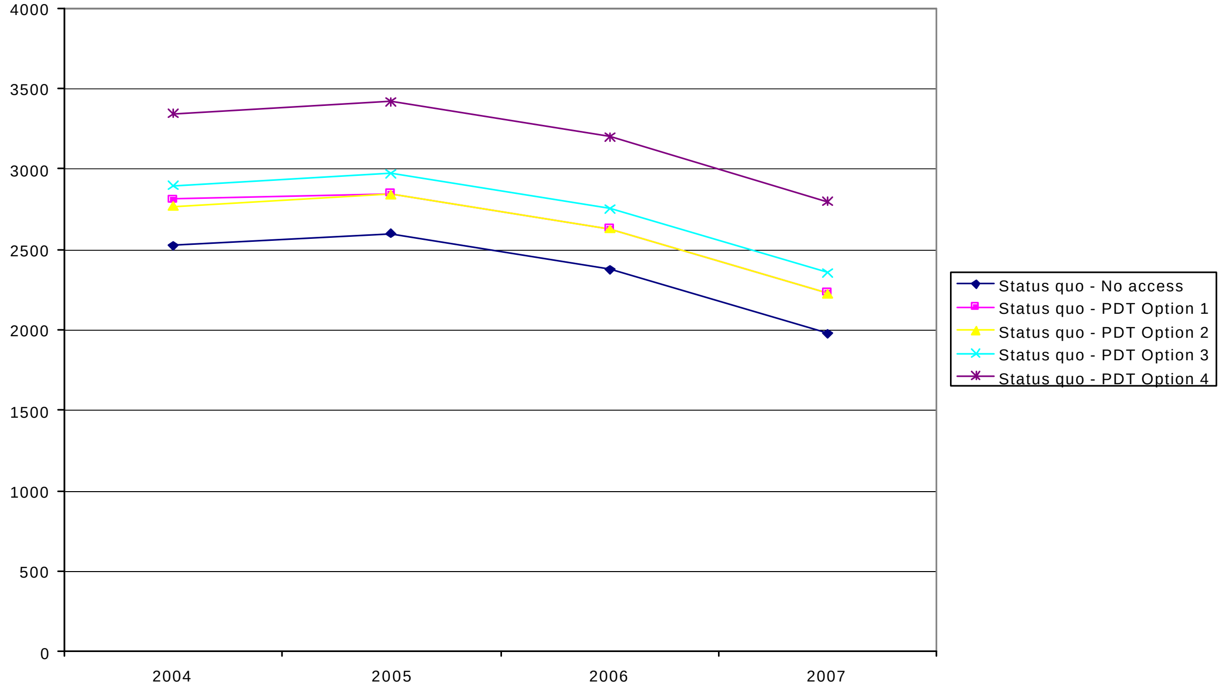


Figure 117. **Comparison of total area swept (nm^2) estimates versus Georges Bank area access options with no rotation management or habitat closures.**

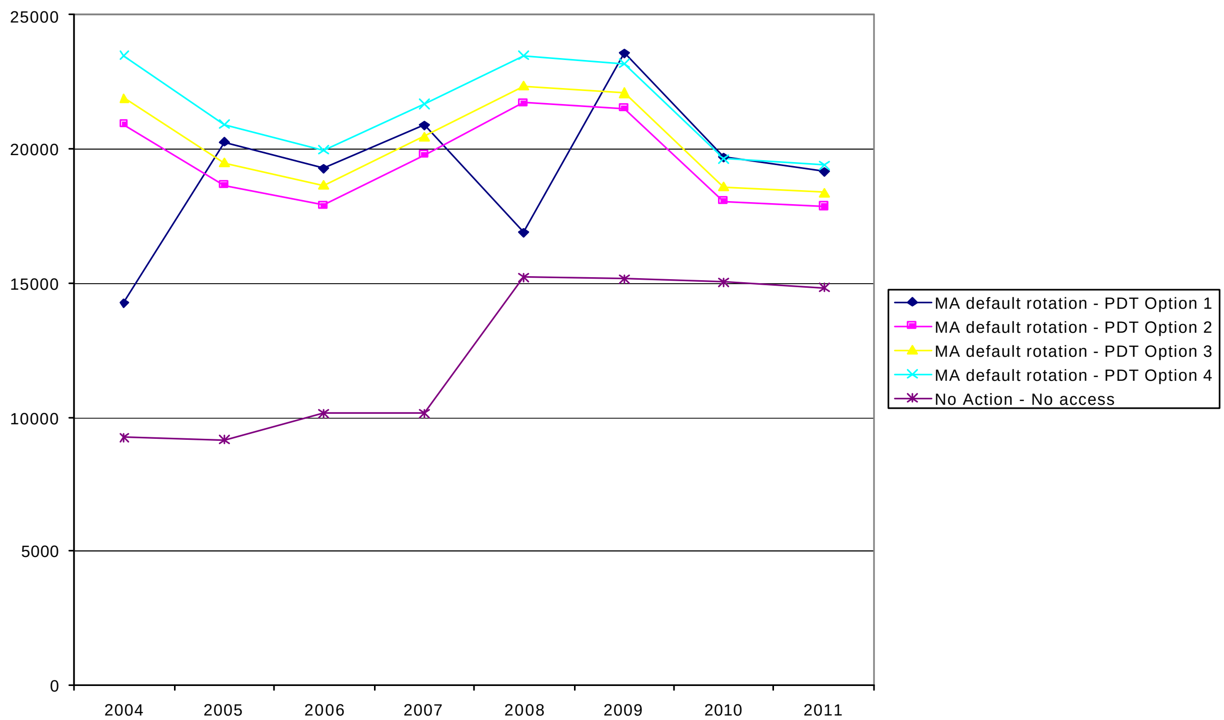


Figure 118. **Comparison of projected landings (mt) versus Georges Bank area access options with rotation management closures and habitat alternative 3a.**

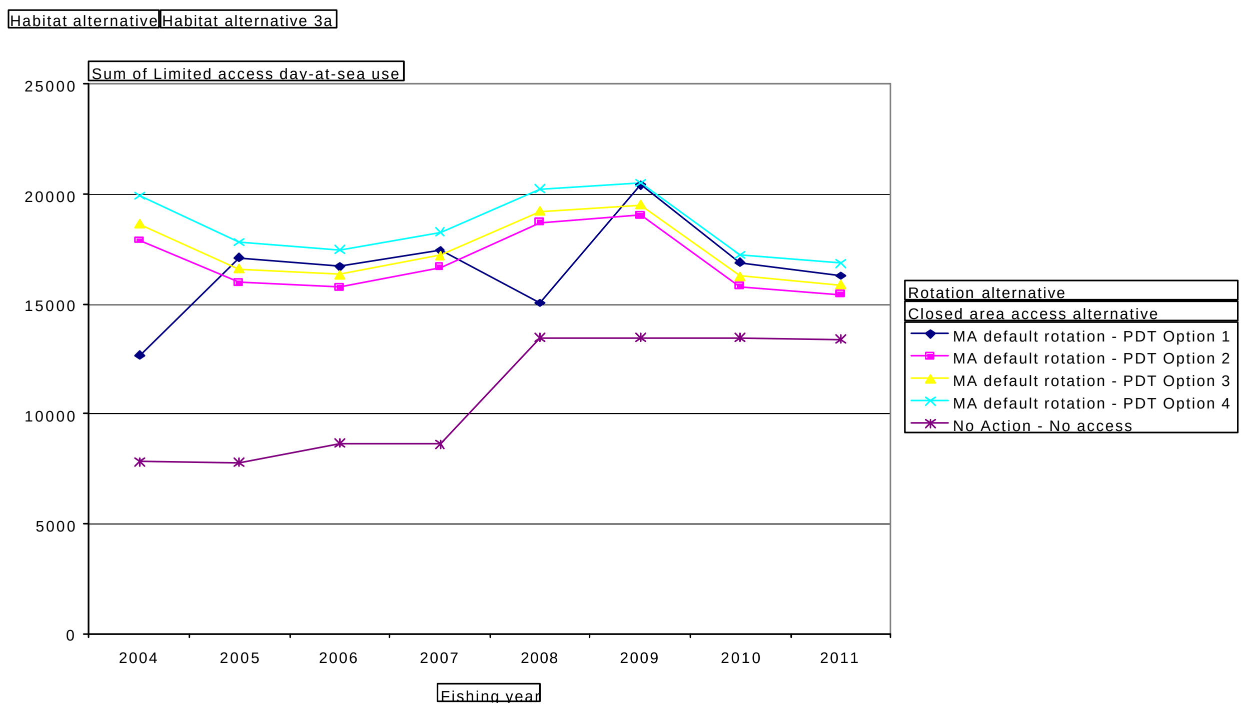


Figure 119. **Comparison of allowable limited access day-at-sea use versus Georges Bank area access options with rotation management closures and habitat alternative 3a.**

Figure 120. **Comparison of total area swept (nm^2) estimates versus Georges Bank area access options with rotation management closures and habitat alternative 3a.**

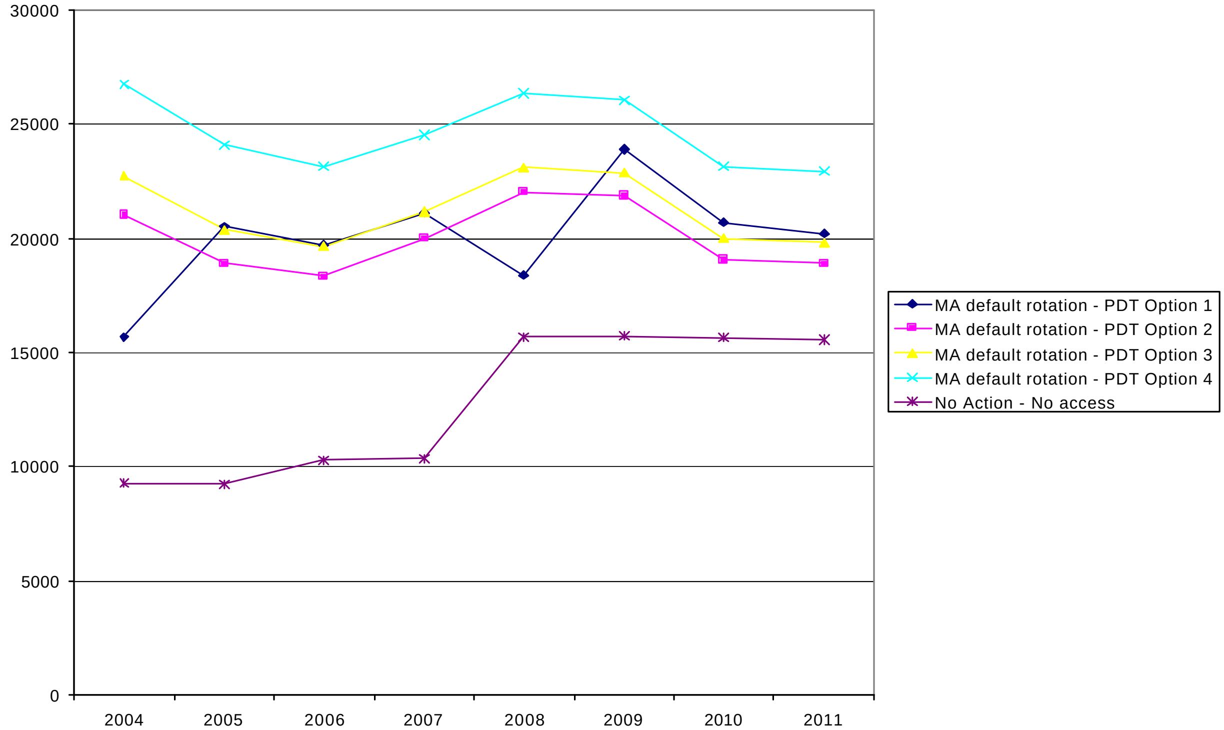


Figure 121. **Comparison of projected landings (mt) versus Georges Bank area access options with rotation management closures and habitat alternative 5a.**

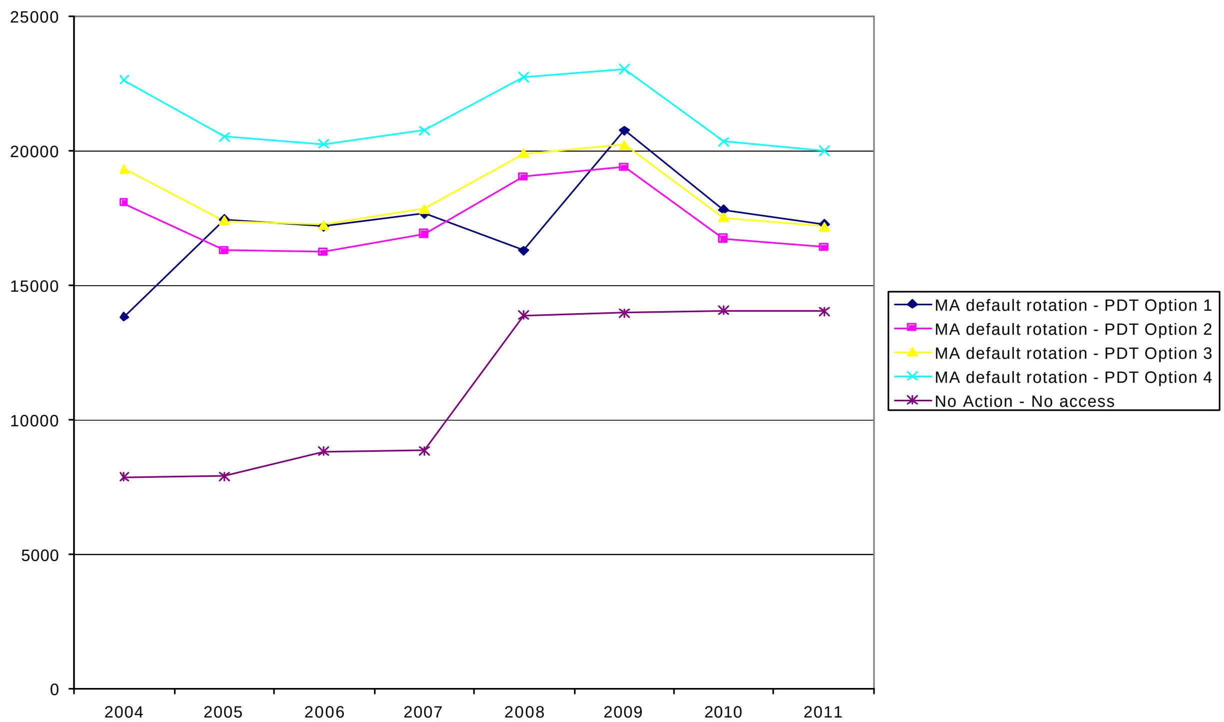


Figure 122. **Comparison of allowable limited access day-at-sea use versus Georges Bank area access options with rotation management closures and habitat alternative 5a.**

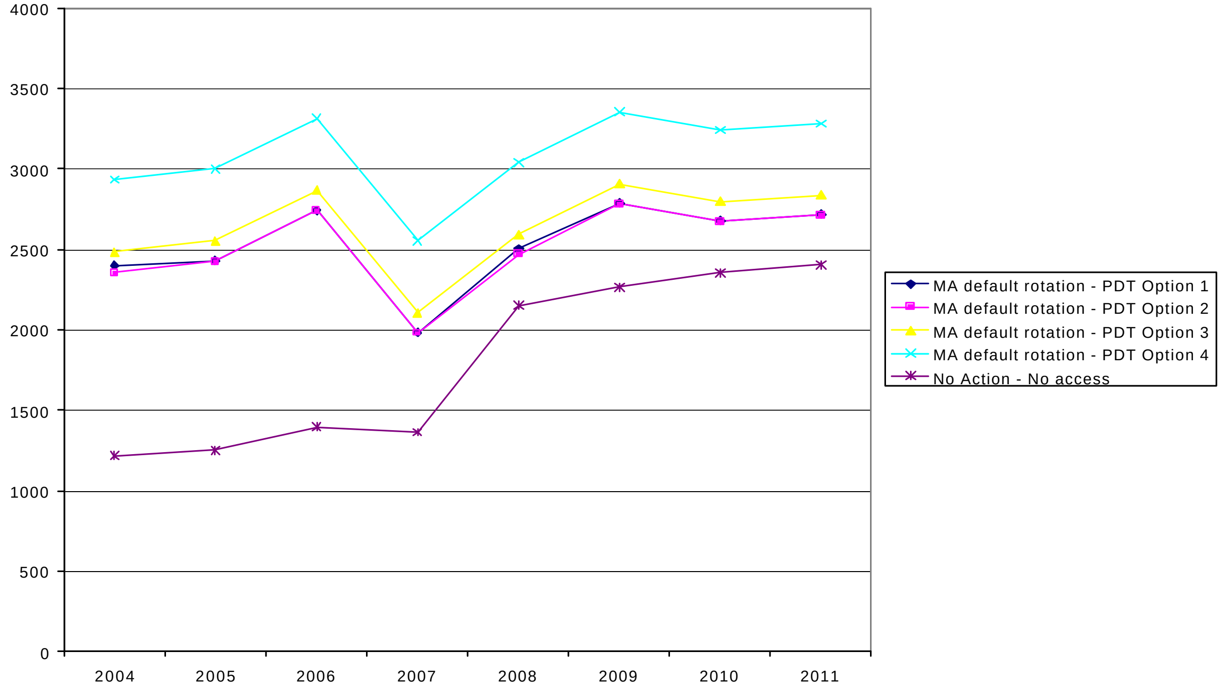


Figure 123. **Comparison of total area swept (nm^2) estimates versus Georges Bank area access options with rotation management closures and habitat alternative 5a.**

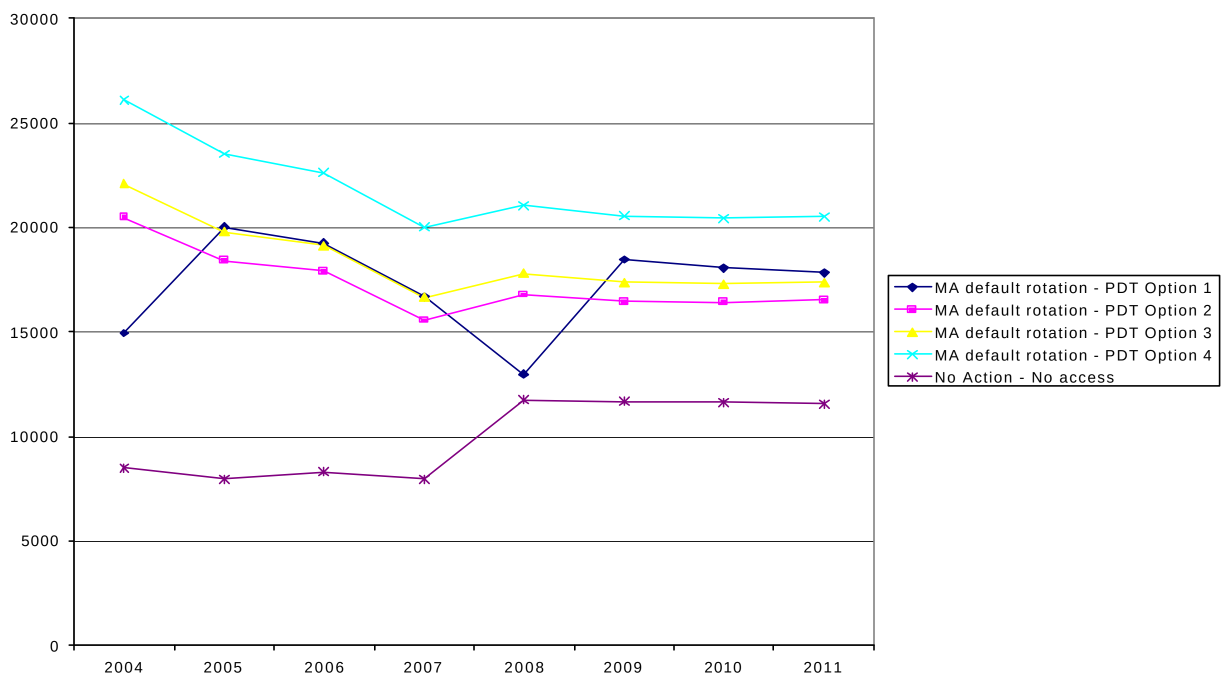


Figure 124. **Comparison of projected landings (mt) versus Georges Bank area access options with rotation management closures and habitat alternative 5b.**

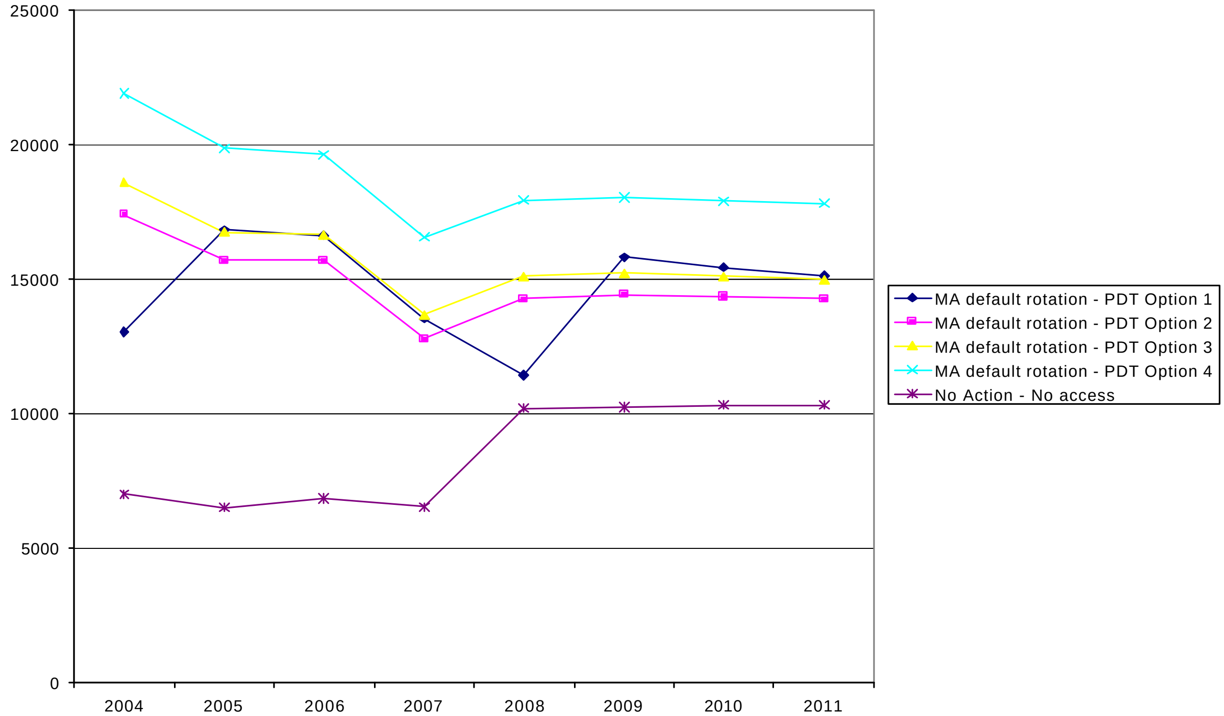


Figure 125. **Comparison of allowable limited access day-at-sea use versus Georges Bank area access options with rotation management closures and habitat alternative 5b.**

Figure 126. **Comparison of total area swept (nm^2) estimates versus Georges Bank area access options with rotation management closures and habitat alternative 5b.**

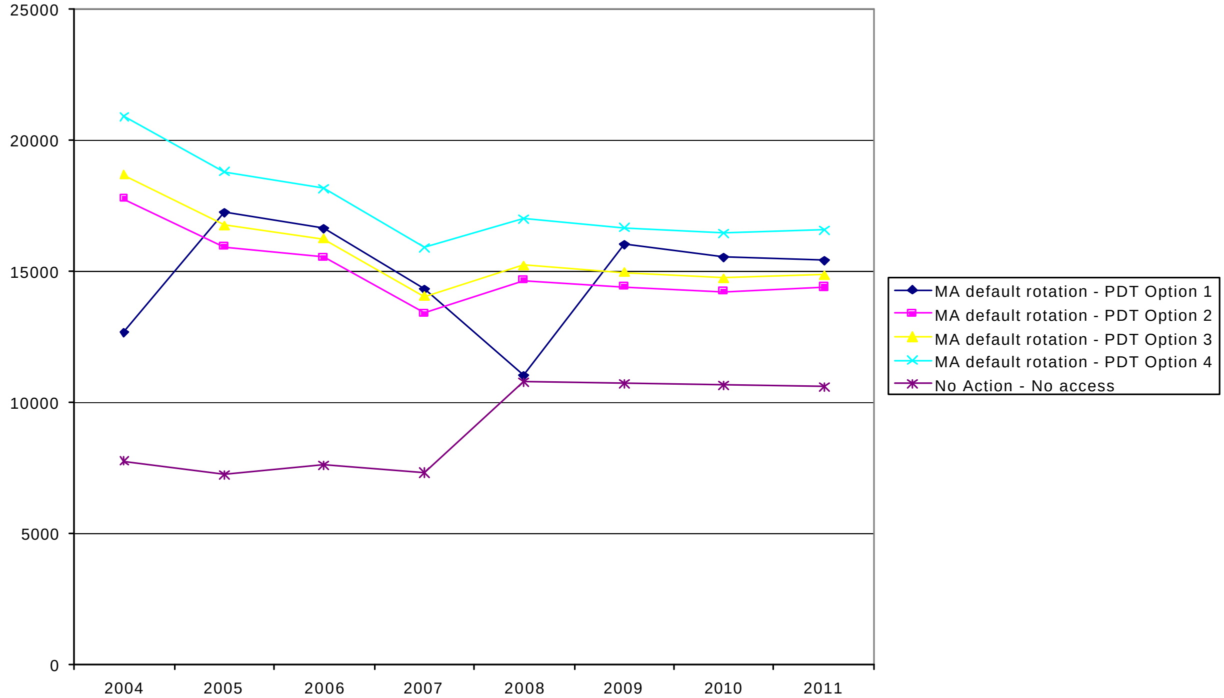


Figure 127. **Comparison of projected landings (mt) versus Georges Bank area access options with rotation management closures and habitat alternative 7.**

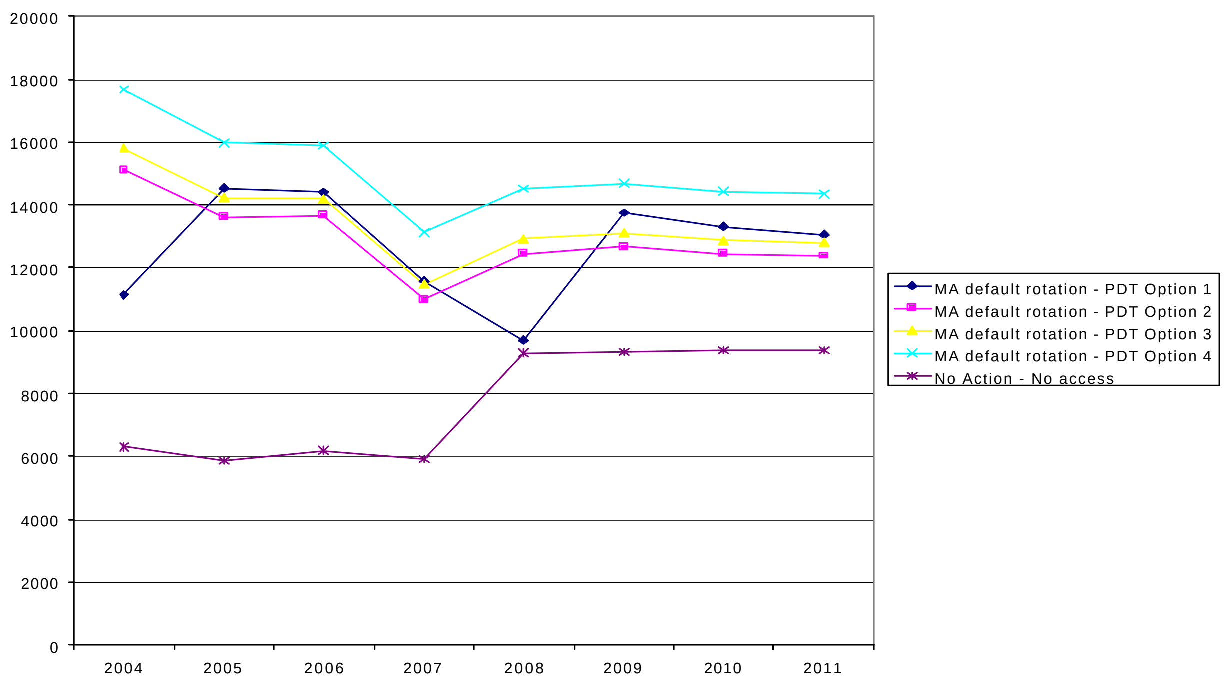


Figure 128. **Comparison of allowable limited access day-at-sea use versus Georges Bank area access options with rotation management closures and habitat alternative 7.**

Figure 129. **Comparison of total area swept (nm^2) estimates versus Georges Bank area access options with rotation management closures and habitat alternative 7.**

8.5.4.14.2 Retrospective analysis

8.5.4.14.2.1 Vessel Monitoring Systems

In addition to the long and short term effects that can be estimated from stock projection models, it is informative to take a retrospective look at the impacts on the scallop fishery had the proposed habitat and groundfish closures been in place. The PDT decided to examine data from three time periods; 1989-1993 (before limited access), 1994-1998 (limited access and groundfish closed areas), 1999 – 2001 (area access programs and rebuilding resource). Three types of data where the location of fishing was reported were available: port interviews, vessel trip reports, vessel monitoring system data.

The VMS data allows us to determine how much fishing time was expended within the proposed closed areas during each year by season. Landings, revenue, bycatch, and port of landing cannot be associated with this aggregate data. The positions and fishing time estimates are from Rago and McSherry (2001), with details down to the one nautical mile and week. The data were treated as point data and it is not clear whether the summarized data are located at the center, edge, or corner of a one nautical mile square, but this detail does not have a significant effect on the comparisons of distributions, substrates, or regions.

Differences in concentration of fishing effort by year, region, or substrate are difficult to identify visually, in part due to unequal amounts of area in each strata. Because of this perception difficulty, a Gini index (Dagnum 1985) was calculated to compare the Lorenz distribution curve (Lorenz 1905, Dagnum 1985). When effort is uniformly distributed throughout the stratum or class, the Gini index is zero because there is no difference between the Lorenz curve and the identity function with which it is compared. At the opposite end of the spectrum, the Gini index approaches one as effort becomes highly concentrated. Originally used for economic analysis of wealth distribution (Dagnum 1985), this method has been applied to northern cod (Myers and Cadigan 1995) and flatfish (Myers et al. 1995) in Newfoundland. The technique was also used by Wigley to examine temporal changes in haddock distribution (NMFS 1996).

Over time, fishing effort became more concentrated in 1999 and 2000 than it was in 1998, presumably because of the intensive fishing effort from the Georges Bank area access program. The Gini index increased from 0.67 in 1998 to 0.73 in 1999 and 2000 (Figure 130). Over the three year period, fishing effort was highly concentrated within Closed Area I and the Nantucket Lightship Area (Figure 131), but more spread out within Closed Area II, compared with average Gini index values of 0.7 for Georges Bank, the Gulf of Maine and Mid-Atlantic regions. Compared to underlying substrate estimates from Poppe et al. (1989), fishing effort was more concentrated on gravelly sand and sand substrates than on other types (Figure 132).

More important for this analysis of potential effectiveness of habitat alternatives to protect sensitive habitats and vulnerable substrates is the amount of fishing time that had occurred in areas proposed as habitat closures. Total fishing time (defined as subsequent VMS pollings that imply a interpolated vessel speed less than five knots) higher from 395,000 hours in 1998 to 408,000 hours in 1999, then declined to 384,000 hours in 2000.

Assuming a fishing speed of 4.5 knots, basic algebra shows that an hour of fishing time equates to two percent of a square nautical mile. Thus it takes at least 50 hours of fishing time to completely sweep a square nautical mile of bottom. Due to overlapping tows, the amount of fishing time to sweep 50 or 75 percent of a square nm is much higher than 50 hours. This compares to the most intensely-fished nautical mile of bottom within Closed Area I experiencing about 1,550 hours of fishing time, a maximum of 750 hours of fishing time on Georges Bank, and a maximum of 850 hours of fishing time on the Mid-Atlantic shelf. While these three square nautical miles indeed were swept rather thoroughly, many areas received less than 50 hours of fishing effort (Figure 131) and could not have been swept completely by scallop dredges, even summed over the three year period.

The scallop rotation management areas include well over 90 percent of the total fishing limited access fishing effort while on a day-at-sea (Table 228). The remaining hours outside the rotation management areas total less than 25,000 hours per year, some of which is due to vessels slowing during transiting or slowing near shore. Table 228 shows the distribution of fishing time by year and fishing region, compared to the areas that might be closed under the various habitat alternatives. At the extreme, habitat alternatives 3a and 3b would effect about 10 to 20 percent of scallop fishing time, followed by alternatives 4 and 5b ranging from 5 to 15 percent. Closures under Amendment 13 groundfish mortality alternative 1 would effect, if they apply to scallop vessels, about 20 to 30 percent of the fishing effort that occurred during 1998-2000.

More important to the evaluation of habitat effects is the distribution of scallop fishing time relative to substrate and habitat closure alternatives in Table 229. Because they were chosen by design to do so, alternatives 3a and 3b would effect 40 to 65 percent of scallop fishing effort that occurs on areas classified as having gravel sediment. At the same time, however, these alternatives would also affect 45 to 60 percent of scallop fishing effort occurring over areas classified as having gravelly sand substrate. Gravelly sand substrate is an important area for sea scallop productivity and catches, because it is well suited for scallop settlement, protection from predation, and filter feeding.

Other features that stand out in this analysis are that alternative 5b would affect a significant amount of scallop fishing effort on sand bottom. While total effort on muddy sand is low, alternatives 5a and 5c would effect about half of the scallop fishing on muddy-sand bottom. Alternative 7 would affect scallop fishing effort over a very wide variety of substrate types, due to the differences in sub-optimal scallop bottoms having silt/sand/clay/mud mixtures.

Table 228. **Summary of VMS sea scallop fishing time estimates by year, region, and habitat alternative.**

Sum of Fishing time (hrs)		3a		3b		4		5a		5b		5c		5d		6		Mort_Alt_1		Mort_Alt_2		Scallop RMA		
Year	Area	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Included	Not included	Grand Total
1998	Closed Area I	1,888	450	1,888	450	1,888	450		2,338	309	2,029		2,338	1	2,337	2,200	138	2,338		2,338		2,338		2,338
	Closed Area II	1,172	1,918	1,172	1,918	1,172	1,918		3,090		3,090		3,090		3,090	1,200	1,890	1,490	1,600	3,090		3,090		3,090
	Georges Bank	63,404	78,884	63,403	78,885	36,472	105,816	5,508	136,780	22,921	119,367	5,508	136,780	6,534	135,754		142,288	47,177	95,111		142,288	140,274	2,014	142,288
	Gulf of Maine	11	5,205	11	5,205		5,216	7	5,209	162	5,054	407	4,809	49	5,167		5,216	4,762	454	287	4,929	1,910	3,306	5,216
	Mid-Atlantic		189,915		189,915		189,915	2,589	187,326	16,956	172,958	2,589	187,326		189,915		189,915		189,915		189,915	182,448	7,466	189,915
	Nantucket Lightship Area	1		1		1			1		1		1		1		1	1		1		1		1
	Southern New England		51,414		51,414		51,414	214	51,200	580	50,834	580	50,834	1,990	49,424		51,414		51,414		51,414	42,989	8,425	51,414
	Western Gulf of Maine Area	148	1	148	1	148	1	39	111		149		149	39	111	149		149		149			149	149
	#N/A		1,122		1,122		1,122	6	1,116	96	1,027	102	1,021	6	1,116		1,122	207	915		1,122	247	875	1,122
1998 Total		66,624	328,908	66,623	328,909	39,682	355,851	8,362	387,170	41,023	354,509	9,185	386,347	8,618	386,914	3,549	391,983	56,125	339,408	5,865	389,667	373,297	22,236	395,532
1999	Closed Area I	1,728	233	1,728	233	1,728	233		1,960	143	1,817		1,960	1	1,959	1,763	198	1,960		1,960		1,960		1,960
	Closed Area II	463	69,512	463	69,512	463	69,512		69,975		69,975		69,975		69,975	483	69,492	43,994	25,981	69,975		69,975		69,975
	Georges Bank	37,304	55,235	37,306	55,233	19,979	72,560	1,870	90,669	13,138	79,401	1,870	90,669	1,859	90,679		92,539	24,484	68,055		92,539	91,921	618	92,539
	Gulf of Maine		1,115		1,115		1,115	1	1,114	173	942	171	944	52	1,063		1,115	968	147	46	1,069	277	838	1,115
	Mid-Atlantic		221,911		221,911		221,911	1,701	220,210	23,559	198,352	1,701	220,210	34	221,876		221,911		221,911		221,911	218,278	3,632	221,911
	Nantucket Lightship Area	84	47	84	47	84	47		131		131		131		131	36	95	131		131		131		131
	Southern New England		18,890		18,890		18,890	27	18,863	114	18,777	114	18,777	606	18,284		18,890		18,890		18,890	16,738	2,152	18,890
	Western Gulf of Maine Area	6		6		6			6		6		6		6	6		6		6			6	6
	#N/A		1,260		1,260		1,260	8	1,252	31	1,230	39	1,222	8	1,252		1,260	87	1,174		1,260	6	1,254	1,260
1999 Total		39,584	368,202	39,586	368,200	22,259	385,527	3,606	404,180	37,157	370,630	3,893	403,893	2,561	405,225	2,288	405,499	71,629	336,157	72,118	335,669	399,286	8,501	407,787
2000	Closed Area I	19,503	3,045	19,503	3,045	19,503	3,045		22,549	1,111	21,438		22,549		22,549	1,571	20,977	22,549		22,549		22,549		22,549
	Closed Area II	356	22,487	356	22,487	356	22,487		22,842		22,842		22,842		22,842	397	22,445	15,381	7,462	22,842		22,842		22,842
	Georges Bank	23,345	29,938	23,346	29,937	10,833	42,450	1,180	52,103	5,806	47,477	1,180	52,103	1,182	52,101		53,283	13,621	39,662		53,283	51,911	1,372	53,283
	Gulf of Maine	4	1,272	4	1,272		1,275	12	1,263	165	1,110	221	1,054	18	1,257		1,275	944	331	42	1,233	217	1,059	1,275
	Mid-Atlantic		252,263		252,263		252,263	1,117	251,145	27,570	224,693	1,117	251,145	3	252,260		252,263		252,263		252,263	248,382	3,880	252,263
	Nantucket Lightship Area	6,017	2,069	6,017	2,069	6,017	2,069		8,086		8,086		8,086		8,086	15	8,072	8,086		8,086		8,086		8,086
	Southern New England		22,895		22,895		22,895	64	22,831	203	22,692	203	22,692	179	22,716		22,895		22,895		22,895	22,146	750	22,895
	Western Gulf of Maine Area	5		5		5			5		5		5		5	5		5		5			5	5
	#N/A		1,367		1,367		1,367	17	1,350	138	1,229	155	1,212	17	1,350		1,367	139	1,228		1,367	6	1,361	1,367
2000 Total		49,229	335,336	49,230	335,335	36,714	347,851	2,390	382,175	34,993	349,572	2,876	381,689	1,399	383,166	1,988	382,577	60,725	323,841	53,524	331,041	376,139	8,426	384,565

Table 229. **Percent of total VMS sea scallop fishing time estimates by year (1998-2000), bottom substrate (Poppe et al. 1989), and habitat alternative, classified by one nm^2.**

Year	EFH sediment type	Alternative 1	Alternative 3a	Alternative 3b	Alternative 4	Alternative 5a	Alternative 5b	Alternative 5c	Alternative 5d	Alternative 6	Alternative 7	Alternative 8a	Alternative 8b	Alternative 9	GFMort Alternative 1
1998	Bedrock	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	100.00%
	Gravel	3.59%	44.83%	44.83%	23.62%	0.66%	28.14%	3.85%	0.66%	1.86%	33.54%	0.00%	21.76%	3.59%	55.13%
	Gravelly sand	3.65%	60.53%	60.53%	28.74%	0.06%	12.31%	0.06%	0.05%	3.17%	13.56%	1.01%	8.66%	3.89%	41.13%
	Mud	3.85%	3.85%	3.85%	3.85%	4.22%	0.93%	1.12%	4.22%	3.85%	10.93%	0.00%	0.00%	26.25%	27.74%
	Muddy sand	0.06%	0.03%	0.03%	0.03%	56.40%	14.32%	58.66%	22.09%	0.06%	15.82%	0.00%	0.00%	0.06%	0.61%
	Sand	0.91%	7.29%	7.29%	5.96%	2.01%	9.76%	2.22%	2.45%	0.40%	11.62%	0.13%	3.93%	0.91%	8.06%
	Unclassified	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	26.43%	0.00%	0.00%	0.00%	0.00%
	#N/A	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1998 Total		1.41%	16.84%	16.84%	10.03%	2.11%	10.37%	2.32%	2.18%	0.90%	12.17%	0.28%	4.86%	1.48%	14.19%
1999	Bedrock	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	100.00%
	Gravel	34.51%	42.87%	42.87%	17.81%	0.00%	13.95%	0.00%	0.00%	0.18%	14.78%	0.00%	17.57%	34.51%	66.93%
	Gravelly sand	12.54%	46.73%	46.73%	22.60%	0.02%	8.15%	0.02%	0.00%	3.23%	8.50%	0.60%	9.41%	12.58%	36.22%
	Mud	0.00%	0.00%	0.00%	0.00%	0.19%	0.19%	0.00%	0.19%	0.00%	49.50%	0.00%	0.00%	4.56%	4.75%
	Muddy sand	0.03%	0.00%	0.00%	0.00%	55.20%	10.63%	55.72%	10.78%	0.03%	14.74%	0.00%	0.00%	0.03%	1.07%
	Sand	18.49%	3.78%	3.78%	2.75%	0.58%	9.22%	0.65%	0.65%	0.16%	13.54%	0.04%	1.44%	18.49%	14.38%
	Unclassified	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	24.67%	0.00%	0.00%	0.00%	0.00%
	#N/A	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1999 Total		17.67%	9.71%	9.71%	5.46%	0.88%	9.11%	0.95%	0.63%	0.56%	12.95%	0.11%	2.60%	17.69%	17.57%
2000	Gravel	13.93%	65.36%	65.36%	46.65%	0.00%	14.63%	1.33%	0.00%	0.08%	15.46%	0.00%	43.02%	13.93%	71.71%
	Gravelly sand	40.12%	61.35%	61.35%	43.72%	0.02%	3.84%	0.02%	0.01%	2.33%	15.35%	0.40%	4.91%	40.17%	51.77%
	Mud	0.00%	0.00%	0.00%	0.00%	1.91%	2.42%	2.75%	1.91%	0.00%	85.03%	0.00%	0.00%	3.59%	6.12%
	Muddy sand	0.00%	0.00%	0.00%	0.00%	31.76%	4.38%	33.15%	4.72%	0.00%	8.49%	0.00%	0.00%	0.00%	0.00%
	Sand	9.40%	4.04%	4.04%	3.38%	0.50%	10.04%	0.63%	0.39%	0.20%	13.98%	0.04%	0.96%	9.40%	9.25%
	Unclassified	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	42.94%	0.00%	0.00%	0.00%	0.00%
	#N/A	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2000 Total		13.91%	12.80%	12.80%	9.55%	0.62%	9.10%	0.75%	0.36%	0.52%	14.24%	0.09%	1.74%	13.92%	15.79%

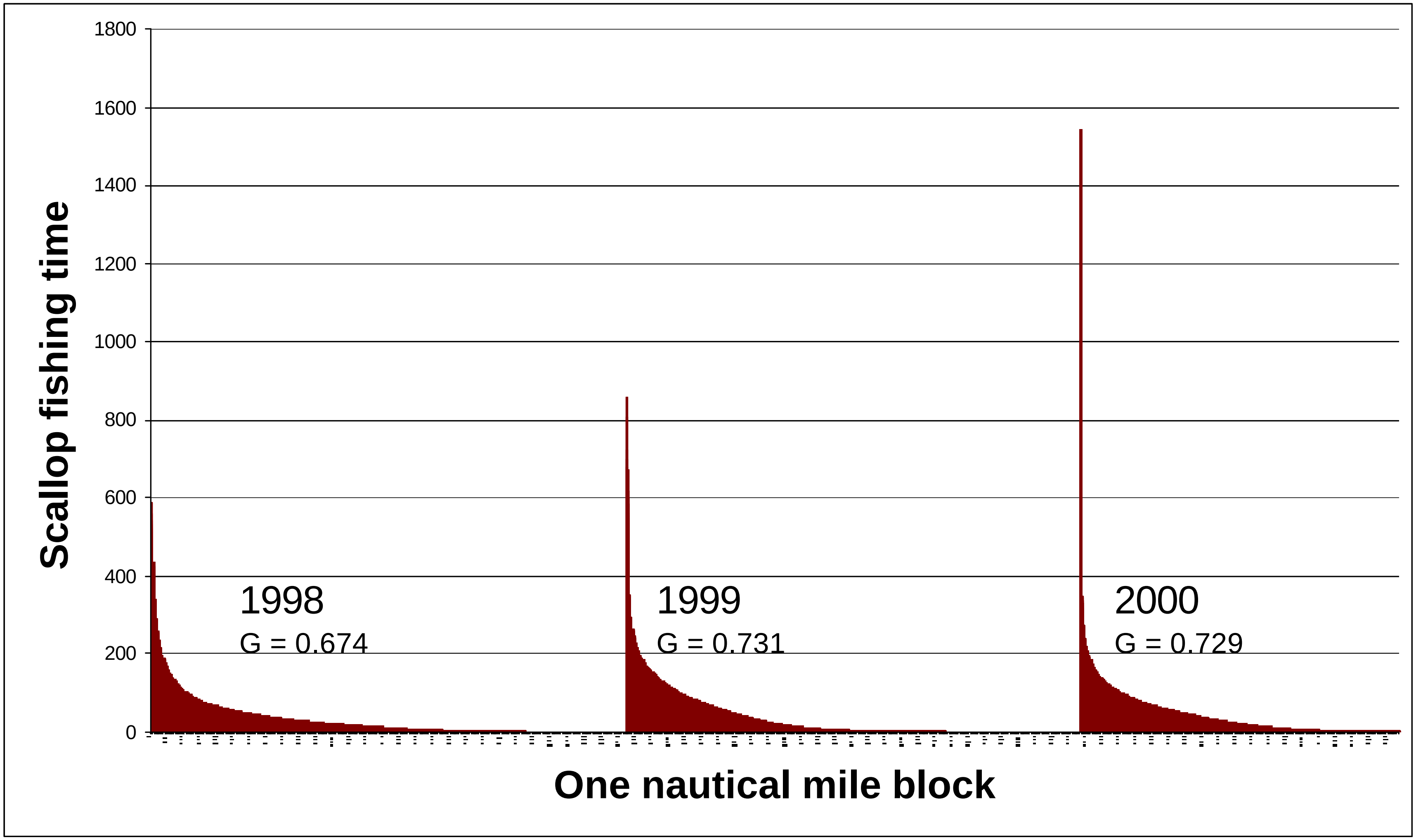


Figure 130. **Cumulative total VMS fishing time (hours) by year. G is the Gini index that ranges from 0 (uniform distribution) to 1 (highly concentrated). 2000 data are truncated on the right due to software limitations.**

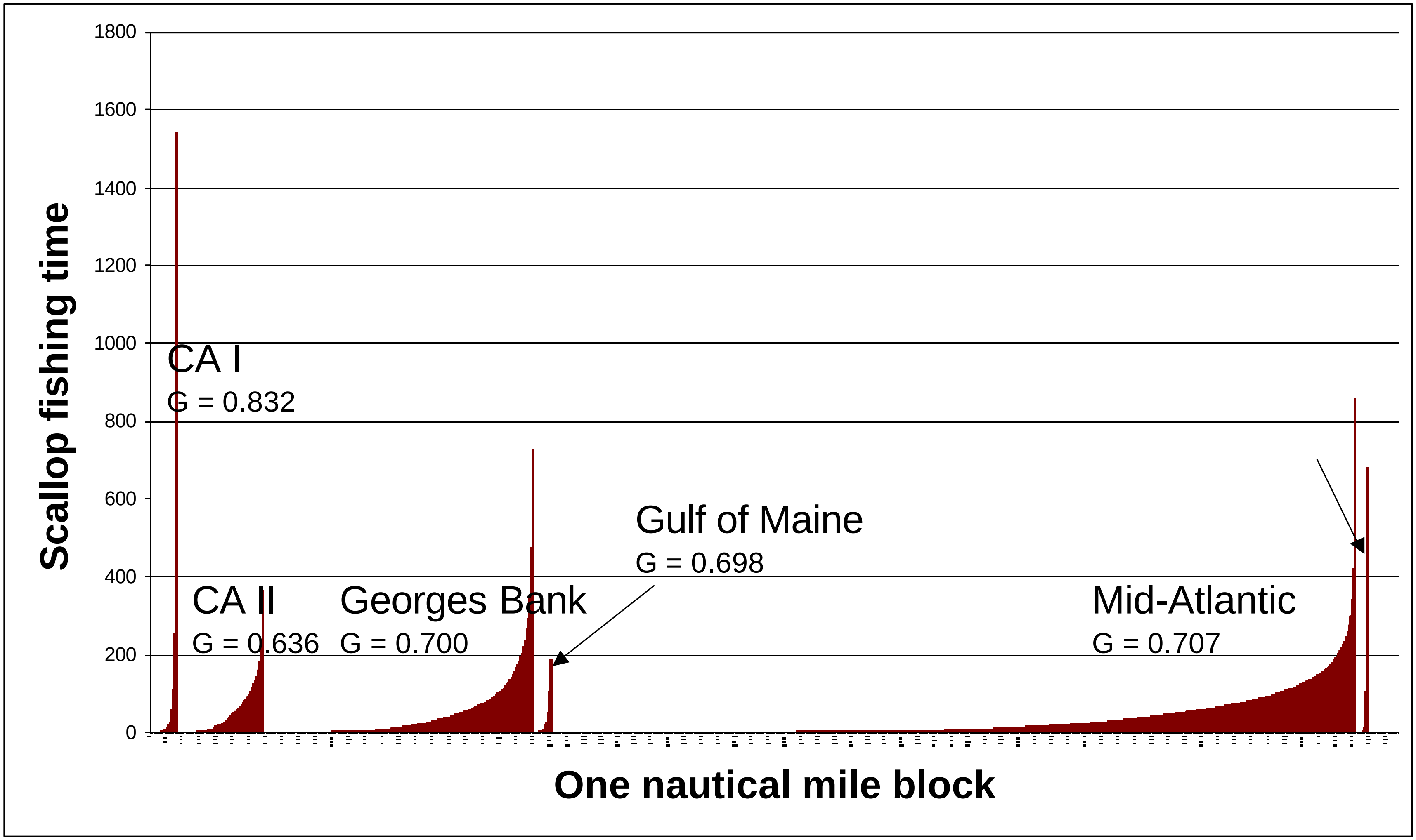


Figure 131. **Cumulative total VMS fishing time (hours) by region. G is the Gini index that ranges from 0 (uniform distribution) to 1 (highly concentrated).**

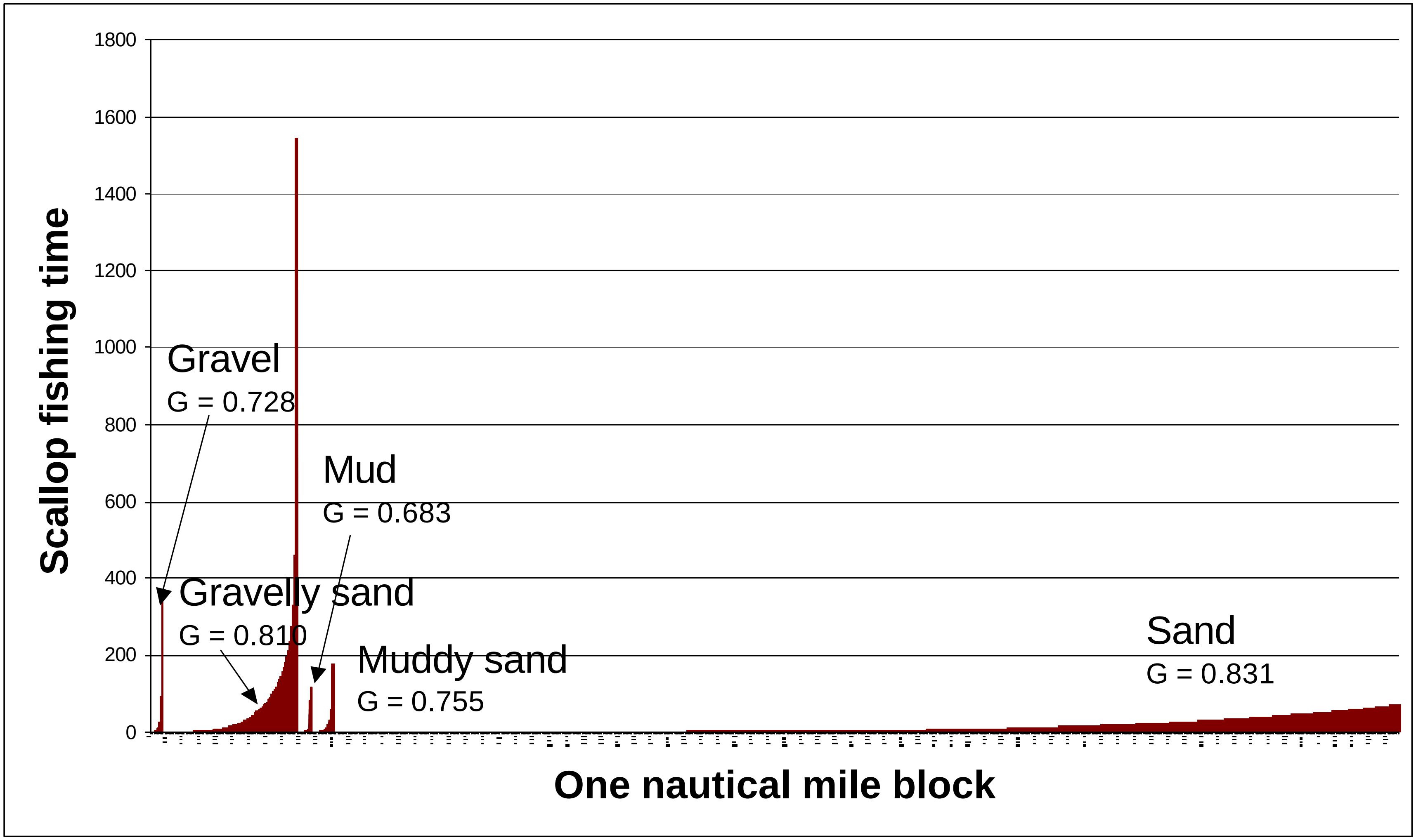


Figure 132. **Cumulative total VMS fishing time (hours) by region. G is the Gini index that ranges from 0 (uniform distribution) to 1 (highly concentrated). Effort distribution for sand substrates are truncated on the right due to software limitations.**

8.5.4.14.2.2 Vessel Trip Reports

Although benefit and practicality analysis both must analyze the impacts on the regulated fishery and on all other fisheries and activities, this analysis focuses on the scallop fishery impacts, i.e. vessels using scallop dredges and trawls. Although it would be preferable that the data were together in one data set, the kept and discarded portions have been summarized in two different data sets requiring parallel analysis. There has been insufficient time to work on the discards, so far, and any further discussion is only about the kept portion of the catches.

Kept catches and associated effort and trip/vessel characteristics were analyzed from VTR records with valid position data (latitude and longitude). Reports with no or impossible location data (land, Canada, etc.) were excluded. These data were filtered by each area closure option and the kept scallops were expanded to total scallop landings reported by dealer data. The VTR data were prorated by 4-digit port group, year, month, and trip type (limited access, general category, and open access).

Total scallop landings from 1995 to 2001 reported in the VTR system totaled 114,804,508 lbs. of meats, while the total scallop landings from dealer reports were 153,545,642 lbs. of meats. The prorated landings from the VTR data totaled 169,194,088 lbs., the difference being some months/ports in which the VTR kept scallops exceeded the dealer landings, in which the VTR kept was assumed to be correct. This may result in a minor amount of double reporting in the analysis, but did not exclude landings in the VTR that might not have been reported by dealers.

With respect to the proposed closed areas, each VTR record was treated as point data, since the geographic range of tows on the reports is not given. This may result in some loss of resolution, but there appears to be no source of directional bias.

Using these methods, a considerable number of historical summaries with respect to the closed areas are possible, including potential impacts by year, month, quarter, port, trip type, gear, vessel size, crew, etc., for all reported kept or discarded species. Several examples are included in the tables that follow this report, all of which compare the kept portion of catches inside (labeled Closed) versus outside (labeled blank) the proposed closures.

In the tables that follow, the potential impact of the proposed habitat closures can be examined by year (1995-2001), quarter (Table 231), permit type (Table 230), gear (Table 232), port (Table 364 to Table 366) and state (Table 233). The results of course vary, but some effects may stand out with careful examination. Overall, the results vary over time (Table 234 to Table 237) but habitat alternative 3a, 3b, and 5b would have the most impacts on landings and the scallop fishery, ranging from 7.1 to 17.6 percent of total landings.

It is also notable that landings per day (LPUE) tends to be about 50 percent higher for proposed closure areas for these three alternatives than for the areas that would remain open (Table 234 to Table 237). This difference also occurs for alternatives 8a and 8b, but the effects are much less. Thus, these five alternatives would cause the scallop fishery to operate in areas that are less productive. Since there is a demonstrated relationship between catch per day and bottom contact time, they have a potential to mitigate the effectiveness of the closure areas by increases in bottom contact elsewhere. For other alternatives, the landings per day in the open areas would be equal to or higher than the LPUE in proposed closed areas. Thus bottom contact time would be either unaffected or be lowered by fishing in more productive areas.

Table 230. Summary of the retrospective impact on total scallop landings by permit type in 1995-2001, assuming that habitat alternative 3a would have been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.

Habitat Alternaitve 3a

Closure effects **Open areas**

		Habitat Alternaitve 3a Data					
		Closed			(blank)		
Year_	Trip type	Prorated scallop landings (lbs.)	Percent	LPUE	Prorated scallop landings (lbs.)	Percent	LPUE
1995							
	General Category	3,846	1.9%	129	202,562	98.1%	173
	Limited Access	1,351,430	6.8%	914	18,511,926	93.2%	721
	Open Access	6	0.1%	0	4,978	99.9%	31
1995 Total		**1,355,282**	**6.8%**	**890**	**18,719,466**	**93.2%**	**694**
1996							
	General Category	2,700	1.1%	223	251,809	98.9%	208
	Limited Access	1,894,082	10.3%	753	16,492,747	89.7%	620
	Open Access		0.0%		11,980	100.0%	73
1996 Total		**1,896,782**	**10.2%**	**751**	**16,756,536**	**89.8%**	**599**
1997							
	General Category	4,475	1.3%	206	347,675	98.7%	203
	Limited Access	1,992,233	14.9%	671	11,420,936	85.1%	482
	Open Access	65	0.7%	30	9,576	99.3%	65
1997 Total		**1,996,773**	**14.5%**	**667**	**11,778,187**	**85.5%**	**460**
1998							
	General Category	3,367	1.0%	142	321,365	99.0%	196
	Limited Access	2,075,522	18.0%	588	9,432,948	82.0%	452
	Open Access	156	1.4%	61	10,943	98.6%	78
1998 Total		**2,079,045**	**17.6%**	**585**	**9,765,256**	**82.4%**	**431**
1999							
	General Category		0.0%		378,110	100.0%	269
	Limited Access	2,447,161	11.2%	1,237	19,403,537	88.8%	1,059
	Open Access	30	0.4%	70	7,470	99.6%	64
1999 Total		**2,447,191**	**11.0%**	**1,237**	**19,789,117**	**89.0%**	**997**
2000							
	General Category	1,870	0.6%	312	286,327	99.4%	493
	Limited Access	5,012,841	16.3%	3,172	25,689,296	83.7%	2,785
	Open Access	600	9.1%	63	5,988	90.9%	68
2000 Total		**5,015,311**	**16.2%**	**3,143**	**25,981,611**	**83.8%**	**2,626**
2001							
	General Category	27,755	2.4%	1,050	1,114,842	97.6%	582
	Limited Access	3,417,289	7.4%	3,749	42,598,754	92.6%	2,611
	Open Access	126	1.3%	24	9,748	98.7%	66
2001 Total		**3,445,170**	**7.3%**	**3,653**	**43,723,344**	**92.7%**	**2,379**
Grand Total		**18,235,554**	**11.1%**	**1,206**	**146,513,517**	**88.9%**	**968**

Table 231. Summary of the retrospective impact on total scallop landings by calendar quarter in 1995-2001, assuming that habitat alternative 3a would have been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.

Habitat Alternaitve 3a

Closure effects **Open areas**

		Habitat Alternaitve 3a Data Closed			(blank)		
Year_	Quarter	Prorated scallop	Percent	LPUE	Prorated scallop	Percent	LPUE
1995							
	1	124,562	3.7%	446	3,222,509	96.3%	673
	2	51,051	0.6%	942	8,830,579	99.4%	926
	3	486,885	8.9%	621	4,993,046	91.1%	594
	4	692,784	29.3%	1,704	1,673,332	70.7%	369
1995 Total		**1,355,282**	**6.8%**	**890**	**18,719,466**	**93.2%**	**687**
1996							
	1	144,136	6.3%	531	2,155,369	93.7%	483
	2	284,707	3.8%	798	7,260,122	96.2%	754
	3	880,705	15.5%	843	4,800,051	84.5%	591
	4	587,234	18.8%	688	2,540,994	81.2%	425
1996 Total		**1,896,782**	**10.2%**	**751**	**16,756,536**	**89.8%**	**594**
1997							
	1	423,672	14.5%	913	2,490,756	85.5%	515
	2	745,571	14.3%	817	4,451,449	85.7%	530
	3	461,466	12.0%	548	3,400,130	88.0%	419
	4	366,064	20.3%	463	1,435,852	79.7%	323
1997 Total		**1,996,773**	**14.5%**	**664**	**11,778,187**	**85.5%**	**457**
1998							
	1	426,874	19.7%	538	1,742,790	80.3%	427
	2	640,633	14.6%	599	3,753,436	85.4%	478
	3	588,962	18.0%	568	2,679,967	82.0%	398
	4	422,576	21.0%	637	1,589,063	79.0%	376
1998 Total		**2,079,045**	**17.6%**	**584**	**9,765,256**	**82.4%**	**427**
1999							
	1	366,267	13.2%	983	2,399,826	86.8%	605
	2	935,941	11.4%	1,196	7,269,749	88.6%	1,065
	3	360,075	5.4%	1,206	6,273,047	94.6%	1,206
	4	784,908	16.9%	1,481	3,846,495	83.1%	923
1999 Total		**2,447,191**	**11.0%**	**1,234**	**19,789,117**	**89.0%**	**981**
2000							
	1	602,900	18.4%	2,819	2,670,874	81.6%	2,785
	2	635,398	5.6%	5,961	10,812,369	94.4%	4,881
	3	1,384,897	13.7%	3,133	8,754,131	86.3%	1,951
	4	2,392,116	39.0%	2,852	3,744,237	61.0%	1,564
2000 Total		**5,015,311**	**16.2%**	**3,132**	**25,981,611**	**83.8%**	**2,584**
2001							
	1	740,777	11.8%	3,477	5,549,608	88.2%	1,964
	2	896,917	5.2%	6,645	16,193,769	94.8%	2,649
	3	1,108,263	7.7%	2,876	13,275,882	92.3%	2,322
	4	699,213	7.4%	3,316	8,704,085	92.6%	2,260
2001 Total		**3,445,170**	**7.3%**	**3,649**	**43,723,344**	**92.7%**	**2,362**
Grand Total		**18,235,554**	**11.1%**	**1,204**	**146,513,517**	**88.9%**	**958**

Table 232. Summary of the retrospective impact on total scallop landings by state of landing in 1995-2001, assuming that habitat alternative 3a would have been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.

Habitat Alternaitve 3a Closure effects / Open areas

		Habitat Alternaitve 3a Data Closed			(blank)		
Year_	Port State	Prorated scallop	Percent	LPUE	Prorated scallop	Percent	LPUE
1995							
	CT		0.0%		392,419	100.0%	617
	MA	1,355,282	14.7%	890	7,851,991	85.3%	678
	ME		0.0%		265,498	100.0%	343
	NC		0.0%		135,448	100.0%	386
	NH		0.0%		17,085	100.0%	853
	NJ		0.0%		2,795,839	100.0%	602
	NY		0.0%		21,964	100.0%	533
	RI		0.0%		97,975	100.0%	522
	VA		0.0%		7,141,247	100.0%	790
1995 Total		**1,355,282**	**6.8%**	**890**	**18,719,466**	**93.2%**	**687**
1996							
	CT	3,519	0.9%	365	377,694	99.1%	495
	MA	1,888,935	20.7%	754	7,245,528	79.3%	613
	MD		0.0%		2,065	100.0%	78
	ME	4,328	1.2%	391	362,646	98.8%	359
	NC		0.0%		122,619	100.0%	346
	NH		0.0%		4,000	100.0%	252
	NJ		0.0%		2,440,322	100.0%	514
	NY		0.0%		3,233	100.0%	452
	RI		0.0%		16,183	100.0%	267
	VA		0.0%		6,179,305	100.0%	659
	(blank)		0.0%		2,941	100.0%	229
1996 Total		**1,896,782**	**10.2%**	**751**	**16,756,536**	**89.8%**	**594**
1997							
	CT	21,669	6.1%	514	331,951	93.9%	446
	MA	1,952,045	25.9%	670	5,586,648	74.1%	505
	MD		0.0%		800	100.0%	200
	ME	14,458	5.8%	519	235,326	94.2%	307
	NC		0.0%		51,729	100.0%	273
	NH		0.0%		1,147	100.0%	86
	NJ		0.0%		2,004,676	100.0%	415
	NY		0.0%		1,551	100.0%	257
	RI		0.0%		118,853	100.0%	435
	VA	8,601	0.2%	341	3,444,966	99.8%	437
	(blank)		0.0%		540	100.0%	64
1997 Total		**1,996,773**	**14.5%**	**664**	**11,778,187**	**85.5%**	**457**
1998							
	CT	12,400	3.2%	440	372,842	96.8%	378
	MA	2,034,675	34.3%	584	3,894,711	65.7%	431
	MD		0.0%		2,680	100.0%	259
	ME	2,366	1.6%	184	149,599	98.4%	242
	NC		0.0%		37,064	100.0%	269
	NH		0.0%		3,970	100.0%	100
	NJ		0.0%		1,649,828	100.0%	388
	NY		0.0%		375	100.0%	200
	RI		0.0%		106,229	100.0%	321
	SC						0
	VA	29,604	0.8%	839	3,547,396	99.2%	475
	(blank)		0.0%		562	100.0%	107
1998 Total		**2,079,045**	**17.6%**	**584**	**9,765,256**	**82.4%**	**427**
1999							
	CT		0.0%		654,118	100.0%	814
	FL		0.0%		8,440	100.0%	2,873
	MA	2,436,973	19.4%	1,232	10,146,259	80.6%	1,161
	ME		0.0%		226,862	100.0%	465
	NC		0.0%		5,462	100.0%	25
	NH		0.0%		45,944	100.0%	741
	NJ	10,218	0.3%	1,790	2,914,872	99.7%	832
	NY		0.0%		11,725	100.0%	306
	RI		0.0%		200,648	100.0%	753
	SC						0

Table 233. Summary of the retrospective impact on total scallop landings by gear type in 1995-2001, assuming that habitat alternative 3a would have been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.

		Habitat Alternaitve 3a Closure effects			Open areas		
		Habitat Alternaitve 3a Data Closed			(blank)		
Year_	Gear	Prorated scallop	Percent	LPUE	Prorated scallop	Percent	LPUE
1995							
	sctrawl		0.0%		1,868,411	100.0%	831
	sdredge	1,355,282	7.4%	890	16,851,055	92.6%	674
1995 Total		**1,355,282**	**6.8%**	**890**	**18,719,466**	**93.2%**	**687**
1996							
	sctrawl		0.0%		1,454,582	100.0%	748
	sdredge	1,896,782	11.0%	751	15,301,954	89.0%	583
1996 Total		**1,896,782**	**10.2%**	**751**	**16,756,536**	**89.8%**	**594**
1997							
	sctrawl		0.0%		758,598	100.0%	406
	sdredge	1,996,773	15.3%	664	11,019,589	84.7%	461
1997 Total		**1,996,773**	**14.5%**	**664**	**11,778,187**	**85.5%**	**457**
1998							
	sctrawl		0.0%		983,936	100.0%	555
	sdredge	2,079,045	19.1%	584	8,781,320	80.9%	416
1998 Total		**2,079,045**	**17.6%**	**584**	**9,765,256**	**82.4%**	**427**
1999							
	sctrawl		0.0%		1,855,699	100.0%	912
	sdredge	2,447,191	12.0%	1,234	17,933,418	88.0%	989
1999 Total		**2,447,191**	**11.0%**	**1,234**	**19,789,117**	**89.0%**	**981**
2000							
	sctrawl		0.0%		2,542,037	100.0%	2,026
	sdredge	5,015,311	17.6%	3,132	23,439,574	82.4%	2,663
2000 Total		**5,015,311**	**16.2%**	**3,132**	**25,981,611**	**83.8%**	**2,584**
2001							
	sctrawl		0.0%		3,965,302	100.0%	2,154
	sdredge	3,445,170	8.0%	3,649	39,758,042	92.0%	2,385
2001 Total		**3,445,170**	**7.3%**	**3,649**	**43,723,344**	**92.7%**	**2,362**
Grand Total		**18,235,554**	**11.1%**	**1,204**	**146,513,517**	**88.9%**	**958**

Table 234. Summary of the retrospective impact on total scallop landings by alternative in 1995-1996, assuming they had been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.

		1995			1996	
		Prorated scallop landings (lbs.)	Percent	LPUE	Prorated scallop landings (lbs.)	Percent
Habitat Alternative 1 (SQ;NA)	Closed	57,041	0.3%	455	105,431	0.6%
	Open	20,017,707	99.7%	698	18,547,887	99.4%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternaitve 3a	Closed	1,355,282	6.8%	890	1,896,782	10.2%
	Open	18,719,466	93.2%	687	16,756,536	89.8%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternaitve 3b	Closed	1,356,046	6.8%	896	1,896,782	10.2%
	Open	18,718,702	93.2%	686	16,756,536	89.8%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternaitve 4	Closed	946,956	4.7%	1,064	1,306,818	7.0%
	Open	19,127,792	95.3%	686	17,346,500	93.0%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternaitve 5a	Closed	192,183	1.0%	388	373,268	2.0%
	Open	19,882,565	99.0%	703	18,280,050	98.0%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternaitve 5b	Closed	2,737,511	13.6%	825	2,865,105	15.4%
	Open	17,337,237	86.4%	681	15,788,213	84.6%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternaitve 5c	Closed	197,175	1.0%	420	350,653	1.9%
	Open	19,877,573	99.0%	702	18,302,665	98.1%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternaitve 5d	Closed	203,301	1.0%	387	344,509	1.8%
	Open	19,871,447	99.0%	703	18,308,809	98.2%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternative 6	Closed	46,320	0.2%	474	95,248	0.5%
	Open	20,028,428	99.8%	698	18,558,070	99.5%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternative 7	Closed	5,239,776	26.1%	751	5,079,221	27.2%
	Open	14,834,972	73.9%	680	13,574,097	72.8%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternaitve 8a	Closed	20,074,748	100.0%	697	18,653,318	100.0%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternaitve 8b	Closed	703,197	3.5%	1,704	580,280	3.1%
	Open	19,371,551	96.5%	683	18,073,038	96.9%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternaitve 9	Closed	57,930	0.3%	439	108,125	0.6%
	Open	20,016,818	99.7%	698	18,545,193	99.4%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**

Table 235. **Summary of the retrospective impact on total scallop landings by alternative in 1997-1998, assuming they had been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.**

		1997			1998	
		Prorated scallop landings (lbs.)	Percent	LPUE	Prorated scallop landings (lbs.)	Percent
Habitat Alternative 1 (SQ;NA)	Closed	174,618	1.3%	490	95,093	0.8%
	Open	13,600,342	98.7%	478	11,749,208	99.2%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternaitve 3a	Closed	1,996,773	14.5%	664	2,079,045	17.6%
	Open	11,778,187	85.5%	457	9,765,256	82.4%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternaitve 3b	Closed	2,002,819	14.5%	663	2,089,665	17.6%
	Open	11,772,141	85.5%	457	9,754,636	82.4%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternaitve 4	Closed	1,397,593	10.1%	690	1,286,594	10.9%
	Open	12,377,367	89.9%	462	10,557,707	89.1%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternaitve 5a	Closed	354,740	2.6%	560	203,202	1.7%
	Open	13,420,220	97.4%	476	11,641,099	98.3%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternaitve 5b	Closed	2,446,902	17.8%	567	1,053,255	8.9%
	Open	11,328,058	82.2%	463	10,791,046	91.1%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternaitve 5c	Closed	312,729	2.3%	530	172,087	1.5%
	Open	13,462,231	97.7%	477	11,672,214	98.5%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternaitve 5d	Closed	355,006	2.6%	513	210,330	1.8%
	Open	13,419,954	97.4%	477	11,633,971	98.2%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternative 6	Closed	142,278	1.0%	479	70,957	0.6%
	Open	13,632,682	99.0%	478	11,773,344	99.4%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternative 7	Closed	4,103,407	29.8%	492	2,281,380	19.3%
	Open	9,671,553	70.2%	473	9,562,921	80.7%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternaitve 8a	Closed	13,774,960	100.0%	478	11,844,301	100.0%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternaitve 8b	Closed	624,991	4.5%	666	618,164	5.2%
	Open	13,149,969	95.5%	472	11,226,137	94.8%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternaitve 9	Closed	178,342	1.3%	490	96,377	0.8%
	Open	13,596,618	98.7%	478	11,747,924	99.2%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**

Table 236. **Summary of the retrospective impact on total scallop landings by alternative in 1998-1999, assuming they had been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.**

		1999			2000	
		Prorated scallop landings (lbs.)	Percent	LPUE	Prorated scallop landings (lbs.)	Percent
Habitat Alternative 1 (SQ;NA)	Closed	6,121,662	27.5%	1,481	5,356,358	17.3%
	Open	16,114,646	72.5%	895	25,640,564	82.7%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternaitve 3a	Closed	2,447,191	11.0%	1,234	5,015,311	16.2%
	Open	19,789,117	89.0%	981	25,981,611	83.8%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternaitve 3b	Closed	2,444,734	11.0%	1,235	5,015,011	16.2%
	Open	19,791,574	89.0%	981	25,981,911	83.8%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternaitve 4	Closed	1,342,811	6.0%	1,279	4,016,483	13.0%
	Open	20,893,497	94.0%	990	26,980,439	87.0%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternaitve 5a	Closed	172,769	0.8%	711	42,682	0.1%
	Open	22,063,539	99.2%	1,007	30,954,240	99.9%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternaitve 5b	Closed	1,586,433	7.1%	888	2,493,874	8.0%
	Open	20,649,875	92.9%	1,014	28,503,048	92.0%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternaitve 5c	Closed	181,872	0.8%	692	74,865	0.2%
	Open	22,054,436	99.2%	1,008	30,922,057	99.8%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternaitve 5d	Closed	88,388	0.4%	594	29,973	0.1%
	Open	22,147,920	99.6%	1,007	30,966,949	99.9%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternative 6	Closed	154,087	0.7%	1,307	139,537	0.5%
	Open	22,082,221	99.3%	1,002	30,857,385	99.5%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternative 7	Closed	3,911,060	17.6%	882	4,890,097	15.8%
	Open	18,325,248	82.4%	1,035	26,106,825	84.2%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternaitve 8a	Closed	Confidential	Confidential	1,592	Confidential	Confidential
	Open	22,204,776	Confidential	1,004	30,996,172	Confidential
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternaitve 8b	Closed	620,093	2.8%	1,134	419,377	1.4%
	Open	21,616,215	97.2%	1,001	30,577,545	98.6%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternaitve 9	Closed	6,123,662	27.5%	1,481	5,356,358	17.3%
	Open	16,112,646	72.5%	895	25,640,564	82.7%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**

Table 237. **Summary of the retrospective impact on total scallop landings by alternative in 2001, assuming they had been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.**

		2001		
		Prorated scallop landings (lbs.)	Percent	LPUE
Habitat Alternative 1 (SQ;NA)	Closed	1,237,187	2.6%	3,339
	Open	45,931,327	97.4%	2,407
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternaitve 3a	Closed	3,445,170	7.3%	3,649
	Open	43,723,344	92.7%	2,362
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternaitve 3b	Closed	3,445,170	7.3%	3,649
	Open	43,723,344	92.7%	2,362
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternaitve 4	Closed	1,753,688	3.7%	3,217
	Open	45,414,826	96.3%	2,402
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternaitve 5a	Closed	591,981	1.3%	2,150
	Open	46,576,533	98.7%	2,429
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternaitve 5b	Closed	5,218,337	11.1%	2,233
	Open	41,950,177	88.9%	2,451
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternaitve 5c	Closed	607,053	1.3%	2,049
	Open	46,561,461	98.7%	2,431
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternaitve 5d	Closed	429,232	0.9%	1,971
	Open	46,739,282	99.1%	2,430
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternative 6	Closed	193,078	0.4%	2,986
	Open	46,975,436	99.6%	2,423
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternative 7	Closed	8,314,937	17.6%	2,135
	Open	38,853,577	82.4%	2,497
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternaitve 8a	Closed	Confidential	Confidential	3,880
	Open	47,076,921	Confidential	2,423
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternaitve 8b	Closed	465,334	1.0%	2,985
	Open	46,703,180	99.0%	2,420
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternaitve 9	Closed	1,237,187	2.6%	3,339
	Open	45,931,327	97.4%	2,407
	Grand Total	**47,168,514**	**100.0%**	**2,425**

Table 238. Summary of the retrospective impact on total scallop landings (lbs.) by alternative in 1995-2001, assuming that they alternatives had been implemented at that time. Data are from vessel trip reports with valid latitude and longitude positions, raised to total revenue by port group, gear, and month of landing.

		1995		1996		1997		1998		1999		2000		2001		Total
		Total scallop landings	Percent	Total scallop landings	Percent	Total scallop landings	Percent	Total scallop landings	Percent	Total scallop landings	Percent	Total scallop landings	Percent	Total scallop landings	Percent	Percent
Habitat Alternative 1 (SQ;NA)	Closed	57,041	0.3%	105,431	0.6%	174,618	1.3%	95,093	0.8%	6,121,662	27.5%	5,356,358	17.3%	1,237,187	2.6%	8.0%
	Open	20,017,707	99.7%	18,547,887	99.4%	13,600,342	98.7%	11,749,208	99.2%	16,114,646	72.5%	25,640,564	82.7%	45,931,327	97.4%	92.0%
Habitat Alternative 3a	Closed	1,355,282	6.8%	1,896,782	10.2%	1,996,773	14.5%	2,079,045	17.6%	2,447,191	11.0%	5,015,311	16.2%	3,445,170	7.3%	11.1%
	Open	18,719,466	93.2%	16,756,536	89.8%	11,778,187	85.5%	9,765,256	82.4%	19,789,117	89.0%	25,981,611	83.8%	43,723,344	92.7%	88.9%
Habitat Alternative 3b	Closed	1,356,046	6.8%	1,896,782	10.2%	2,002,819	14.5%	2,089,665	17.6%	2,444,734	11.0%	5,015,011	16.2%	3,445,170	7.3%	11.1%
	Open	18,718,702	93.2%	16,756,536	89.8%	11,772,141	85.5%	9,754,636	82.4%	19,791,574	89.0%	25,981,911	83.8%	43,723,344	92.7%	88.9%
Habitat Alternative 4	Closed	946,956	4.7%	1,306,818	7.0%	1,397,593	10.1%	1,286,594	10.9%	1,342,811	6.0%	4,016,483	13.0%	1,753,688	3.7%	7.3%
	Open	19,127,792	95.3%	17,346,500	93.0%	12,377,367	89.9%	10,557,707	89.1%	20,893,497	94.0%	26,980,439	87.0%	45,414,826	96.3%	92.7%
Habitat Alternative 5a	Closed	192,183	1.0%	373,268	2.0%	354,740	2.6%	203,202	1.7%	172,769	0.8%	42,682	0.1%	591,981	1.3%	1.2%
	Open	19,882,565	99.0%	18,280,050	98.0%	13,420,220	97.4%	11,641,099	98.3%	22,063,539	99.2%	30,954,240	99.9%	46,576,533	98.7%	98.8%
Habitat Alternative 5b	Closed	2,737,511	13.6%	2,865,105	15.4%	2,446,902	17.8%	1,053,255	8.9%	1,586,433	7.1%	2,493,874	8.0%	5,218,337	11.1%	11.2%
	Open	17,337,237	86.4%	15,788,213	84.6%	11,328,058	82.2%	10,791,046	91.1%	20,649,875	92.9%	28,503,048	92.0%	41,950,177	88.9%	88.8%
Habitat Alternative 5c	Closed	197,175	1.0%	350,653	1.9%	312,729	2.3%	172,087	1.5%	181,872	0.8%	74,865	0.2%	607,053	1.3%	1.2%
	Open	19,877,573	99.0%	18,302,665	98.1%	13,462,231	97.7%	11,672,214	98.5%	22,054,436	99.2%	30,922,057	99.8%	46,561,461	98.7%	98.8%
Habitat Alternative 5d	Closed	203,301	1.0%	344,509	1.8%	355,006	2.6%	210,330	1.8%	88,388	0.4%	29,973	0.1%	429,232	0.9%	1.0%
	Open	19,871,447	99.0%	18,308,809	98.2%	13,419,954	97.4%	11,633,971	98.2%	22,147,920	99.6%	30,966,949	99.9%	46,739,282	99.1%	99.0%
Habitat Alternative 6	Closed	46,320	0.2%	95,248	0.5%	142,278	1.0%	70,957	0.6%	154,087	0.7%	139,537	0.5%	193,078	0.4%	0.5%
	Open	20,028,428	99.8%	18,558,070	99.5%	13,632,682	99.0%	11,773,344	99.4%	22,082,221	99.3%	30,857,385	99.5%	46,975,436	99.6%	99.5%
Habitat Alternative	Closed	5,239,776	26.1%	5,079,221	27.2%	4,103,407	29.8%	2,281,380	19.3%	3,911,060	17.6%	4,890,097	15.8%	8,314,937	17.6%	20.5%

		1995		1996		1997		1998		1999		2000		2001		Total
		Total scallop landings	Percent	Total scallop landings	Percent	Total scallop landings	Percent	Total scallop landings	Percent	Total scallop landings	Percent	Total scallop landings	Percent	Total scallop landings	Percent	Percent
7	Open	14,834,972	73.9%	13,574,097	72.8%	9,671,553	70.2%	9,562,921	80.7%	18,325,248	82.4%	26,106,825	84.2%	38,853,577	82.4%	79.5%
Habitat Alternative 8a	Closed		0.0%		0.0%		0.0%		0.0%	Confidential		Confidential		Confidential		0
	Open	20,074,748	100.0 %	18,653,318	100.0%	13,774,960	100.0%	11,844,301	100.0%	Confidential		Confidential		Confidential		1
Habitat Alternative 8b	Closed	4,289,300	4.2%	3,418,259	3.3%	4,162,249	4.7%	3,868,560	5.4%	3,570,717	2.9%	2,264,058	1.5%	1,939,963	0.9%	
	Open	98,077,264	95.8%	101,225,124	96.7%	84,981,397	95.3%	68,409,804	94.6%	118,288,150	97.1%	153,546,647	98.5%	213,753,068	99.1%	
Habitat Alternative 9	Closed	57,930	0.3%	108,125	0.6%	178,342	1.3%	96,377	0.8%	6,123,662	27.5%	5,356,358	17.3%	1,237,187	2.6%	8.0%
	Open	20,016,818	99.7%	18,545,193	99.4%	13,596,618	98.7%	11,747,924	99.2%	16,112,646	72.5%	25,640,564	82.7%	45,931,327	97.4%	92.0%
GF Mortality Alternative 1	Closed	1,719,876	8.6%	2,506,457	13.4%	2,941,175	21.4%	1,999,792	16.9%	5,515,435	24.8%	6,242,051	20.1%	3,559,686	7.5%	14.9%
	Open	18,354,872	91.4%	16,146,861	86.6%	10,833,785	78.6%	9,844,509	83.1%	16,720,873	75.2%	24,754,871	79.9%	43,608,828	92.5%	85.1%
Grand Total		**102,366,565**	**20,074,748**		**18,653,318**		**13,774,960**		**11,844,301**		**22,236,308**		**30,996,922**		**47,168,514**	

Table 239. Summary of the retrospective impact on total scallop revenue by alternative in 1995-2001, assuming that they alternatives had been implemented at that time. Data are from vessel trip reports with valid latitude and longitude positions, raised to total revenue by port group, gear, and month of landing.

		1995		1996		1997		1998		1999		2000		2001		Total
		Total scallop revenue	Percent	Total scallop revenue	Percent	Total scallop revenue	Percent	Total scallop revenue	Percent	Total scallop revenue	Percent	Total scallop revenue	Percent	Total scallop revenue	Percent	Percent
Habitat Alternative 1 (SQ;NA)	Closed	353,810	0.3%	630,541	0.6%	1,128,143	1.3%	602,259	0.8%	35,787,509	29.4%	30,210,593	19.4%	5,766,218	2.7%	8.6%
	Open	102,012,754	99.7%	104,012,843	99.4%	88,015,503	98.7%	71,676,106	99.2%	86,071,359	70.6%	125,600,112	80.6%	209,926,813	97.3%	91.4%
Habitat Alternative 3a	Closed	7,927,064	7.7%	11,369,557	10.9%	13,297,725	14.9%	12,950,115	17.9%	14,078,935	11.6%	27,974,935	18.0%	15,875,060	7.4%	12.0%
	Open	94,439,501	92.3%	93,273,827	89.1%	75,845,921	85.1%	59,328,250	82.1%	107,779,932	88.4%	127,835,770	82.0%	199,817,971	92.6%	88.0%
Habitat Alternative 3b	Closed	7,938,339	7.8%	11,369,557	10.9%	13,341,141	15.0%	13,018,005	18.0%	14,065,916	11.5%	27,972,933	18.0%	15,875,060	7.4%	12.0%
	Open	94,428,226	92.2%	93,273,827	89.1%	75,802,505	85.0%	59,260,359	82.0%	107,792,951	88.5%	127,837,772	82.0%	199,817,971	92.6%	88.0%
Habitat Alternative 4	Closed	5,667,685	5.5%	7,794,920	7.4%	9,342,814	10.5%	8,035,642	11.1%	7,883,405	6.5%	22,908,380	14.7%	8,078,863	3.7%	8.1%
	Open	96,698,879	94.5%	96,848,464	92.6%	79,800,832	89.5%	64,242,722	88.9%	113,975,462	93.5%	132,902,324	85.3%	207,614,168	96.3%	91.9%
Habitat Alternative 5a	Closed	1,149,972	1.1%	2,314,239	2.2%	2,356,367	2.6%	1,274,970	1.8%	969,945	0.8%	257,310	0.2%	2,622,305	1.2%	1.3%
	Open	101,216,593	98.9%	102,329,145	97.8%	86,787,279	97.4%	71,003,394	98.2%	120,888,923	99.2%	155,553,395	99.8%	213,070,726	98.8%	98.7%
Habitat Alternative 5b	Closed	13,853,722	13.5%	16,658,772	15.9%	16,084,383	18.0%	6,507,730	9.0%	8,822,471	7.2%	12,945,753	8.3%	22,663,977	10.5%	11.3%
	Open	88,512,842	86.5%	87,984,612	84.1%	73,059,263	82.0%	65,770,634	91.0%	113,036,396	92.8%	142,864,951	91.7%	193,029,054	89.5%	88.7%
Habitat Alternative 5c	Closed	1,128,614	1.1%	2,191,507	2.1%	2,093,246	2.3%	1,079,758	1.5%	1,026,093	0.8%	541,429	0.3%	2,709,792	1.3%	1.2%
	Open	101,237,951	98.9%	102,451,877	97.9%	87,050,400	97.7%	71,198,606	98.5%	120,832,775	99.2%	155,269,276	99.7%	212,983,239	98.7%	98.8%
Habitat Alternative 5d	Closed	1,157,390	1.1%	2,155,998	2.1%	2,360,923	2.6%	1,313,335	1.8%	505,247	0.4%	193,467	0.1%	1,968,068	0.9%	1.1%
	Open	101,209,175	98.9%	102,487,386	97.9%	86,782,723	97.4%	70,965,030	98.2%	121,353,621	99.6%	155,617,238	99.9%	213,724,963	99.1%	98.9%
Habitat Alternative 6	Closed	287,142	0.3%	564,760	0.5%	910,665	1.0%	452,910	0.6%	952,759	0.8%	783,841	0.5%	839,596	0.4%	0.6%
	Open	102,079,423	99.7%	104,078,623	99.5%	88,232,981	99.0%	71,825,455	99.4%	120,906,109	99.2%	155,026,864	99.5%	214,853,435	99.6%	99.4%
Habitat Alternative	Closed	27,445,939	26.8%	29,763,381	28.4%	26,940,805	30.2%	14,213,984	19.7%	22,076,488	18.1%	25,865,188	16.6%	37,451,914	17.4%	21.3%

		1995		1996		1997		1998		1999		2000		2001		Total
		Total scallop revenue	Percent	Total scallop revenue	Percent	Total scallop revenue	Percent	Total scallop revenue	Percent	Total scallop revenue	Percent	Total scallop revenue	Percent	Total scallop revenue	Percent	Percent
7	Open	74,920,626	73.2%	74,880,002	71.6%	62,202,841	69.8%	58,064,380	80.3%	99,782,379	81.9%	129,945,517	83.4%	178,241,117	82.6%	78.7%
Habitat Alternative 8a	Closed		0.0%		0.0%		0.0%		0.0%	Confidential		Confidential		Confidential		0.1%
	Open	102,366,565	100.0%	104,643,384	100.0%	89,143,646	100.0%	72,278,364	100.0%	Confidential		Confidential		Confidential		99.9%
Habitat Alternative 8b	Closed	4,289,300	4.2%	3,418,259	3.3%	4,162,249	4.7%	3,868,560	5.4%	3,570,717	2.9%	2,264,058	1.5%	1,939,963	0.9%	2.7%
	Open	98,077,264	95.8%	101,225,124	96.7%	84,981,397	95.3%	68,409,804	94.6%	118,288,150	97.1%	153,546,647	98.5%	213,753,068	99.1%	97.3%
Habitat Alternative 9	Closed	359,091	0.4%	646,811	0.6%	1,153,541	1.3%	610,233	0.8%	35,800,370	29.4%	30,210,593	19.4%	5,766,218	2.7%	8.7%
	Open	102,007,474	99.6%	103,996,572	99.4%	87,990,104	98.7%	71,668,131	99.2%	86,058,497	70.6%	125,600,112	80.6%	209,926,813	97.3%	91.3%
GF Mortality Alternative 1	Closed	10,038,394	9.8%	14,962,785	14.3%	19,331,656	21.7%	12,534,948	17.3%	32,391,973	26.6%	34,922,680	22.4%	16,480,626	7.6%	16.3%
	Open	92,328,171	90.2%	89,680,598	85.7%	69,811,990	78.3%	59,743,417	82.7%	89,466,894	73.4%	120,888,025	77.6%	199,212,406	92.4%	83.7%
Grand Total		**102,366,565**		**104,643,384**		**89,143,646**		**72,278,364**		**121,858,867**		**155,810,705**		**215,693,031**		

8.5.4.14.2.3 Effects on incidental landings and bycatch

Habitat closures will always help to minimize bycatch, but also reduce incidental (or non-target) landings of finfish if fishing mortality targets in the remaining open areas is held constant (i.e. no effort displacement). The effects vary by species depending on the location of the proposed habitat closure relative to the distribution of the species.

The tables below summarize the percent of landings of all species from scallop dredge and trawl trips, reported as "Kept" on vessel trip reports, relative to the proposed habitat closure areas. To generalize, the habitat closures are more effective for reducing the non-target landings of finfish (and possibly discards) when the percent of total landings for a species exceeds the percent of total scallop landings affected by the proposed closure. In other words, the closure would have a greater reduction in landings of some finfish species than the comparable reduction of scallop landings.

For yellowtail flounder, a species highly vulnerable to scallop dredges, only alternatives that retain the existing groundfish closed areas (Alternatives 1 and 9) and groundfish mortality alternative 1 would be more effective at reducing yellowtail flounder landings on scallop dredge vessels than it would for reducing sea scallop landings.

Table 240. **Summary of the retrospective impact on total scallop and incidental finfish landings in 1995-2001, assuming the various habitat alternatives would have been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.**

	Gear	Area status	Prorated scallop landings (lbs.)	Percent	Cod	Haddock	Winter Flounder	American Plaice	Witch Flounder	Windowpane flounder	Yellowtail Flounder	Pollock	Redfish	White Hake
Habitat Alternative 1 (SQ;NA)	sctrawl	Closed	9,815	0.0%	0.0%	0.0%	0.0%	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Open	13,418,750	8.1%	1.9%	1.9%	4.9%	26.6%	4.4%	49.0%	7.8%	6.1%	100.0%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	13,137,575	8.0%	2.8%	0.0%	11.3%	16.2%	12.1%	12.9%	25.9%	0.0%	0.0%	0.0%
		Open	138,182,931	83.9%	95.4%	98.1%	83.8%	55.6%	83.5%	38.1%	66.3%	93.9%	0.0%	99.6%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
GF Mortality Alternative 1	sctrawl	Closed	0	0.0%	0.6%	0.0%	0.3%	2.7%	1.1%	0.0%	0.1%	0.0%	83.3%	0.0%
		Open	13,428,565	8.2%	1.3%	1.9%	4.7%	25.5%	3.3%	49.0%	7.7%	6.1%	16.7%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	24,484,472	14.9%	37.0%	75.2%	48.1%	29.8%	22.5%	21.3%	30.4%	0.0%	0.0%	0.1%
		Open	126,836,034	77.0%	61.1%	22.8%	47.0%	42.0%	73.1%	29.7%	61.8%	93.9%	0.0%	99.5%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
Habitat Alternative 3a	sctrawl	Open	13,428,565	8.2%	1.9%	1.9%	5.0%	28.2%	4.4%	49.0%	7.8%	6.1%	100.0%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	18,235,554	11.1%	35.8%	75.2%	43.0%	21.3%	9.4%	9.8%	8.4%	0.0%	0.0%	0.0%
		Open	133,084,952	80.8%	62.3%	22.8%	52.0%	50.5%	86.2%	41.2%	83.9%	93.9%	0.0%	99.6%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
Habitat Alternative 3b	sctrawl	Open	13,428,565	8.2%	1.9%	1.9%	5.0%	28.2%	4.4%	49.0%	7.8%	6.1%	100.0%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	18,250,227	11.1%	35.8%	75.2%	42.9%	21.4%	9.3%	9.8%	8.4%	0.0%	0.0%	0.0%
		Open	133,070,279	80.8%	62.3%	22.8%	52.1%	50.4%	86.3%	41.2%	83.9%	93.9%	0.0%	99.6%

	Gear	Area status	Prorated scallop landings (lbs.)	Percent	Cod	Haddock	Winter Flounder	American Plaice	Witch Flounder	Windowpane flounder	Yellowtail Flounder	Pollock	Redfish	White Hake
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
Habitat Alternative 4	sctrawl	Open	13,428,565	8.2%	1.9%	1.9%	5.0%	28.2%	4.4%	49.0%	7.8%	6.1%	100.0%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	12,050,943	7.3%	28.1%	74.9%	34.7%	19.2%	6.7%	9.8%	5.3%	0.0%	0.0%	0.0%
		Open	139,269,563	84.5%	70.0%	23.2%	60.3%	52.6%	88.9%	41.2%	86.9%	93.9%	0.0%	99.6%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
Habitat Alternative 5a	sctrawl	Closed	5,745	0.0%	0.5%	0.0%	0.4%	1.3%	0.8%	0.0%	0.0%	0.0%	83.3%	0.0%
		Open	13,422,820	8.1%	1.4%	1.9%	4.5%	26.9%	3.6%	49.0%	7.8%	6.1%	16.7%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	1,925,080	1.2%	2.6%	0.0%	2.8%	1.7%	7.8%	0.0%	1.9%	0.0%	0.0%	0.0%
		Open	149,395,426	90.7%	95.5%	98.1%	92.2%	70.1%	87.8%	51.0%	90.4%	93.9%	0.0%	99.6%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
Habitat Alternative 5b	sctrawl	Closed	130,649	0.1%	0.5%	0.0%	0.0%	1.3%	0.8%	0.0%	0.0%	0.0%	83.3%	0.0%
		Open	13,297,916	8.1%	1.4%	1.9%	5.0%	26.9%	3.6%	49.0%	7.8%	6.1%	16.7%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	18,270,768	11.1%	13.0%	0.1%	13.6%	7.0%	18.5%	1.9%	8.7%	0.0%	0.0%	0.0%
		Open	133,049,738	80.8%	85.1%	98.0%	81.5%	64.8%	77.1%	49.1%	83.5%	93.9%	0.0%	99.6%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
Habitat Alternative 5c	sctrawl	Closed	2,561	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Open	13,426,004	8.1%	1.9%	1.9%	4.5%	28.2%	4.4%	49.0%	7.8%	6.1%	100.0%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	1,893,873	1.1%	2.6%	0.0%	2.6%	0.8%	4.4%	0.6%	1.8%	0.0%	0.0%	0.0%
		Open	149,426,633	90.7%	95.5%	98.1%	92.5%	71.0%	91.2%	50.4%	90.4%	93.9%	0.0%	99.6%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**

	Gear	Area status	Prorated scallop landings (lbs.)	Percent	Cod	Haddock	Winter Flounder	American Plaice	Witch Flounder	Windowpane flounder	Yellowtail Flounder	Pollock	Redfish	White Hake
Habitat Alternative 5d	sctrawl	Closed	54	0.0%	0.5%	0.0%	0.0%	19.4%	0.8%	32.9%	6.2%	0.0%	83.3%	0.0%
		Open	13,428,511	8.2%	1.4%	1.9%	5.0%	8.8%	3.6%	16.1%	1.6%	6.1%	16.7%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	1,660,685	1.0%	2.7%	0.0%	2.9%	1.3%	6.3%	0.0%	2.3%	0.0%	0.0%	0.0%
		Open	149,659,821	90.8%	95.4%	98.1%	92.1%	70.5%	89.3%	51.0%	89.9%	93.9%	0.0%	99.6%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
Habitat Alternative 6	sctrawl	Open	13,428,565	8.2%	1.9%	1.9%	5.0%	28.2%	4.4%	49.0%	7.8%	6.1%	100.0%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	841,505	0.5%	1.8%	0.0%	1.4%	1.4%	2.1%	2.9%	0.5%	0.0%	0.0%	0.0%
		Open	150,479,001	91.3%	96.3%	98.1%	93.6%	70.4%	93.5%	48.1%	91.7%	93.9%	0.0%	99.6%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
Habitat Alternative 7	sctrawl	Closed	1,543,471	0.9%	1.8%	1.9%	3.9%	24.7%	3.5%	45.3%	6.4%	6.1%	100.0%	0.4%
		Open	11,885,094	7.2%	0.1%	0.0%	1.0%	3.5%	0.9%	3.7%	1.4%	0.0%	0.0%	0.0%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	32,276,407	19.6%	15.7%	70.3%	24.5%	33.7%	34.6%	6.5%	17.6%	0.0%	0.0%	3.2%
		Open	119,044,099	72.3%	82.5%	27.8%	70.5%	38.1%	61.0%	44.5%	74.6%	93.9%	0.0%	96.4%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
Habitat Alternative 8a	sctrawl	Open	13,428,565	8.2%	1.9%	1.9%	5.0%	28.2%	4.4%	49.0%	7.8%	6.1%	100.0%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	123,875	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	2.5%	0.0%	0.0%	0.0%	0.0%
		Open	151,196,631	91.8%	98.1%	98.1%	94.9%	71.8%	95.6%	48.5%	92.2%	93.9%	0.0%	99.6%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
Habitat Alternative 8b	sctrawl	Open	13,428,565	8.2%	1.9%	1.9%	5.0%	28.2%	4.4%	49.0%	7.8%	6.1%	100.0%	0.4%

	Gear	Area status	Prorated scallop landings (lbs.)	Percent	Cod	Haddock	Winter Flounder	American Plaice	Witch Flounder	Windowpane flounder	Yellowtail Flounder	Pollock	Redfish	White Hake
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	4,031,436	2.4%	19.0%	0.0%	9.4%	3.9%	2.1%	4.7%	1.1%	0.0%	0.0%	0.0%
		Open	147,289,070	89.4%	79.1%	98.1%	85.7%	67.9%	93.5%	46.3%	91.1%	93.9%	0.0%	99.6%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
Habitat Alternative 9	sctrawl	Closed	9,815	0.0%	0.0%	0.0%	0.0%	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Open	13,418,750	8.1%	1.9%	1.9%	4.9%	26.6%	4.4%	49.0%	7.8%	6.1%	100.0%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	13,148,166	8.0%	2.8%	0.3%	11.3%	16.3%	12.1%	12.9%	25.9%	0.0%	0.0%	0.0%
		Open	138,172,340	83.9%	95.3%	97.8%	83.8%	55.6%	83.5%	38.1%	66.3%	93.9%	0.0%	99.6%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**

Table 241. **Summary of the retrospective impact on total scallop and incidental finfish landings in 1995-2001, assuming the various habitat alternatives would have been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.**

	Gear	Area status	White Hake	Small Mesh species	Skates	Squid	Herring & Mackerel	Scup	Black Sea Bass	Fluke	Surf clam & Ocean quahog	Shrimp	Monkfish	Dogfish	Lobster	Tuna
Habitat Alternative 1 (SQ;NA)	sctrawl	Closed	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Open	0.4%	35.2%	3.6%	19.3%	10.4%	5.6%	65.7%	49.8%	0.0%	43.2%	1.6%	42.6%	9.7%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	0.0%	2.3%	10.8%	1.5%	14.0%	2.0%	0.1%	0.0%	0.0%	5.1%	0.0%	5.4%	20.1%
		Open	99.6%	64.8%	94.0%	69.9%	88.1%	80.3%	32.3%	50.1%	100.0%	56.8%	93.2%	57.4%	84.9%	69.3%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
GF Mortality Alternative 1	sctrawl	Closed	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.5%	0.1%	0.0%
		Open	0.4%	35.0%	3.7%	19.3%	10.4%	5.6%	65.7%	49.8%	0.0%	43.2%	1.7%	38.1%	9.6%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.1%	33.5%	6.7%	22.2%	4.6%	14.0%	2.6%	0.2%	0.0%	2.6%	13.6%	0.0%	21.7%	10.3%
		Open	99.5%	31.3%	89.6%	58.5%	85.0%	80.3%	31.7%	50.0%	100.0%	54.2%	84.8%	57.4%	68.6%	79.1%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
Habitat Alternative 3a	sctrawl	Open	0.4%	35.2%	3.7%	19.3%	10.4%	5.6%	65.7%	49.8%	0.0%	43.2%	1.7%	42.6%	9.7%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	0.0%	4.8%	0.0%	0.0%	7.3%	0.5%	0.2%	0.0%	0.0%	13.4%	0.0%	16.5%	7.6%
		Open	99.6%	64.8%	91.5%	80.7%	89.6%	87.1%	33.8%	50.0%	100.0%	56.8%	85.0%	57.4%	73.9%	81.8%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
Habitat Alternative 3b	sctrawl	Open	0.4%	35.2%	3.7%	19.3%	10.4%	5.6%	65.7%	49.8%	0.0%	43.2%	1.7%	42.6%	9.7%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	0.0%	4.9%	0.0%	0.0%	7.3%	0.5%	0.2%	0.0%	0.0%	13.4%	0.0%	16.5%	7.6%
		Open	99.6%	64.8%	91.4%	80.7%	89.6%	87.1%	33.8%	50.0%	100.0%	56.8%	84.9%	57.4%	73.9%	81.8%

	Gear	Area status	White Hake	Small Mesh species	Skates	Squid	Herring & Mackerel	Scup	Black Sea Bass	Fluke	Surf clam & Ocean quahog	Shrimp	Monkfish	Dogfish	Lobster	Tuna
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
Habitat Alternative 4	sctrawl	Open	0.4%	35.2%	3.7%	19.3%	10.4%	5.6%	65.7%	49.8%	0.0%	43.2%	1.7%	42.6%	9.7%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	0.0%	3.5%	0.0%	0.0%	7.3%	0.5%	0.1%	0.0%	0.0%	6.5%	0.0%	7.4%	0.0%
		Open	99.6%	64.8%	92.8%	80.7%	89.6%	87.1%	33.8%	50.1%	100.0%	56.8%	91.8%	57.4%	82.9%	89.4%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
Habitat Alternative 5a	sctrawl	Closed	0.0%	29.6%	0.1%	0.3%	10.2%	0.9%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
		Open	0.4%	5.6%	3.7%	19.0%	0.2%	4.8%	65.0%	49.8%	0.0%	43.2%	1.7%	42.6%	9.6%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	0.0%	5.2%	1.0%	0.0%	0.0%	0.8%	0.7%	0.9%	0.4%	1.9%	0.0%	3.7%	22.3%
		Open	99.6%	64.8%	91.1%	79.7%	89.6%	94.4%	33.6%	49.5%	99.1%	56.4%	96.4%	57.4%	86.6%	67.1%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
Habitat Alternative 5b	sctrawl	Closed	0.0%	0.3%	0.0%	0.0%	0.0%	0.1%	0.3%	0.0%	0.0%	0.0%	0.1%	0.0%	1.1%	0.0%
		Open	0.4%	35.0%	3.7%	19.3%	10.4%	5.6%	65.3%	49.8%	0.0%	43.2%	1.5%	42.6%	8.6%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	23.3%	6.2%	6.9%	4.2%	50.1%	1.6%	2.9%	0.0%	28.4%	13.2%	21.3%	15.5%	21.5%
		Open	99.6%	41.5%	90.1%	73.8%	85.3%	44.3%	32.7%	47.2%	100.0%	28.4%	85.1%	36.1%	74.8%	67.9%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
Habitat Alternative 5c	sctrawl	Closed	0.0%	29.3%	0.1%	0.3%	10.2%	0.9%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
		Open	0.4%	5.9%	3.7%	19.0%	0.2%	4.8%	65.0%	49.8%	0.0%	43.2%	1.7%	42.6%	9.6%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	7.6%	5.2%	1.0%	0.0%	0.0%	0.8%	0.7%	0.0%	0.8%	1.8%	0.0%	3.6%	32.6%
		Open	99.6%	57.1%	91.0%	79.7%	89.6%	94.4%	33.6%	49.5%	100.0%	56.0%	96.5%	57.4%	86.7%	56.8%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
Habitat Alternative 5d	sctrawl	Closed	0.0%	0.3%	0.0%	0.1%	0.0%	0.0%	0.0%	4.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

	Gear	Area status	White Hake	Small Mesh species	Skates	Squid	Herring & Mackerel	Scup	Black Sea Bass	Fluke	Surf clam & Ocean quahog	Shrimp	Monkfish	Dogfish	Lobster	Tuna
		Open	0.4%	35.0%	3.7%	19.2%	10.4%	5.6%	65.7%	45.1%	0.0%	43.2%	1.7%	42.6%	9.7%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	0.0%	0.6%	0.8%	0.0%	2.0%	0.0%	0.1%	0.0%	0.4%	2.6%	0.0%	2.6%	32.6%
		Open	99.6%	64.8%	95.7%	79.9%	89.6%	92.4%	34.3%	50.1%	100.0%	56.4%	95.8%	57.4%	87.7%	56.8%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
Habitat Alternative 6	sctrawl	Open	0.4%	35.2%	3.7%	19.3%	10.4%	5.6%	65.7%	49.8%	0.0%	43.2%	1.7%	42.6%	9.7%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.0%	0.3%	0.0%
		Open	99.6%	64.8%	96.2%	80.7%	89.6%	94.4%	34.3%	50.2%	100.0%	56.8%	97.8%	57.4%	90.0%	89.4%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
Habitat Alternative 7	sctrawl	Closed	0.4%	30.5%	3.4%	10.5%	10.4%	1.2%	11.3%	29.6%	0.0%	34.7%	0.3%	12.2%	2.7%	0.0%
		Open	0.0%	4.7%	0.3%	8.8%	0.0%	4.5%	54.3%	20.2%	0.0%	8.5%	1.3%	30.4%	7.0%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	3.2%	33.6%	14.5%	30.6%	10.4%	58.8%	4.4%	7.6%	99.8%	39.1%	24.2%	21.3%	22.9%	21.5%
		Open	96.4%	31.2%	81.8%	50.0%	79.1%	35.5%	29.9%	42.6%	0.2%	17.8%	74.2%	36.1%	67.4%	67.9%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
Habitat Alternative 8a	sctrawl	Open	0.4%	35.2%	3.7%	19.3%	10.4%	5.6%	65.7%	49.8%	0.0%	43.2%	1.7%	42.6%	9.7%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Open	99.6%	64.8%	96.3%	80.7%	89.6%	94.4%	34.3%	50.2%	100.0%	56.8%	98.3%	57.4%	90.3%	89.4%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
Habitat Alternative 8b	sctrawl	Open	0.4%	35.2%	3.7%	19.3%	10.4%	5.6%	65.7%	49.8%	0.0%	43.2%	1.7%	42.6%	9.7%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	0.0%	1.3%	0.0%	0.0%	0.0%	0.5%	0.1%	0.0%	0.0%	2.8%	0.0%	5.1%	0.0%
		Open	99.6%	64.8%	95.0%	80.7%	89.6%	94.4%	33.8%	50.1%	100.0%	56.8%	95.6%	57.4%	85.2%	89.4%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**

	Gear	Area status	White Hake	Small Mesh species	Skates	Squid	Herring & Mackerel	Scup	Black Sea Bass	Fluke	Surf clam & Ocean quahog	Shrimp	Monkfish	Dogfish	Lobster	Tuna
Habitat Alternative 9	sctrawl	Closed	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Open	0.4%	35.2%	3.6%	19.3%	10.4%	5.6%	65.7%	49.8%	0.0%	43.2%	1.6%	42.6%	9.7%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	0.0%	2.3%	10.8%	1.5%	14.0%	2.0%	0.1%	0.0%	0.0%	5.2%	0.0%	5.5%	20.1%
		Open	99.6%	64.8%	94.0%	69.9%	88.1%	80.3%	32.3%	50.1%	100.0%	56.8%	93.1%	57.4%	84.8%	69.3%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**

8.5.5 Evaluation of Habitat Impacts of Scallop Management Measures under Consideration

The following metrics are used qualitatively and quantitatively in the habitat impacts analysis of the proposed management measures in Amendment 10.

8.5.5.1 Changes in fishing effort: Days-at-sea

There are a number of factors that will affect the speed and degree of habitat recovery in areas where bottom tending mobile gear use is reduced. These include: 1) the degree, duration, and extent of fishing in the area; 2) any other anthropogenic sources of habitat disturbance (e.g., contamination of bottom sediments in coastal waters); 3) the natural disturbance regime (e.g., frequency and intensity of storms, bottom currents, etc.); 4) the type of substrate or sediment; 5) depth; 6) the type of benthic organisms that inhabit the area; and 7) the length of time that the area remains undisturbed by fishing. Improvements in habitat quality would most likely occur in areas where trawling and dredging activity was minimal to begin with and is totally eliminated, or substantially reduced; in deeper, low-energy locations not exposed to storm events or strong bottom currents; in hard-bottom areas (in shallow or deep water) that support prolific growth of large, attached epifauna, or in other bottom habitat types that provide food and cover for demersal fish; and in areas populated by benthic organisms that grow faster and reproduce quickly. For some benthic environments that have been altered by fishing activity, complete recovery could take years. For others, recovery might only take a few months. If reductions in bottom trawling activity in marginal areas are temporary and increase after a year or two as stock abundance increases, habitat recovery in certain areas may never be complete.

A useful conceptual model for understanding the relationship between changes in fishing effort and the degree of habitat modification is described in the National Research Council report on trawling and dredging effects (NRC 2002). Starting from zero fishing effort with no habitat impact, a change in fishing effort will change the degree of habitat modification, but as effort continues to increase habitat alteration reaches its maximum point and levels off even as effort continues to increase. For heavily modified habitats exposed to high levels of fishing activity, effort must be reduced substantially before any improvement in habitat quality is realized. Although there is much uncertainty regarding the relationship between fishing effort and habitat alteration at low effort levels, it is probably not linear as depicted in NRC 2002. A more realistic relationship, at least for certain habitats exposed to mobile bottom-tending gear, is curvilinear since the first few tows in an undisturbed habitat would be expected to produce the greatest relative change in habitat conditions (e.g. three-dimensional structure), with reduced effects as fishing effort increases to the point of maximum habitat modification. In this scenario, reductions in effort would have to be even more severe (approaching zero effort) in order to achieve, say, a 50% habitat recovery.

Most of the available studies of gear effects for mobile gear types used in the Northeast region examine the effects of single or multiple tows in previously fished or un-fished locations within some defined time period, with control plots in nearby undisturbed locations. There are a few studies that compare benthic communities or physical habitat features in areas exposed historically to different levels of fishing effort. One of them (Frid et al. 1999) compared periods of low, medium, and high otter trawling activity at two sites in the North Sea over a 27-year period. At the heavily-fished, mud-bottom, site, benthic organisms that were predicted to increase as fishing effort did increase in abundance, but organisms that were expected to decrease in abundance did not. At the lightly-fished, sand-bottom site, there was a correlation with primary production, but no correlation with fishing effort. In a similar study, Kaiser et al. (2000b) compared benthic communities exposed to high, medium, and low fishing intensity by otter trawls, beam trawls, toothed scallop dredges, and lobster pots in the English Channel (sand substrate) and found no significant effects of increased effort on the numbers of benthic organisms or species, but did find reductions in the abundance of larger, less mobile, emergent epifauna and increased abundance of more mobile invertebrate species, fewer larger organisms, and more smaller organisms in high effort areas. Two factors that complicate this kind of research are the effects of different habitat conditions (e.g., depth, sediment type) that may exist at low and high-effort sites, and temporal changes in environmental conditions (e.g., changes in sediment composition or water temperatures) that occur over the time period being investigated.

More direct evidence of the effects of changes in bottom fishing effort is provided by studies that relate progressive increases in disturbance to changes in benthic community structure and seafloor topography and sediment composition. Jennings et al. (2001) documented effects of increasing beam trawling activity on sand and muddy sand-bottom communities in the North Sea. Thrush et al. (1998) did the same for 18 stations (mud and sand bottom) in Hauraki Gulf, New Zealand, that were fished at varying levels of effort by otter trawls, Danish seines, and toothed scallop dredges. Unfortunately, these studies examine the combined effects of a number of gear types, including toothed scallop dredges and beam trawls, that are not used in the Northeast region of the U.S. Nevertheless, a number of significant impacts to benthic communities are identified which can probably, to some extent, be generalized to dredging and otter trawling on similar habitat types in the Northeast region. These included decreased infaunal and epifaunal biomass (North Sea), decreased densities of large epifauna, echinoderms, and long-lived surface dwellers, and increased densities of small, opportunistic species (New Zealand).

There are three experimental studies of the habitat effects of increasing otter trawling effort in commercially un-exploited areas. Two of these were performed in mud-bottom habitats, one in Sweden (Hansson et al. 2000) and the other in Scotland (Tuck et al. 1998). Another (Moran and Stephenson 2000) was conducted in Australia on sandy substrate. In the Swedish study, two tows were made per week for a year in an area closed to fishing for six years. During the last six months of the experiment, 61% of the infaunal species were negatively affected (i.e., they decreased more or increased less in the trawled sites compared to the control sites), and there were significant reductions in brittle stars (compared to a control area), but not in polychaetes, amphipods, or mollusks. In the Scottish study, multiple tows were made during a single day for 16 consecutive months in an area closed to fishing for more than 25 years. Increased bottom trawling produced door tracks, increased bottom roughness, but had no effect on sediment composition. There were significant increases in the number of infaunal species after 16 months of disturbance, but no changes in biomass or total number of individuals; community structure, however, was altered after five months and community diversity declined six months after trawling ceased. Effects on species groups varied: polychaetes increased in abundance while bivalves decreased in abundance five months after trawling began. In the Australian study, four tows made at 2-day intervals on the same area of bottom. Underwater video surveys showed that the first tow reduced the density of large (>20 cm) benthic organisms by 15% and four tows by 50%. Sainsbury et al. (1997), working in the same general area, reported that a single pass of a trawl footrope removed 89% of sponges larger than 15 cm.

Although there is some information (summarized above) that documents habitat modifications that result from increasing fishing effort by mobile bottom-tending gear, there is no corresponding evidence of the effects of progressive reductions in fishing effort on benthic marine habitats. There are, however, a number of studies that document the recovery of benthic habitats following the cessation of bottom fishing. These have been performed in areas that have been closed to various types of fishing activity, mostly by mobile bottom-tending gear. Tuck et al. (1998) monitored the recovery of a mud-bottom benthic habitat for 18 months in a closed area in Scotland after 16 months of bottom trawling and found that door tracks were still visible after 18 months, and that the infaunal community had recovered completely within the same period. This is the only directed study of recovery from simulated commercial trawling activity that has been conducted. Other observations have been made by a number of authors who have monitored the recovery of benthic habitats from single trawl or dredge tows, or following multiple tows in a single day (see section 9.3.2). Kenchington et al. (2001) did note that infaunal organisms that were reduced in abundance during one of three years of experimental fishing in a closed area on the Grand Banks had recovered by the time experimental fishing resumed a year later and Schwinghamer et al. (1998), working on the same project, noted that door tracks lasted up to a year and seafloor topography recovered within a year's time. Sainsbury et al. (1997) compared historical survey data – collected before and after commercial fishing started – to data collected in an area in Australia that remained open to trawling and another area that was closed for five years and reported increased catch rates of fish associated with large epifauna and small benthic epifaunal organisms (but not large ones) within the five-year period.

8.5.5.2 Changes in fishing effort: Area swept

The amount of sea bottom disturbed by scallop fishing depends on two factors: the amount of fishing effort and the geographic concentration of that effort. Although the lasting effects of scallop fishing on sea bottom communities and its relationship to the ecosystem require more research, the amount and distribution of that effort can be examined in much more detail than previously possible.

There are two sources of data with which to conduct an area swept analysis: day-at-sea use and VMS reports. The first source can provide a crude estimate of total area swept, as if it were laid out like a blanket (i.e. individual tows lying end-to-end and side-by-side). Applying a few simple assumptions yields a maximum estimate of the total sea floor bottom that might be disturbed by fishing. The second data source comes from the VMS units, required on nearly all limited access scallop vessels, which allow a finer estimate of actual fishing time and the potential for modeling overlapping fishing areas. These two data sources are used to hind cast approximations of swept area, based on the following assumptions.

Total dredge width is assumed to be 31 feet. Vessels are required to use dredges no more than two 15-foot dredges. The extra foot accounts for the edges of the dredge that could come into contact with the sea floor. In actuality, the average is less than this because some vessels use two 13-foot dredges and others use a single 10.5 foot dredge. Another consideration is that some of the day-at-sea use is by scallop trawl vessels that have much wider sweeps, but believed to have less impact per square foot swept by the gear.

Another assumption is that vessels fish at 4.5 knots. In actuality some vessels fish slower than this, depending on the vessel's horsepower, the size of the dredges, currents, and bottom conditions. A third factor is the amount of time fishermen has the gear on deck to haul back and dump the catch. In this exercise, the assumption is that the vessels had gear on the bottom for 22 hours per day, or approximately five minutes for haul-back, dumping the catch, and resetting the gear for an hour long tow. This assumption is probably too high for historical data, and is almost certainly too high under current conditions, but it is a conservative assumption and will overestimate the total area swept.

Processing time will increase as catches rise, because the crew cannot shuck enough scallops to keep up with the catches in the dredges. Under this condition, vessels temporarily stop fishing to maximize their shucking production. This factor is estimated in the forecast projections.

A fourth factor to take into account is the days-at-sea used to steam to the fishing grounds from port and back. This time is estimated to be roughly 3 days for an average 15-day trip, or roughly 20% of the fishing time (NEFMC 2001, Rago et al. 2000). To factor this in, 20% of a 24-hour day (4.8 hours) is subtracted from the estimated gear bottom time of 22 hours, leaving an average of 17.2 hours fishing per day. VMS-based estimates do not employ this correction, as fishing time is computed using VMS positional data.

Area swept calculations are not intended to provide meaningful data with regard to the actual impacts of fishing upon EFH. For example, it does not account for the impacts of the "first pass" of a scallop dredge vs. subsequent scallop dredge passes on a given area of the bottom. Similar to the DAS discussion above (Section 8.5.5.1), the habitat types affected and their sensitivity and recovery times are critical to understanding actual impacts on habitat, as are the effects of individual dredge or trawl tows on entire fishing grounds. At this time there is not enough information available on habitat sensitivity and recovery times to quantify impacts based upon the swept area calculation. What it can show, however, is a relative amount of area potentially impacted by scallop fishing in aggregate.

Table 242. Backcast swept area calculations based on DAS utilized from 1990-1999.

Year	Days At Sea	Hours Fished (total-17.2 hr fishing day)	Area Swept (sqft X 10^9- 31 ft dredge width)	Area Swept (nm^2)
90	41191	708485.2	600.5	16,266.0
91	42122	724498.4	614.1	16,633.7
92	42670	733924	622.1	16,850.1
93	34469	592866.8	502.5	13,611.5
94	28223	485435.6	411.5	11,145.0
95	28446	489271.2	414.7	11,233.1
96	29730	511356	433.4	11,740.1
97	29532	507950.4	430.5	11,662.0
98	25441	437585.2	370.1	10,046.5
99	24720	425184	360.4	9,761.7

This analysis estimates total area swept, as if no scallop fishing tows overlap and is simply an estimate of total bottom contact time, a product of days fished and fishing time per day (which is affected by the crew shucking capacity). It does not take into account the distribution of that effort or where it occurs, because the necessary data for that type of analysis is only available from VMS monitoring since 1998. A more detailed analysis of this is given in Section 8.5.7.2.1.1 and the total area swept by the fishery is estimated in one nautical mile square blocks, which are characterized by their association with underlying sediment maps and with EFH designations. The area swept or footprint of the fishery is about ¼ to ½ of the total area swept calculations using the method in this section.

8.5.5.3 Changes in fishing effort: Vessel trip report data

VTR data is used throughout the habitat analysis to establish baseline levels of otter trawl and clam dredge intensity. In areas where Amendment 10 management measures will influence the frequency and intensity of scallop vessel effort, but not prohibit fishing effort by other gear types, it is important to understand the potential magnitude of the impacts of otter trawls on traditional scalloping bottom and scallop EFH.

The dataset includes all trips not reported to occur on land or in waters outside of the Northwest Atlantic. Spatial data errors such as reporting the latitude and longitude of a vessel's homeport (instead of fishing area), reporting inaccurate positions, and data entry errors are assumed to be random and, due to the large sample size, are not likely to bias the magnitude and direction of these data. However, at the individual trip level high levels of inaccuracy have been noted. Additionally, the VTR data format requires vessel captains to chose one latitude/longitude or, more commonly, set of loran TD lines (time delay lines) to summarize an entire multi-day fishing trip. Therefore, the area reported may or may not be a close approximation of the area in which the majority of a fishing trip has occurred. No formal studies have been conducted to determine the extent of any inaccuracies within this data set.

8.5.6 Practicability Analysis

The legal EFH provisions state that each FMP shall identify and "minimize to the extent practicable adverse effects on such habitat caused by fishing…" In this context "practicable" was interpreted to man "reasonable and capable of being done in light of available technology and economic considerations."

The EFH regulations at 50 CFR 600.815(a)(2)(iii) provide guidance on evaluating the practicability of management measures:

> *"In evaluating the practicability of the identified habitat management measures, Council should consider the nature and extent of the adverse effect on EFH and the long and short-term costs and benefits of potential management measures to EFH, associated fisheries and the nation consistent with national standard 7. In determining whether management measures are practicable, Councils are not required to perform a formal cost/benefit analysis."*

A practicability analysis of EFH measures in a fisheries management plan is supposed to weigh the economic and social costs (and benefits) against the benefits to habitat of EFH protections. However, the ecological costs and benefits (of taking or not taking action) are substantially harder to evaluate. In essence, the benefits of specific actions to protect or restore habitat are not all readily quantifiable in the same units as the costs (dollars). It is therefore very difficult to make direct quantitative comparisons and hence give specific quantified answers to questions of practicability. This is in part due to uncertainty in the direct effects of fishing gears on habitat function and the lack of information on the relationships between habitat function and the productivity of managed and non-managed species. This uncertainty and lack of information is both a consequence of and exacerbated by the complexities of the ecological relationships and processes involved.

8.5.6.1 Assessing Practicability

There is no preferred methodology for conducting the practicability analysis. Therefore, the Habitat Technical Team and members of the Scallop PDT have worked together to combine habitat, economic, and social analysis of the habitat alternatives to determine their overall practicability. The habitat closed area alternatives have been analyzed in a more quantitative fashion by incorporating habitat, economic, and social information described in earlier sections of the document. The non-closed area habitat alternatives are analyzed in a more qualitative manner. This analysis synthesizes some of the conclusions from the habitat analysis, the socio-economic impact analysis, the biological and ecological impacts, as well as issues such as compliance with National Standards or MSA in general that are described in other parts of the document.

Specific practicability factors relevant to the EFH Final rule requirements were used to determine if each action is reasonable and capable of being done in light of available technology and economic considerations, and will not impose unreasonable burdens on the fishing industry. Four primary components have been extracted from the full analysis to assess the practicability of the habitat management alternatives.

Table 243. **Description of four primary analytical components used to determine practicability.**

Practicability Factor	Relevance to 50 CFR 600.815(a)(2(iii)	Description
Net economic change to fishery	The long and short-term costs and benefits of potential management measures to **associated fisheries and the nation**	Industry-level impacts to scallop, groundfish, monkfish and other fisheries
Equity of potential costs among communities	The long and short-term costs and benefits of potential management measures to **fishing communities**	Short-term impacts on coastal subregions
Differences in EFH Value	The nature and extent of the adverse impact on EFH and the long and short-term costs and benefits of potential management measures to **EFH (direct impacts)**	Directionality of change in amount and type of area, vulnerable or adversely impacted EFH and complex sediment types
Population effects and ecosystem changes	The long and short-term costs and benefits of potential management measures to **EFH (indirect impacts)**	Directionality of change in amount and type of important species guilds and species assemblages as indicated by analysis

8.5.6.2 Assessing Practicability with Limited Information

According to information included and evaluated in this document (see Gear Effects Evaluation, Vulnerability of EFH to Bottom-Tending Fishing Gears, and Adverse Impact Determination Sections), there is some understanding in the Northeast U.S. that a relationship exists between the type and intensity of fishing and effects on habitat. For some species, there is also some understanding of the links between exploited populations and habitat in terms of ecological functions. However, there is little or no understanding of how habitat degradation (past, present and future) affects the productivity of managed species populations. According to a provisional framework outlined in Auster (2001), it would seem that the types of management measures needed for preventing, mitigating, or minimizing adverse effects of fishing on EFH are a mixture of preventative and corrective measures and the precautionary approach. The types of actions the author suggests be taken under each of these approaches are as follows:

Preventative approach: restrict effort or gear or use no-take marine protected areas (MPAs) to minimize effects of particular gear types on particular habitats.

Corrective approach: Adjust boundaries or change management measures on the basis of data on habitat recovery and links to population dynamics.

Precautionary approach: Designate no-take MPAs to protect long-lived and sensitive species in areas that do or potentially contain such taxa.

The Council will be considering similar issues and approaches in the upcoming Omnibus Habitat Amendment #2. Additionally, the Council's MPA Committee will be developing a policy and approach to MPAs for the Council's consideration in the near future.

8.5.6.3 Results

8.5.6.3.1 Area Closure-Based Alternatives

This analysis synthesizes some of the conclusions from the habitat analysis, the socio-economic impact analysis, the biological and ecological impacts, as well as issues such as compliance with National Standards or MSA in general that are described in other parts of the document. Six primary components have been pulled out of the full analysis. This information will feed into the analysis of the Practicability Factors.

8.5.6.3.1.1 Net Economic Change to Fishery

The retrospective impact on yield was analyzed in Section 8.5.4.14.2 by including the percent of effort, landings, and revenues that would have been affected by habitat closed area alternatives as compared to historic scallop distribution and area management policies. A projected impact on yield was included to analyze the overall landings that are projected to be harvested if the habitat closed areas are implemented with the Preferred Area Access Alternative 1 (Section 8.2.6). A projected impact on producer surplus was performed (Section 8.7.4.5) to estimate the gross profit (un-adjusted for fixed costs) for the entire scallop fleet if the habitat closed areas are implemented combined with all four access alternatives. Net benefits were estimated to assess the overall impact to the nation (a summation of total producer surplus and consumer surplus).

Retrospective Yield Evaluation

Analyzing the retrospective yield that would have been generated from the habitat closed area alternatives is one way to evaluate the potential effort, landings, and revenues that have been generated from these areas in the recent past. Section 8.5.4.14.2 provides a detailed description of the retrospective yield analysis.

Percent of <u>Effort</u> Potentially Impacted

Table 244 and Figure 133 summarize the retrospective impact on yield based on effort. Simply averaging the percentages over time is misleading because management measures have been implemented over the years that have prevented access into portions of areas or entire alternatives. The effort data has to be based on 1998-2000 because those are the years after VMS was required. Keep in mind that this could be misleading because during these years scallop vessels were restricted from fishing in some of the areas. Therefore, the shifts in effort are heavily dependent on changes to management measures. Overall, Alternatives 1, 3a, 3b, and 9 contained more effort on average in recent years than most of the other habitat closed area alternatives.

Table 244. Percent of Retrospective Effort potentially impacted by each of the habitat closed area alternatives, assuming that the alternatives had been implemented at that time

	1998	1999	2000	Average 98-00
No Action	1.40	17.67	13.91	**10.99**
3a	16.84	9.71	12.80	**13.12**
3b	16.84	9.71	12.80	**13.12**
4	10.03	5.46	9.55	**8.35**
5a	2.11	0.88	0.62	**1.20**

	1998	1999	2000	Average 98-00
5b	10.37	9.11	0.75	**6.74**
5c	2.32	0.95	0.36	**1.21**
5d	2.18	0.63	0.52	**1.11**
6	0.90	0.56	14.24	**5.23**
7	12.17	12.95	0.09	**8.40**
8a	0.28	0.11	1.74	**0.71**
8b	4.86	2.60	13.92	**7.13**
9	1.48	17.69	15.79	**11.65**

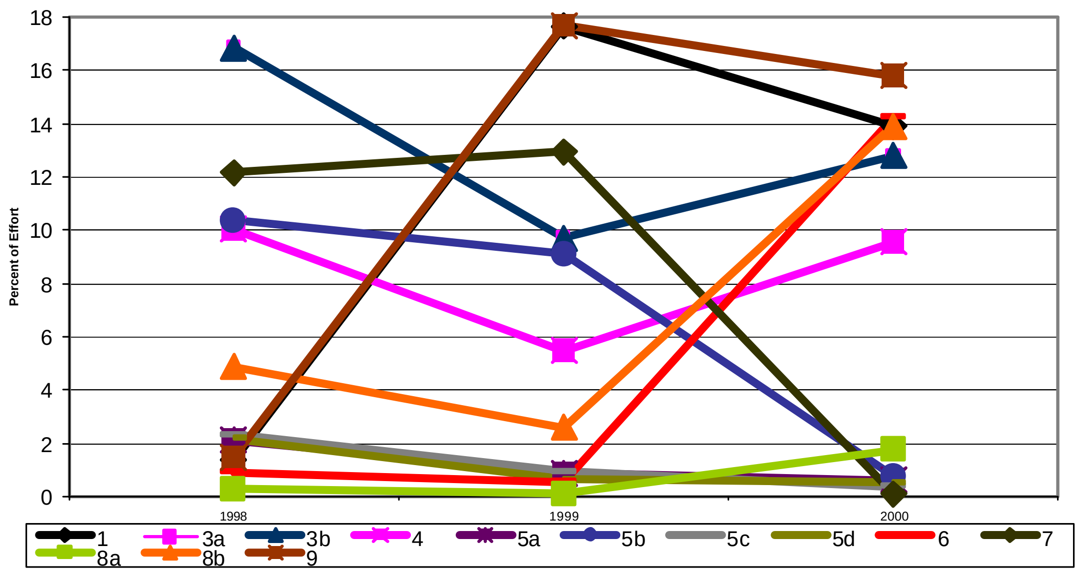


Figure 133. **Retrospective impact on total scallop effort by alternative in 1995-2001, assuming that the alternative had been implemented at that time.**

Percent of <u>Landings</u> Potentially Impacted

Table 245 and Figure 134 summarize the retrospective impact on yield based on landings. Simply averaging the percentages over time is misleading so the table and figure below highlight the changes each year. Overall, Alternatives 3a, 3b, 5b, and 7 contained the most landings on average from 1995 to 2001. Once again, trends in landings are heavily dependent on other management measures. The same data could be presented for years before the implementation of the groundfish closures, but the status of the stock was much different prior to 1995 in most areas.

Table 245. Percent of Retrospective Landings potentially impacted by each of the habitat closed area alternatives, assuming that the alternatives had been implemented at that time.

	1995	1996	1997	1998	1999	2000	2001	Average 95-01
No Action	0.3	0.6	1.3	0.8	27.5	17.3	2.6	**7.2**
3a	6.8	10.2	14.5	17.6	11.0	16.2	7.3	**11.9**
3b	6.8	10.2	14.5	17.6	11.0	16.2	7.3	**11.9**
4	4.7	7.0	10.1	10.9	6.0	13.0	3.7	**7.9**
5a	1.0	2.0	2.6	1.7	0.8	0.1	1.3	**1.4**

	1995	1996	1997	1998	1999	2000	2001	Average 95-01
5b	13.6	15.4	17.8	8.9	7.1	8.0	11.1	**11.7**
5c	1.0	1.9	2.3	1.5	0.8	0.2	1.3	**1.3**
5d	1.0	1.8	2.6	1.8	0.4	0.1	0.9	**1.2**
6	0.2	0.5	1.0	0.6	0.7	0.5	0.4	**0.6**
7	26.1	27.2	29.8	19.3	17.6	15.8	17.6	**21.9**
8a	0.0	0.0	0.0	0.0	Conf	Conf	Conf	**0.0**
8b	3.5	3.1	4.5	5.2	2.8	1.4	1.0	**3.1**
9	0.3	0.6	1.3	0.8	27.5	17.3	2.6	**7.2**

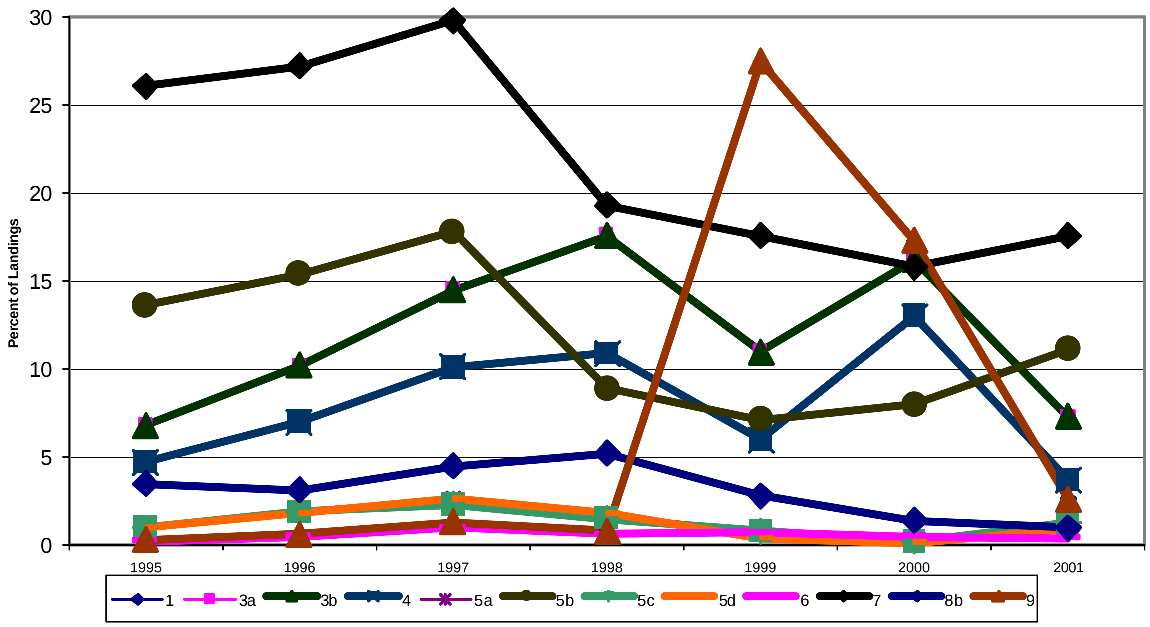


Figure 134. **Retrospective impact on total scallop landings by alternative in 1995-2001 (assuming that the alternative had been implemented at that time).**

Percent of <u>Revenues</u> Potentially Impacted

Table 246 and Figure 135 summarize the retrospective impact on yield based on revenues. Simply averaging the percentages over time is misleading so the table and figure below highlight the changes each year. For example, the percentages of revenues that have been generated from areas within Alternatives 1, 4, and 9 increased dramatically starting in 1998 because of the Georges Bank controlled access program implemented through Framework 11. Overall, Alternatives 3a, 3b, 5b, and 7 have contained the greatest amount of revenues on average compared to the other alternatives.

Table 246. Percent of Retrospective Revenues potentially impacted by each of the habitat closed area alternatives, assuming that the alternatives had been implemented at that time

	1995	1996	1997	1998	1999	2000	2001	Average 95-01
No Action	0.3	0.6	1.3	0.8	29.4	19.4	2.7	**7.8**
3a	7.7	10.9	14.9	17.9	11.6	18.0	7.4	**12.6**
3b	7.8	10.9	15.0	18.0	11.5	18.0	7.4	**12.7**

	1995	1996	1997	1998	1999	2000	2001	Average 95-01
4	5.5	7.4	10.5	11.1	6.5	14.7	3.7	**8.5**
5a	1.1	2.2	2.6	1.8	0.8	0.2	1.2	**1.4**
5b	13.5	15.9	18.0	9.0	7.2	8.3	10.5	**11.8**
5c	1.1	2.1	2.3	1.5	0.8	0.3	1.3	**1.3**
5d	1.1	2.1	2.6	1.8	0.4	0.1	0.9	**1.3**
6	0.3	0.5	1.0	0.6	0.8	0.5	0.4	**0.6**
7	26.8	28.4	30.2	19.7	18.1	16.6	17.4	**22.5**
8a	0.0	0.0	0.0	0.0	Conf.	Conf.	Conf.	**Conf.**
8b	4.2	3.3	4.7	5.4	2.9	1.5	0.9	**3.3**
9	0.4	0.6	1.3	0.8	29.4	19.4	2.7	**7.8**

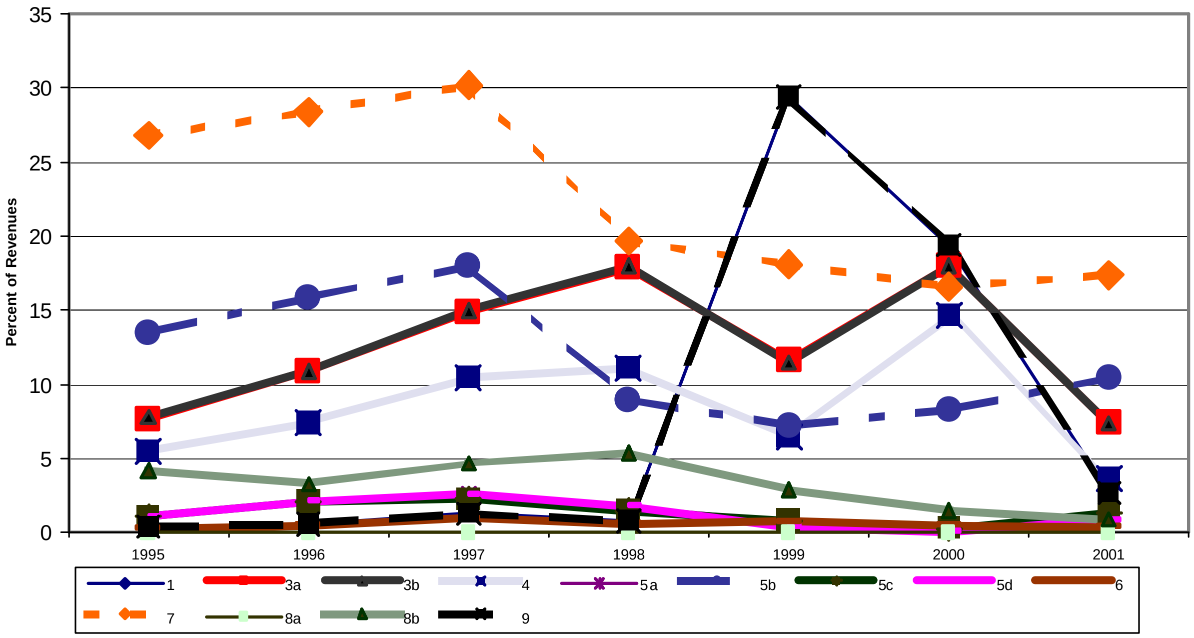


Figure 135. **Retrospective impact on total scallop revenue by alternative in 1995-2001, assuming that the alternative had been implemented at that time.**

Projected Yield Evaluation (Landings for 2004-2007)

In contrast to the retrospective analysis just described, Table 247 reports the net influence of the various habitat alternatives on the Council's preferred scallop management alternative as projected for the years 2004-2007. The last row in the table shows outcomes for the preferred alternative before taking into account the impacts of habitat measures. These values are subtracted from the options which combine the preferred alternative with each habitat alternative to show the impact of the alternative. For example, average annual landings under the preferred alternative for scallop fishery management is 43 million pounds. In contrast, when combined with Habitat Closure Alternative 3a, landings are projected to average 41 million pounds a year during 2004-2007, a net loss of 2 million pounds.

Habitat Closure Alternatives 7 (-9 million pounds) and, especially, 9 (-14 million pounds) and 1 (-17 million pounds) should have the greatest impact on landings in the short-term if these areas provide no access to the scallop fleet. Not surprisingly, these alternatives also encompass the greatest amounts of both juvenile scallop EFH and EFH for species with vulnerable EFH. The remaining alternatives reduce landings by less than 10% compared to the preferred alternative with no habitat alternative combined. Of particular interest are Habitat Closure Alternatives 3a, 3b, and 4, which encompass nearly 10% of the juvenile scallop EFH and 4-5% of the managed species EFH at a cost of only two million pounds of scallop landings.

Projected Producer Surplus (2004-2007)

The results for producer surplus are similar to landings. (Although not technically precise, producer surplus can be thought of as gross profit, i.e. revenues minus operating costs (fixed costs are not subtracted.)) Habitat Closure Alternatives 1 (assuming no access) and 9 are projected to cost industry nearly $100 million (nearly 20%) over the four years compared to the Council's preferred alternative for scallop fishery management with no habitat alternatives (not an annual average). The producer surplus for Alternative 7 would be reduced more than a $40 million over the next four years, and all other alternatives are predicted to reduce producer surplus by $12 million or less.

Projected Net Benefits to the Nation (2004-2007)

Total net economic benefits combine producer surplus with the effect of prices on consumers, i.e., consumer surplus. Once again, Habitat Closure Alternatives 1 and 9 have the greatest impact with losses approaching $250 million over 2004-2007, but in this case losses amount to about a third of the net benefits of the preferred alternative due to the large impact on consumers. Remember that this analysis assumes that Alternative 1 would not provide access into the existing groundfish closed areas. Losses from other habitat alternatives range from $5 million (alternatives 5a, 5c, 5d) to $49 million (alternative 5b) and $131 million (alternative 7) over the next four years.

Table 247. Summary of economic benefits and costs associated with closure alternatives.

Alt.	Retrospective Yield			Projected Yield (2004-2007)		Projected Producer Surplus (2004-2007)		Projected Net Benefits	
	Average % of Total Effort (98-00)	Average % of Total Landings (95-01)	Average % of Total Revenues (95-01)	Average Landings for Alternative 2 (million lbs.)	Projected yield as compared to Alternative 2	Cumulative Discounted Producer Surplus Alternative 2 (million $)	Projected PS as compared to Alternative 2	Cumulative Discounted Net Benefits for Alternative 2 PS+CS (million $)	Projected Net Benefits as compared to Alternative 2
No Action	10.99	7.2	7.8	26	-17	407	-98	522	-246
3a	13.12	11.9	12.6	41	-2	494	-11	735	-33
3b	13.12	11.9	12.7	41	-2	494	-11	735	-33
4	8.35	7.9	8.5	41	-2	494	-11	735	-33
5a	1.2	1.4	1.4	42	-1	504	-1	763	-5
5b	6.74	11.7	11.8	39	-4	493	-12	719	-49
5c	1.21	1.3	1.3	42	-1	504	-1	763	-5
5d	1.11	1.2	1.3	42	-1	504	-1	763	-5
6	5.23	0.6	0.6	40	-3	497	-8	736	-32
7	8.4	21.9	22.5	34	-9	463	-42	637	-131

Alt.	Retrospective Yield			Projected Yield (2004-2007)		Projected Producer Surplus (2004-2007)		Projected Net Benefits	
	Average % of Total Effort (98-00)	Average % of Total Landings (95-01)	Average % of Total Revenues (95-01)	Average Landings for Alternative 2 (million lbs.)	Projected yield as compared to Alternative 2	Cumulative Discounted Producer Surplus Alternative 2 (million $)	Projected PS as compared to Alternative 2	Cumulative Discounted Net Benefits for Alternative 2 PS+CS (million $)	Projected Net Benefits as compared to Alternative 2
8a	0.71	0	Conf.	42	-1	504	-1	736	-32
8b	7.13	3.1	3.3	42	-1	503	-2	758	-10
9	11.65	7.2	7.8	29	-14	407	-98	522	-246
No Action with No Access	N/A	N/A	N/A	22		365		446	
SQ with No Access	N/A	N/A	N/A	30		432		577	
Area Access Alt.1	N/A	N/A	N/A	43		505		768	

8.5.6.3.1.2 Equity of Potential Costs Among Communities

An indicator for social impacts by port will be summarized to analyze the variation of impacts across all affected ports. The synthesis of all these components, coupled with additional detail from other sections of the analysis and input from public comment will help determine the overall practicability of implementing each of the habitat closed area alternatives.

There are numerous ways to describe the potential social impacts of closed areas on ports, fishing communities etc. The overall practicability analysis has incorporated a coefficient of variance to indicate whether the potential impacts of closed areas on a community are evenly distributed throughout the entire region. For a detailed description of how this coefficient of variance indicator is determined and a summary of the overall social impacts of the alternatives refer to Section 8.8.4.1. In general, the higher the value, the more “unequal” the social impacts are distributed. Therefore, Alternative 8a has the greatest “risk” of unequal social impacts based on this analysis (Table 248). The majority of the habitat alternatives seem to have a similar value for distribution of impacts, except Alternative 7,which had a low risk of unequal social impacts because this alternative proposes to close areas throughout the range.

The overall practicability analysis focused on the relative distribution of gross sales impacts by sub-region to give an indication of how the impacts would be distributed in different regions. The gross sales impacts measures the total losses associated with a reduction in harvest landings on all industries impacted by fishing in the region (processing, transportation, etc.). The general trends of revenue impacts from each proposed alternative are described for each region (Table 247). It is very clear from this analysis that the New Bedford Area is expected to bear the majority of revenue losses for all of the alternatives, although some alternatives have a less disproportionate impact on New Bedford and other Massachusetts ports than others (See Section 8.8.4.1).

Table 248. Summary of social benefits and costs associated with each closure alternative.

Alt.	**Community Impacts** Coefficient of Variance as a measure of distribution of impacts
No Action	3.18
3a	3.43
3b	3.44
4	3.53
5a	3.89
5b	2.79
5c	3.55
5d	4.2
6	4.61
7	1.03
8a	10.55
8b	5.25
9	3.17

8.5.6.3.1.3 Differences in EFH Value

Three primary components have been incorporated in the overall habitat evaluation portion of the practicability analysis: 1) size of closed areas, 2) EFH value, and 3) amount of rocky substrate. The size/overlap component includes the area of each alternative in square nautical miles, and the percent of each alternative that occurs inside the existing groundfish closed areas. The EFH component includes per-unit-area EFH values for all species with M/H vulnerable and with only H vulnerable EFH. The substrate component of the practicability analysis includes the amount of bedrock and “gravel” (in square nautical miles) contained in each area. These two substrate types best represent “hard-bottom” habitats, which are structurally more complex and support the growth of emergent epifauna. The “gravel” substrate classification includes pebbles, cobbles, and boulders.

The area closure options range from about 150 to 65,000 square nautical miles in size (Table 249). Alternative 7 is the largest proposed closed area. The habitat closed area alternatives contain from 0.4% to 71.7% of the percent-of-total EFH values for all species with M/H vulnerable EFH. Alternative 6 contains the highest amount of total EFH for both categories. Alternatives 6, 7, and 9 contain the highest percent of EFH for all species with moderately and highly vulnerable EFH, as well as the highest percent of EFH for all species with highly vulnerable EFH. The substrate component, however, demonstrates a large disparity among the alternatives, with 3(a), 3(b), 4, 6 and 7 containing rockier substrate than the others.

Table 249. Percent of total EFH area inside each alternative for species with EFH moderately and highly vulnerable to bottom tending gear, and species with EFH highly vulnerable to bottom tending gear.

Alternative	Size of Closures	Vulnerable EFH for All Species	Highly Vulnerable EFH	Rocky Substrate
	Area closed in square nautical miles	Percent of total EFH contained in each area for all species with "highly and moderately vulnerable" EFH	Percent of EFH Area for Species with Highly Vulnerable EFH Only	Total amount of Bedrock and "Gravel" enclosed by each alternative (measured in nm^2)
No Action	5853	11.2%	10.6%	106
3(a)	2913	6.1%	6.5%	196
3(b)	2821	5.9%	6.2%	196
4	2241	5.0%	5.2%	154
5(a)	3032	6.4%	6.8%	21
5(b)	3073	6.6%	6.5%	15
5(c)	3022	6.7%	6.9%	32
5(d)	3098	5.4%	5.7%	38
6	4041	7.9%	7.6%	92
7	65,503	71.7%	69.7%	542
8a	186	0.4%	0.5%	0
8b	732	1.5%	1.7%	35
9	6254	12.1%	11.5%	129

Table 250 summarizes the effectiveness of the various closure options based upon the amount (summed area) of designated EFH they contain relative to their size. It makes sense that the larger alternatives contain more EFH because of their size; therefore the amount of EFH (in square nautical miles) was also divided by the area of each alternative (in square nautical miles) to give a measure of the relative effectiveness of each closure, in terms of EFH contained in each alternative. According to the relative effectiveness values, Alternatives 4, 5c and 8a are the most effective in protecting all adversely impacted species and life stages, while Alternative 8a is the most effective in protecting the highly vulnerable species and life stages. When looking specifically at protecting juvenile or scallop EFH, alternatives 3a, 3b 7 and 9 are the most effective. These data are provided for informational purposes. Because scallop EFH is not adversely affected by bottom-tending gear, therefore, alternatives to minimize adverse effects are not necessary. See Section 8.5.2 for a detailed description of the EFH benefits of each alternative.

Table 250. Relative Effectiveness of Habitat Closed Area Alternatives in Protecting EFH for Two Categories of Species and Life Stages

Alternatives	Species with EFH Medium/Highly Vulnerable	Species with EFH Highly Vulnerable Only	Juvenile or Adult Scallop EFH ***
	Sum*	Sum*	
NoAction	15.8	4.4	0.30
3a	17.3	5.3	0.21
3b	17.2	5.3	0.21
4	18.4	5.6	0.18
5a	17.4	5.2	0.01
5b	17.6	4.9	0.16
5c	18.3	5.2	0.01
5d	14.3	4.1	0.03
6**	16.0	4.4	0.11
7	9.0	2.6	0.25
8a	18.6	6.4	0.03
8b	17.4	5.7	0.08
9	15.9	4.4	0.30

**Values are EFH area (in square nautical miles) per 100 square nautical miles in each closed area summed for all moderately and highly vulnerable species and life stages, for only the highly vulnerable species and life stages, and for juvenile and adult scallop EFH..*
*** Proposed measures*
**** The relative effectiveness of each alternative in protecting juvenile or adult Scallop EFH has been included for information only since this is a Scallop action; the EFH of this species has not been deemed vulnerable to bottom tending gear for any life stages.*

8.5.6.3.1.4 Population Effects and Ecosystem Changes

Distribution of biomass by type of trophic guild and species assemblage

The EFH Final Rule stipulates that fishery management measures be evaluated in terms of their direct and indirect effects on essential fish habitat, or the direct and indirect benefits of proposed habitat protection measures in meeting the provision of the Magnuson-Stevens Act to minimize the effects of fishing on EFH. The previous section of this Practicability Analysis considered the more direct benefits of the ten proposed habitat closure alternatives on EFH. This section evaluates the indirect benefits or ecosystem effects of these closures on EFH by examining the fish communities that occupy them (Section 8.5.2).

Bottom-feeding fish accounted for most of the total biomass in all the proposed closed areas and would therefore benefit the most from management measures that minimize the adverse impacts of fishing on EFH (see Table 251). This result confirms the importance of habitat closures that protect benthic invertebrate prey populations, which are the food source for benthic-feeding fishes. Fish that feed exclusively on other bottom feeders and on plankton were more abundant in the four Alternative 5a, 5d and 7 options. Species and sizes of fish that feed on shrimp and smaller fish are highest in Alternative 6 but are also important components of the fish fauna in Alternatives 3a, 3b, 4 and 7.

Principal groundfish species (cod, haddock, redfish, pollock, two species of hake, and five species of flounder) accounted for a greater proportion of the finfish biomass in alternatives 3a, 3b and 4 but were also important components of the fauna in proposed closures 6, 8a, 8b and 9. These species made up a relatively small percentage of the fish biomass in the Alternatives 5a-d. A large group (many species) of demersal (bottom-dwelling) finfish species accounted for about 50% of the fish biomass in all the alternatives.

These results indicate that habitat closed areas would be practicable as management measures to protect assemblages of bottom-feeding and bottom-dwelling finfish, especially alternatives 3a, 3b, 4 and 6. Fish populations in the four Alternative 5 closures were ecologically more diverse and included pelagic as well as demersal species.

Table 251. Percent composition of total biomass (summed mean wt/tow by ten minute squares of latitude and longitude) within each proposed habitat closed area for three trophic guilds and two species assemblages during 1995-2001.

Alt.	Trophic Guilds[89]			Species Assemblages[90]	
	Bottom Feeders	Amphipod Feeders	Shrimp & Fish Eaters	Principle Groundfish	Demersal Finfish
No Action	38%	17%	19%	16%	49%
3(a)	42%	11%	24%	22%	49%
3(b)	42%	11%	23%	21%	49%
4	43%	11%	23%	22%	49%
5(a)	26%	14%	17%	11%	47%
5(b)	33%	14%	6%	9%	47%
5(c)	32%	15%	9%	11%	47%
5(d)	28%	8%	12%	11%	45%
6[91]	36%	14%	26%	15%	49%
7	24%	6%	23%	10%	49%
8a	46%	16%	2%	15%	49%
8b	43%	19%	2%	17%	50%
9	36%	16%	24%	17%	49%

8.5.6.3.2 Non-Area Closure-Based Alternatives

The practicability analysis of the non-closure habitat alternatives is qualitative in nature. Overall the practicability of these alternatives is described in Table 252. After public comment the practicability analysis of these alternatives will be completed.

Table 252. Assessment of non-closed area habitat alternatives based on habitat benefits and social and economic costs of the measures.

Alternative	Assessment of non closed area habitat alternatives based on habitat benefits and social and economic costs of the measures
2	Neutral
10	Neutral to slightly negative
11	Slightly positive

[89] *Two guilds and three assemblages not shown.*
[90] *Two guilds and three assemblages not shown.*
[91] Proposed measure

Alternative	Assessment of non closed area habitat alternatives based on habitat benefits and social and economic costs of the measures
12	Negative
13	N/A

8.5.6.4 Overall Discussion of Practicability

The impacts of other habitat alternatives compared to the Status Quo and No Action would be sizeable, but not as large as the comparison to Alternatives 2, 11 and 12.

8.5.6.4.1 Alternative 1 (Section 5.3.4.1)

Net economic change to fishery / Equity of potential costs among communities

Although the status quo alternative does seem to contain some EFH in the region, it may not be the most effective way to protect habitat. However, this alternative does not require additional regulatory burden on the fishing community since the same measures would be in place as in fishing year 2001. It is not expected that the industry or fishing dependent communities would be impacted in any additional way from the status quo habitat alternative. In fact, this alternative may be more practical than some of the other habitat alternatives because less ocean bottom would be closed, causing potentially less social and economic consequences. This alternative may be practical in the short term in terms of implementation, but may be less practical in the long term in regards to effectiveness of habitat protection.

Based on the results of the overall practicability analysis, Alternative 1 contains a significant amount of EFH and retrospective yield of sea scallops. When this alternative is combined with the Preferred Alternative (Area Access Alternative 1), the projected loss of landings, producer surplus, and Net benefits are significantly more than the other alternatives. This is important because the analysis assumes no access in any of the areas, which has not been the case for the last several years. According to the community impacts analysis, the distribution of impacts on fishing communities are relatively the same as the other habitat alternatives.

Differences in EFH Value / Population effects and ecosystem changes

Based on analysis from the habitat metric approach, habitat benefits are derived from the status quo measures primarily in the form of large year round area closures. It is important to keep in mind that the analysis assumed that no access would be granted to the scallop fleet into the groundfish closed areas. If some gears were permitted into the closures under the Status Quo/ No Action alternative, then the habitat benefits would be reduced. The status quo alternative does seem to contain some EFH, but not as effectively as many of the other habitat closed area options. Although the biomass and EFH of many species are most likely contained within these areas, when the overall sum is scaled for area, the habitat "strength" of this alternative is reduced.

This alternative does not minimize the adverse impacts of the scallop fishery on EFH. Therefore, the Council has determined that this alternative is not practicable.

8.5.6.4.2 Alternative 2 (Section 5.3.4.2; also proposed action in Section 5.1.6.1)

Net economic change to fishery / Equity of potential costs among communities

This alternative appends no further costs to industry or management beyond those required of the management measure in question.

Differences in EFH Value / Population effects and ecosystem changes

Alternative 2 includes the habitat protection components inherent in the non-habitat protection alternative and the Council has determined that the non-habitat alternatives chosen for implementation in Amendment 10 will help to minimize adverse effects on EFH to the extent practicable.

Summary

The Council selected to implement Habitat Alternative 2 (a preferred alternative in the DSEIS). The Council discussed the practicability of the alternatives to minimize adverse effects of fishing on EFH and concluded that Habitat Alternative 2, which relies on the habitat benefits derived from the other Amendment 10 measures to meets the SFA mandate, was practicable.

Alternative 2 is clearly practicable. The Council discussed the idea that the area swept reductions seen under the analysis bolster the argument for Alternative 2. Although not as high a reduction as under the proposed overfishing definition, the analysis shows some reduction in area swept under status quo overfishing definition.

8.5.6.4.3 Alternative 3 (Section 5.3.4.3)

Net economic change to fishery / Equity of potential costs among communities

Closing more area for fishing will most likely negatively impact the industry. Based on the results of the overall practicability analysis, these two alternatives contain a significant amount of retrospective yield. The distributions of impacts on fishing communities are relatively the same as the other habitat alternatives. Both the groundfish and other fishery revenue losses are significant for these alternatives, assuming no displacement. These alternatives may be less beneficial in the short term because they require additional closures, which could be a regulatory burden and additional cost to the industry.

Differences in EFH Value / Population effects and ecosystem changes

Alternative 3 contains modifications of the boundaries of existing groundfish closed areas. According to the overall habitat metric analysis, alternative 3a and 3b rank relatively high. Compared to the other habitat closed area alternatives, these closures seem to contain a variety of habitat types, EFH, and biomass of defined guilds and aggregations.

Habitat Alternative 3a and 3b are areas intended to protect more complex and sensitive bottom, therefore these closures may be more practicable from an ecological and biological standpoint for habitat protection. Furthermore, the majority of these areas are enclosed in existing year-round closures, so the additional closures may not be as burdensome on the industry as closing entirely new areas. However, this alternative does close more ocean bottom to fishing, so there may be economic losses for vessels that have less fishing opportunities, especially id these additional areas are critical ones. Overall, both alternatives 3a and 3b are beneficial from a habitat standpoint because they add significantly more sensitive habitat protection from relatively small additional closures. More bedrock, gravel, and gravelly sand are contained under these alternatives. Furthermore, over 75% of Alternative 3(a) and 3(b) contain juvenile cod and haddock EFH, which are important species to protect because of their high vulnerability and reliance on complex bottom.

Summary

Alternative 3 includes the closure of the Great South Channel, which is impracticable due to the dramatic social and economic impacts. Further, the equity of impacts is uneven and is focused mainly in the New Bedford, MA port. Due to the significant revenue losses to the scallop fishery, the groundfish fishery and other fisheries, the Council has determined that this alternative is not practicable.

8.5.6.4.4 Alternative 4 (Section 5.3.4.4)

Net economic change to fishery / Equity of potential costs among communities

Closing more ocean bottom to fishing does impact the industry and this needs to be considered when determining the practicality of implementing this alternative. This alternative contains a significant amount of retrospective yield, but less than Alternatives 3a and 3b. The distribution of impacts on fishing communities is relatively the same as the other habitat alternatives. The potential revenue losses are also slightly less that Alternatives 3a and 3b. This alternative may be less beneficial in the short term because it requires additional areas to be closed, which could be a regulatory burden and additional cost to the industry.

Differences in EFH Value / Population effects and ecosystem changes

Alternative 4 contains a significant amount of sensitive habitat and EFH. Alternative 4 may also have long-term habitat benefits for reasons explained under Alternative 3; both alternatives add closed bottom in close proximity to existing closed areas. Habitat Alternative 4 ranked relatively high in all the habitat metric components except for Aggregation. This scenario consistently seems to contain more sediment types, EFH, and biomass of defined species according to the habitat metric analysis. About 18% of gravelly sand in the Northwest Atlantic analysis area is contained under this alternative as well as over 25% of gravel. Furthermore, several key species have high percentages of EFH contained within this closure. For example, 76% of the area has juvenile cod EFH within the boundaries, 43% has juvenile halibut EFH, 59% has juvenile Pollock EFH, and 85% of the area contains EFH for red fish.

Summary

Alternative 4 was deemed impracticable because it is inconsistent with the rotational management areas as they overlap the boundaries of Alternative 4. The Council expressed concern of implementing an area-based rotational management scheme with these areas closed as habitat closures. Due to the significant revenue losses to the scallop fishery, the groundfish fishery and other fisheries, the Council has determined that this alternative is not practicable.

8.5.6.4.5 Alternative 5 (Section 5.3.4.5)

Net economic change to fishery / Equity of potential costs among communities

From a regulatory standpoint, this alternative may present some issues because there are several alternatives that close areas in the Mid-Atlantic bight, which may not be necessary to protect New England species. Furthermore, these areas are high-energy sand environments that recover rapidly from impacts. Additionally, the Mid-Atlantic Council has determined that it is not necessary to implement year-round closures in the Mid-Atlantic bight to protect species managed by the Mid-Atlantic. Qualitatively speaking, the costs associated to the industry for closing these additional areas outweighs the habitat benefits associated with closing these areas. Compared to Alternatives 5a, 5c, and 5d, Alternative 5b generates greater losses in projected yield, producer surplus, and Net benefits when combined with the Preferred Alternative. Furthermore, Alternative 5b generates greater potential losses in groundfish, scallop, and "other fishery" revenues if those areas were closed. On the other hand, Alternatives 5a and 5b contain areas that would cause more revenue losses for the Monkfish fishery, assuming no displacement.

Differences in EFH Value / Population effects and ecosystem changes

When the alternatives are scaled for area, the habitat benefits generated from the four scenarios under alternative 5 are reduced because these alternatives close more ocean bottom than most of the other habitat alternatives. There was significant variety between the results of these alternatives in the overall habitat metric analysis. For example, Alternative 5c ranked first in the EFH component, and almost last in the Guild component.

As stand-alone alternatives, these four alternatives contain less complex bottom (bedrock and gravel). Since impacts to this type of habitat has been shown to be of the highest concern (NEEFHSC 2002, NRC 2002) and the stocks of many species that depend on these habitats are overfished, this is considered one habitat type that is very important to protect. Alternatives 5a-5d contained less EFH than some of the other alternatives, however Alternative 5b does contain a significant amount of juvenile scallop EFH.

Summary

Alternative 5 was thought to be impracticable due to the inequity of social and economic impacts in the ports of Provincetown, MA, Chatham, MA, and Gloucester,MA. Due to the significant revenue losses to the scallop fishery, the groundfish fishery and other fisheries, the Council has determined that this alternative is not practicable.

8.5.6.4.6 Alternative 6 (Section 5.3.4.6; also proposed action in Section 5.1.6.2)

Net economic change to fishery / Equity of potential costs among communities

This alternative is completely contained within existing closed areas, thus would not require closing any new areas. Based on the overall practicability analysis, this alternative negative effects the projected yield, producer surplus, and net benefits. When combined with the Preferred alternative, this habitat alternative generates slightly more losses in projected yield, producer surplus, and net benefits than most of the other habitat alternatives. This is the only alternative that does not have significant revenue losses for the groundfish, monkfish, scallop, or "other fishery" categories. This is intuitive since most of this area was not accessible to these fisheries in 2001. This alternative may be beneficial in the short term in terms of implementation, but may be less practical in the long term in regards to effectiveness of habitat protection. It is impracticable to eliminate all future access to these areas by scallop dredge gear and not to other gears that adversely effect EFH.

Differences in EFH Value / Population effects and ecosystem changes

Habitat Alternative 6 includes the access areas from the Controlled Area Access Program in Framework 13 for scallops. This alternative closes more ocean than most of the other stand-alone habitat closed area alternatives. However, under Alternative 6 habitat closures are entirely contained within the existing year round groundfish closed areas. According to the sediment metric analysis, this alternative contains a significant amount of gravel and gravelly sand, but still not as much as Alternative 4 or 3. Based on the overall practicability analysis, this alternative does not score as well in the EFH components. According to the overall habitat metric analysis, this alternative ranks very high for the guild and aggregate component.

This alternative will help to minimize the adverse impacts of the scallop fishery on EFH. Additionally, because it closes areas that are already within existing groundfish closed areas only and allows for the potential access of Framework 13 scallop areas, Alternative 6 will not incur as high a burden on the fishery. Therefore, the Council has determined that this alternative is practicable.

Summary

Critical and sensitive habitats occur within these area boundaries and protection of these areas from fishing with scallop gear will allow continued habitat recovery in these areas, particularly when other bottom tending mobile gear are prohibited to promote groundfish rebuilding and to protect groundfish spawning activities. Under the present management circumstances, selection of these closures for habitat protection carries little cost as long as the groundfish closed areas apply to scallop fishing. If other areas are later identified to be better areas for habitat protection by closure to various types of fishing gear, the costs of the habitat closures under this alternative would be much higher and subject to re-evaluation by the Council.

In terms of EFH protection, the percent of total vulnerable EFH in Alternative 6 ranks higher than most of the other alternatives, excluding habitat alternatives 7 and 9. However, because this area is larger than most of the other alternatives (except for habitat alternatives 7 and 9), this alternative ranks lower than most when the EFH values are scaled for area. It is less "effective" than alternatives 3, 4, 8, and 5a-c in terms of EFH value per nautical mile. Alternative 6 contains high amounts of biomass for three bottom-feeding trophic guilds which is an important indication of what species live in this area, and how many. For example, more benthivore biomass (species that eat from the ocean bottom) is contained in Alternative 6 than any of the other alternatives, except for habitat alternatives 7 and 9. In terms of the sediment composition, over 60% of the area in this closure alternative is composed of sandy bottom. And although habitat alternative 6 is a small part of the total area under management, 2.3% of the proposed habitat closed area is made up of gravel and comprises a significant portion (17%) of the total amount of gravel sediment substrates in the Northwest Atlantic Analysis Area.

The Council determined that Habitat Alternative 6 is practicable and selected to implement this alternative in Amendment 10 for the following reasons:

- Because these areas had already been defined and used as closed areas, this alternative would minimize any re-distribution of impacts which would help gain widespread acceptability among stakeholders.

- Closing areas within the boundaries of existing groundfish closed area would help build on the habitat protection benefits that had been provided to date by the these areas by clarifying and elevating the intent of the closures to protect essential fish habitat (habitat closures).

- While the closures include some productive scallop fishing areas and areas of relatively low habitat value (e.g. high energy sandy environments), these closures also protect a substantial amount of complex bottom in the Gulf of Maine (WGOM closure) and George's Bank (Closed Area II north of the 72°30' N latitude and the northern and southern thirds of Closed Area I). This is accomplished by converting a large portion of the current year round groundfish closed areas into modified Level 3 habitat closures (closed indefinitely to scallop dredge gear).

- Uncertainty over the efficacy of closing large areas, given the uncertainties about benefits v. costs, optimal location of areas, distribution of impacts, and the difficulty of re-opening the areas if they are not optimal. The Council is initiating action on an omnibus habitat amendment that will strive to integrate habitat protection across all plans and to explore other approaches using new data to develop better habitat alternatives.

- Closing any additional areas could be costly and imprudent, until the Council takes action under Amendment 13 to the Northeast Multispecies FMP. Additionally, the Council believes that Amendment 10 and Amendment 13 will implement measures to meet plan objectives, rebuild fishery stocks, while meeting the Council's obligations to minimize adverse effects of fishing in the short term.

- Reducing day-at-sea use by 25% in Scallop Amendment 10 will minimize habitat impacts, which will be bolstered by the crew limits while fishing in re-opened scallop rotation areas. These scallop management measures are expected to minimize bottom contact time and projection analyses The analyses show that redistribution of intensive fishing effort in sensitive areas (measured by the EFH metrics analysis) is not significant. As such, other measures besides closed habitat areas implemented in Amendment 10 will help reduce the impacts of fishing on EFH.

- Enforcement and compliance will be supported by the coincidental boundaries of this alternative with the existing groundfish closure boundaries

8.5.6.4.7 Alternative 7 (Section 5.3.4.7)

Net economic change to fishery / Equity of potential costs among communities

Based on the overall practicability analysis, this alternative seems to generate significant losses to the industry and the nation. The distributions of impacts are distributed relatively evenly, but the benefits to habitat probably do not outweigh the costs since other gear types will be permitted in these areas.

Differences in EFH Value / Population effects and ecosystem changes

Habitat Alternative 7 proposes to close the majority of the Northwest Atlantic to scallop dredge gear only. Although this alternative provides significant protection for most species that are vulnerable to dredge gear, other bottom tending gears will still be permitted in these areas, thus compromising the overall habitat benefits. Therefore, the potential habitat benefits from this large area will not provide effective EFH protection for species with vulnerable EFH in the region.

Summary

Alternative 7 is impracticable because it includes a tremendous amount of the EEZ, which is largely comprised of sandy sediment. These areas do not experience scallop dredging and don't warrant protection. Due to the significant revenue losses and the failure of this alternative to minimize adverse impacts to EFH, the Council has determined that this alternative is not practicable.

8.5.6.4.8 Alternative 8 (Section 5.3.4.8)

Net economic change to fishery / Equity of potential costs among communities

Based on the overall practicability analysis, these alternatives do not score very high in terms of projected net benefits to the nation when compared to other habitat alternatives that potentially protect EFH.

Differences in EFH Value / Population effects and ecosystem changes

These areas are too small to provide sufficient protection for essential fish habitat. Both Alternative 8a and 8b may be too small to provide sufficient habitat protection. The potential habitat benefits from these small areas will not provide enough EFH protection for species with vulnerable EFH in the region. Furthermore, alternative 8a permits other gear types to fish within the area, which will compromise the potential habitat benefits from closing the area to scallop dredging.

Summary

Alternative 8 is impracticable due to the concern with implementing either of these closure alternatives only to scallop gear was noted. The Council acknowledges that closing these areas to scallop dredging will lead to some habitat benefit. However, since otter trawling will still be able to occur in this area, the habitat benefit will be greatly reduced. This alternative does not minimize the adverse impacts of the scallop fishery on EFH. Therefore, the Council has determined that this alternative is not practicable.

8.5.6.4.9 Alternative 9 (Section 5.3.4.9)

Net economic change to fishery / Equity of potential costs among communities

Based on the overall practicability analysis, this alternative does contain a significant amount of total EFH for species with EFH vulnerable to bottom tending gear, but the economic costs to society and the industry are higher than most of the other alternatives.

Differences in EFH Value / Population effects and ecosystem changes

Alternative 9 implements the groundfish mortality closed areas that were in place during the fishing year 2001 as habitat closures, with the addition of the Cashes Ledge closure as a year-round closures. Closing Cashes Ledge year-round may increase the habitat benefits of this alternative versus the no action alternative, but this area does not seem to provide more habitat benefit than the No action alternative (assuming no access). According to the overall habitat metric analysis, this alternative did rank slightly higher than the no action alternative in all components (excluding the aggregate component). This alternative may be practical in the short term in terms of implementation, but may be less beneficial in the long term in regards to effectiveness of habitat protections.

Summary

Alternative 9 was not practicable because it included the Framework 13 Access Areas as habitat closures. The Council believes that not allowing access to these areas is be impracticable due to the high costs that are associated with lack of access to scallops, compared to the benefits that might accrue from closing the parts of the groundfish closed areas that had been previously open for scallop fishing. Due to the significant revenue losses and the failure of this alternative to minimize adverse impacts to EFH, the Council has determined that this alternative is not practicable.

8.5.6.4.10 Alternative 10 (Section 5.3.4.10)

Net economic change to fishery / Equity of potential costs among communities

Alternative 10 may place an economic burden on industry that is disproportionate with anticipated positive impacts on habitat.

Differences in EFH Value / Population effects and ecosystem changes

Analysis concludes that this alternative may not yield the benefits intended; specifically, this alternative may not decrease fishable bottom for the scallop fishery. Furthermore, there may be serious safety concerns by the elimination or modification of rock chains, which further decrease the practicability of this alternative.

Summary

Scallop vessels using dredges often use rock chains in some areas to deflect large rocks, boulders, and other debris. It prevents damage to fishing gear, handling problems at the surface and on deck, improves safety at sea, and reduces bycatch mortality due to crushing. On the other hand, the use of rock chains allows vessels to fish in more rugged areas, having complex habitats. Controlling the use of rock chains has the potential to reduce fishing in these areas having more sensitive and vulnerable habitats. Therefore, this alternative does not minimize the adverse impacts of the scallop fishery on EFH and it places an economic cost to the industry that is not commensurate with its habitat benefits. The Council has determined that this alternative is not practicable.

8.5.6.4.11 Alternative 11 (Section 5.3.4.11; also proposed action in Section 5.1.6.3)

Net economic change to fishery / Equity of potential costs among communities

This alternative proposes to increase the dredge ring size to 4 inches throughout the range of the fishery. New requirements would be phased in to allow time for manufacturers to produce the larger dredge rings and fisherman to fit them to their gear. Short-term costs associated with the first option include potentially reduced yields. Both options have long-term benefits to industry through increased productivity and revenues.

Differences in EFH Value / Population effects and ecosystem changes

The impacts of increasing dredge ring size to 4 inches are positive to EFH. It has been observed that the bycatch of benthic organisms such as finfish, sponges, crabs, and starfish is reduced in dredges with larger rings. Reduced damage and mortality of bottom dwelling species enhances biodiversity and reduces the impact of dredging on benthic community structure. As the average size of scallops throughout the range of the fishery increases, the area swept will decrease.

Summary

Scallop research indicates that gear efficiency for a dredge outfitted with 4" rings increases by 10-15 percent for scallops over 110 mm. Particularly in areas having predominately large scallops, like a re-opened controlled access scallop rotation area, this measure will decrease bottom contact time to take the same number of scallops and achieve the fishing mortality targets. This result can help reduce habitat benefits, particularly when it reduces the 'footprint' of the fishing activity by reducing effort in areas that are fished infrequently. Four-inch dredge rings appear to be more efficient harvesters of larger (110+ mm) scallops, and long-term projections indicate that the effect will be to also improve scallop yield by about 4 to 5%. As a result of the combined effect of improving scallop yield (i.e. the fleet catching larger sea scallops) and dredge efficiency for large scallops, long-term projection indicate an reduction in area swept by 14%. Because of the long-term benefits to the industry through increased productivity and revenues and the ability to minimize adverse effects of scallop fishing on EFH from the 4-inch ring size, this alternative has been determined to be practicable.

8.5.6.4.12 Alternative 12 (Section 5.3.4.12; also proposed action in Section 5.1.6.4)

Net economic change to fishery / Equity of potential costs among communities

So far as the TAC set-aside is an approved feature of management, use of these funds for habitat research imposes no additional regulatory costs.

Differences in EFH Value / Population effects and ecosystem changes

This alternative proposes funding from the TAC set-aside for habitat research, which may benefit EFH protection in the future.

Summary

Research funded through this mechanism could identify fishing gear or methods that have fewer habitat impacts, or might be useful to identify ways that fishing is managed to minimize related habitat impacts. While there may be some benefit to habitat through the research itself, and research may result in additional bottom contact time for fishing gears, these alternatives address only mechanisms for enabling research. Under this program, however, funds and a research mechanism could become available to advance habitat research if it relates to scallop fishery management.

Research conducted under this alternative would directly benefit the habitats of the region. There are large gaps in the understanding of fishery impacts on EFH, and much research is needed. Valuable research that is currently being conducted would also likely benefit from additional funding. This alternative does not quantify the funds available specifically for habitat research. Priorities and funding will be managed by the Council in cooperation with the Scallop and Habitat Oversight Committees, according to the priorities identified in this document and as modified by future framework adjustments. Because of the insignificant cost to the industry and the potential for long-term habitat benefits, the Council has determined that this alternative is practicable.

8.5.6.4.13 Alternative 13

This alternative would integrate habitat management with area rotation. The concept is outlined and described in Section 5.3.2.7, one of the scallop area rotation alternatives. Under the alternatives, the frequency, duration, and intensity of scallop fishing in rotation management areas would be modified to minimize adverse habitat impacts. Although the concept and structure of this alternative is described in Section 5.3.2.7, specific criteria for controlling the frequency, duration, and intensity of scallop fishing have not been defined. Therefore, it is impossible to assess the social, economic and habitat costs and benefits.

Summary

Habitat impacts could vary with the frequency, duration, and intensity of scallop fishing. For example, rotation management area closures could reduce overall habitat impacts by allowing time for a more complete habitat recovery after a period of fishing. Some benthic species take longer to recolonize the bottom and restore ecological structure than it takes for scallops to grow from juveniles to an optimum size for harvest as adults. On the other hand, scallop yield loss from waiting too long to fish is small for a slightly longer closure (an additional 3-5 years, for example), but could have measureable benefits to the ecosystem. Over a longer period, the annual scallop yield loss (because scallops don't migrate) would approach the natural mortality rate, or about 20 percent per year. Very long rotation management area closures would also increase the risk of episodic, widespread scallop mortality from thermal stress or predation. Thus, habitat impacts from scallop fishing might be addressed through adjustments in area rotation strategies rather than long-term, indefinite closures described in other habitat alternatives in this section. However, because the area based management with area-specific fishing mortality targets without formal rotation (Section 5.3.2.7) was not selected for implementation in Amendment 10, it is not practicable to implement Alternative 13 at this time.

8.5.7 Environmental Consequences of Proposed Scallop Management Alternatives

8.5.7.1 No Action and Status Quo Alternatives

8.5.7.1.1 No Action Alternative

The No Action Alternative continues the provisions set forth in Amendment 7 to the Atlantic sea scallop FMP. These include DAS reductions of up to 70% by fishing year 2005 and the re-opening of the Hudson Canyon and VA/NC Areas to regular scallop fishing. The year-round groundfish closed areas continue to be closed to scallop vessels under the No Action Alternative.

DAS Reductions

Reductions in DAS may have a significant impact on benthic habitats, scallop EFH and other species' EFH. The impacts of DAS reductions on habitat, in general terms, are discussed below.

The reductions DAS and bottom contact time that would result from the no-action alternative would be substantial (Table 253). It is expected, in certain circumstances, that a 70% reduction in bottom contact time will have beneficial effects on benthic marine habitats in the Northeast region by reducing the adverse effects of fishing that are identified in this document.

The primary gear to consider in evaluating the habitat benefits of reduced days-at-sea in this fishery is the scallop dredge. Scallop dredges account for the majority of the landings in the fishery and, along with bottom trawls, have a greater impact on EFH for Northeast region species than hydraulic clam dredges (Section 7.2.6.2.4.6.3). Management alternatives included in this document would not affect fishing activities managed by other federal or state management plans

An overall reduction in scallop fishing activity throughout the range of the fishery will not uniformly reduce bottom contact time in all areas where fishing is currently taking place. Highly productive fishing grounds that remain accessible to the fleet will, in all probability, continue to be fished at high intensity while fishing effort in less productive areas declines to a much greater degree. This seems a likely scenario given the fact that fishermen concentrate their fishing activity in areas where they can maximize catch rates. Reductions in bottom contact time in marginal fishing grounds could be substantial. If these are areas that are also not exposed to much, or any, trawling activity, improvements in habitat function and value are likely.

It is not currently possible to quantify the habitat benefits of even large DAS reductions for the scallop fishery. Given that otter trawls are typically used in similar areas as scallop dredges, the effect of reduced intensity of scallop dredging effort becomes even more difficult to determine. However, evidence supports the general assumption that large reductions in DAS, as seen under the No Action Alternative, would generally improve habitat conditions for scallops and other affected resources through the reduction in the frequency and intensity of scallop dredging. In addition to a projected 78% reduction in swept area by the year 2005 (Table 253) in all areas that would remain open to scallop fishing, this alternative would result in further increases in scallop biomass and density which would improve juvenile scallop EFH by increasing the amount of hard surface area available for spat settlement. An increased density of scallops could also improve habitat for bottom fish and other organisms that find shelter from predators among scallop shells and provide substrate for epifauna that attach to scallop shells.

	No Action Alternative			
	Swept Area	DAS	Land(MT)	Biomass(MT)
2003	**5,871.8**	30,532.5	23,439.3	179,340.1
2004	**6,684.7**	30,686.0	24,566.9	183,427.3
2005	**1,281.4**	9,259.1	9,668.5	207,333.9
2006	**1,318.2**	9,285.5	9,650.2	231,301.7
2007	**1,467.2**	10,291.3	10,759.6	253,803.1
2008	**1,436.1**	10,308.5	10,867.9	275,757.8
Total:	**18,059.4**	100,363.0	88,952.4	1,330,963.8

Table 253. Projected Swept Area, DAS and Landings under the No Action Alternative.

Gear Modifications

No gear modifications are proposed under the No Action Alternative.

Groundfish Closed Areas

Under the No Action Alternative, there are no scallop access programs and scallop vessels would not be permitted to harvest scallops inside the groundfish year-round closed areas.

Scallop Closed Areas in the Mid-Atlantic

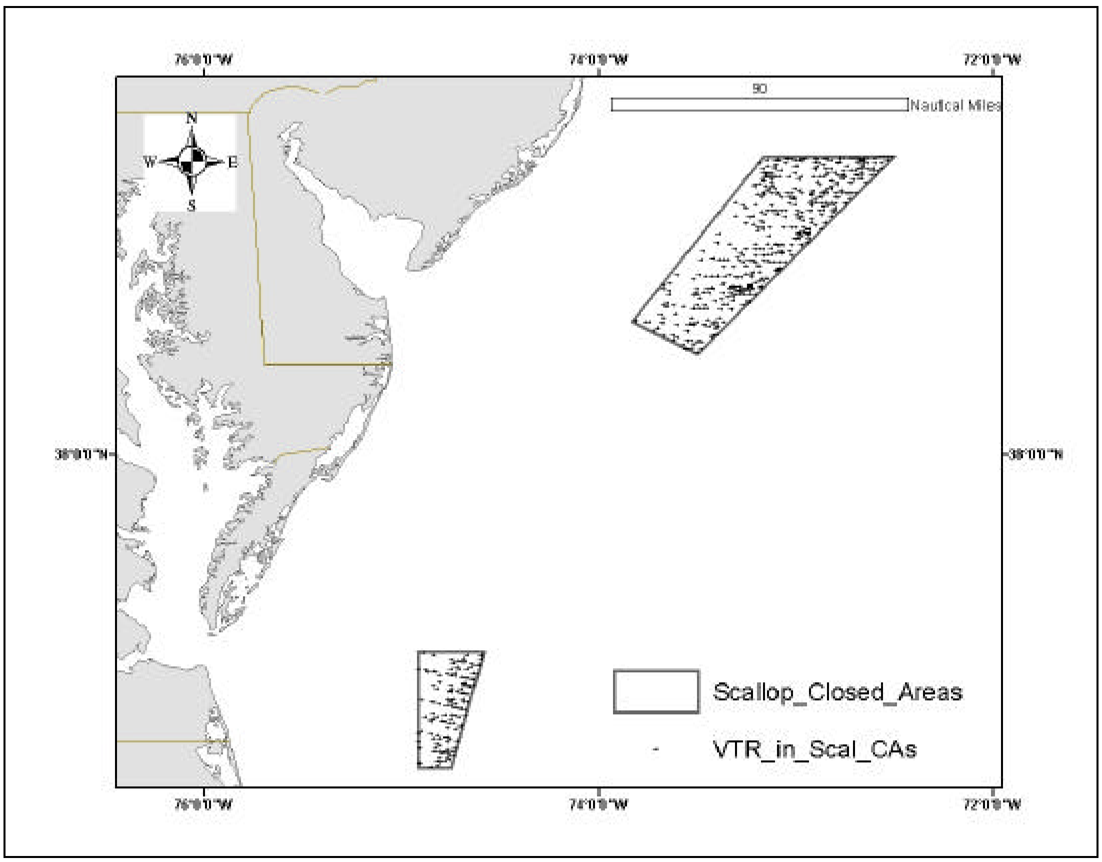
The re-opening of the Hudson Canyon and VA/NC Closed Areas will increase fishing pressure on those areas, which are known to be highly productive scallop grounds and will likely see large increases in scallop fishing effort should they re-open.

VTR Data for Otter Trawl Activity Levels in the Scallop Closed Areas

The Hudson Canyon and Virginia/North Carolina scallop closure areas have been open to fisheries other than scalloping throughout their duration. VTR data from 1995 – 2001 indicates that 1,279 fishing trips employing otter trawls took place inside these two areas, corresponding to approximately 4,915 days absent from port. Due to the nature of the days absent data field in the VTR data (which accounts for both fishing and transiting time) these numbers over-estimate actual fishing time inside these areas.

	# Trips/yr	# Days Absent/yr	Area (nm^2)	Days Absent/nm^2
All Northwest Atlantic Trips	32,289.9	51,669.1	69,486	0.744
Trips Occurring Inside Scallop Closed Areas	182.7	702.1	1,901	0.369

Table 254. VTR data (1995 – 2001) for otter trawl gear inside the scallop closed areas.



Map 57. VTR data (1995 – 2001 total) for otter trawl gear inside the scallop closed areas.

Map 57 is a visual display of the otter trawl effort reported to have occurred inside the two scallop closed areas. Table 254 summarizes the reported days absent from these trips. The Days Absent per square nautical mile metric is an indication of the relative intensity of otter trawling activity inside these areas. It is important to note that this metric cannot quantify the intensity of fishing effort's impacts on habitat; i.e. the relationship between decreasing Days Absent per square nautical mile and decreasing adverse impacts of fishing on EFH is not a linear one. Days Absent per square nautical mile does, however, provide a baseline from which to build an understanding of relative levels of otter trawl effort.

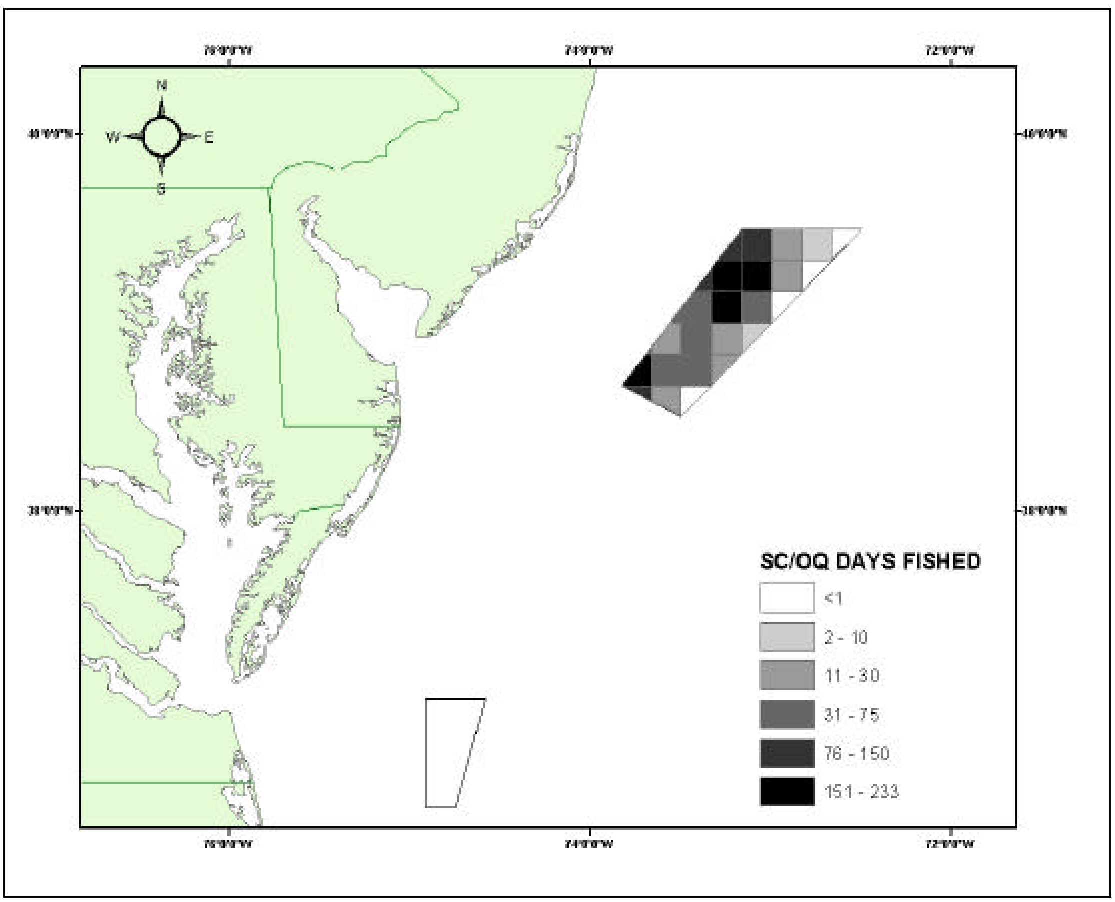
In this case, the otter trawling intensity is substantially lower than that in the entire Northwest Atlantic analysis area. Therefore, the addition of scallop dredge activity will likely have an adverse impact on benthic communities of these areas as well as the species' EFH contained within them.

VTR Data for Clam Dredge Activity Levels in the Scallop Closed Areas

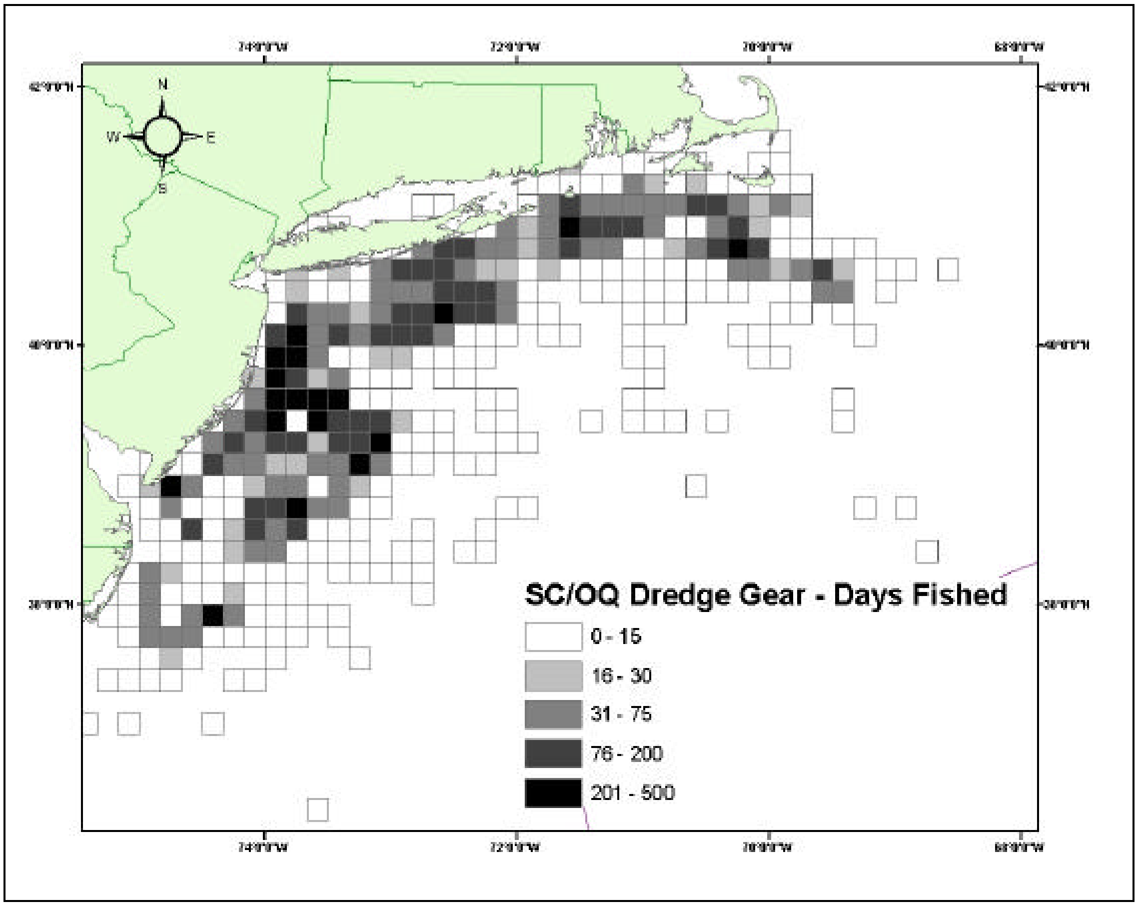
VTR data from 1995 – 2001 indicates that surf clam/ocean quahog vessels employed clam dredge gear inside these two areas for approximately 1,282 fishing days. This data field takes in to account transit time and is therefore likely to be a more accurate indicator of actual time fishing than the similar metric utilized for calculating otter trawl activity levels.

	# Days Fished/yr	Area (nm^2)	Days Fished/nm^2
All Northwest Atlantic Trips	2,306.0	69,486	0.033
Trips Occurring Inside Scallop Closed Areas	183.14	1,901	0.096

Table 255. VTR data (1995 – 2001) for clam dredge gear inside the scallop closed areas.



Map 58. VTR data (1995-2001 total) for clam dredge gear inside the scallop closed areas.



Map 59. VTR data (1995-2001 total) for clam dredge gear, all days fished.

VTR data shows that no trips were made inside the VA/NC scallop closed area. Map 58 shows a slightly higher intensity within the scallop closed areas (which, in fact, would be even higher given that there was no clam dredge activity inside the VA/NC closure) than within the NWA analysis area as a whole. This is a slightly deceiving result, as the surf clam/ocean quahog fishery is highly concentrated (Map 59).

Summary of otter trawl and clam dredge impacts on scallop closed areas

Clam dredge gears have no impact on bottom sediments in the VA/NC closure and otter trawl intensity in this area is low. Opening this area to scallop dredging would likely expose these habitats to levels of fishing pressure not seen since the area was closed in 1998. The Hudson Canyon closure, however, has a significantly higher level of fishing pressure from gears other than scallop dredges. The opening of this area to scalloping would have a somewhat less severe impact. The predominantly sandy bottom sedimentation and shallow average depth (20-65 fathoms) of these two areas, however, indicates that these two areas recover relatively quickly from fishing impacts.

Other Considerations

Further discussion on the physical characteristics of the Hudson Canyon and Virginia Beach scallop closed areas are found in Section 7.3.2.4. Additional analysis of the affected habitats and impacts of scalloping in these areas are contained in Framework Adjustment 14 to the Atlantic Sea Scallop FMP (NEFSC 2001).

8.5.7.1.2 Status Quo Alternative

The Status Quo Alternative involves an indefinite constant fishing mortality rate of F=0.2. This rate is roughly equivalent to 120 DAS. The Hudson Canyon and Virginia/North Carolina scallop closed areas remain closed. The Status Quo Alternative does not provide for access to the year-round groundfish closed areas.

	Status Quo			
	SweptAr	DAS	Land(MT)	Biomass(MT)
2003	**5,871.8**	30,532.5	23,439.3	179,340.1
2004	**6,684.7**	30,686.0	24,566.9	183,427.3
2005	**7,632.5**	30,972.1	23,758.9	184,004.3
2006	**8,168.3**	30,304.7	20,653.0	185,822.2
2007	**9,151.3**	30,100.6	16,991.1	190,235.2
2008	**9,781.2**	30,780.9	17,285.9	197,032.2

Table 256. Projected Swept Area, DAS and Landings under the Status Quo.

The Status Quo Alternative impacts species' EFH most notably through the continuation of current DAS allocations. The result is a dramatic increase in nominal fishing effort (DAS) relative to the NAA. Swept area also increases dramatically over six years (67%) due to the additional effort required to maintain landings Table 256 points out very clearly an important relationship between effort levels, landings and swept area. If effort levels remain above those corresponding to optimal LPUE, LPUE will tend to decline. Under the status quo, the decline in LPUE is projected to be on the order of 27%, with a corresponding 40% increase in swept area. The implication of these projections in the scallop industry is that as resource abundance declines, the fishery shifts from shucking-limited production to resource-limited production. Projected bottom contact time (swept area) increases substantially as this shift occurs.

8.5.7.2 Alternatives to Improve Scallop Yield (Section 5.3.2)

Ten alternatives are presented for the purpose of improving scallop yield. Of these, six employ various permutations of a rotational area management regime.

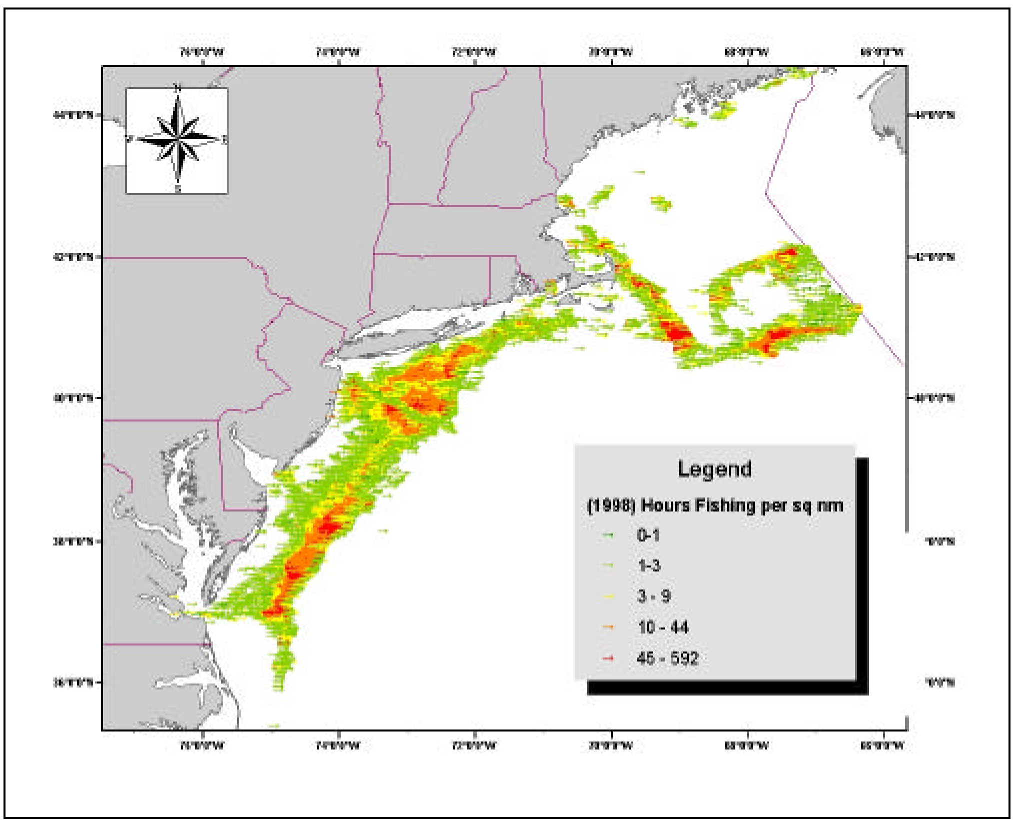
8.5.7.2.1 Rotational Area Management

Under rotational area management, three types of areas are defined: Closed Rotation, Recently Re-opened, and Open Areas. Varying levels of fishing effort are permitted in each of the three area types; none of these prohibit fishing with gears other than scallop dredges or scallop trawls. Closed Rotation areas are closed to all limited access and general category scallop permit holders fishing for scallops with dredge or trawl gear. It is very important to note that vessels may fish in such an area with gear other than scallop dredges or trawls. Closed Rotation areas, additionally, are closed for a limited duration (estimated to be between 3 and 5 years) intended to precede a Recently Re-opened designation. Recently Re-opened areas will be fished with significantly higher levels of intensity than either Closed Rotation or Open Areas. Open Areas will be no different than the areas not designated as a part of the rotational management program and may be fished by all limited entry and general category scallop permits, as well as all other gear types, as constrained by applicable Fishery Management Plans. These areas will likely see a more consistent, albeit lower, level of fishing effort.

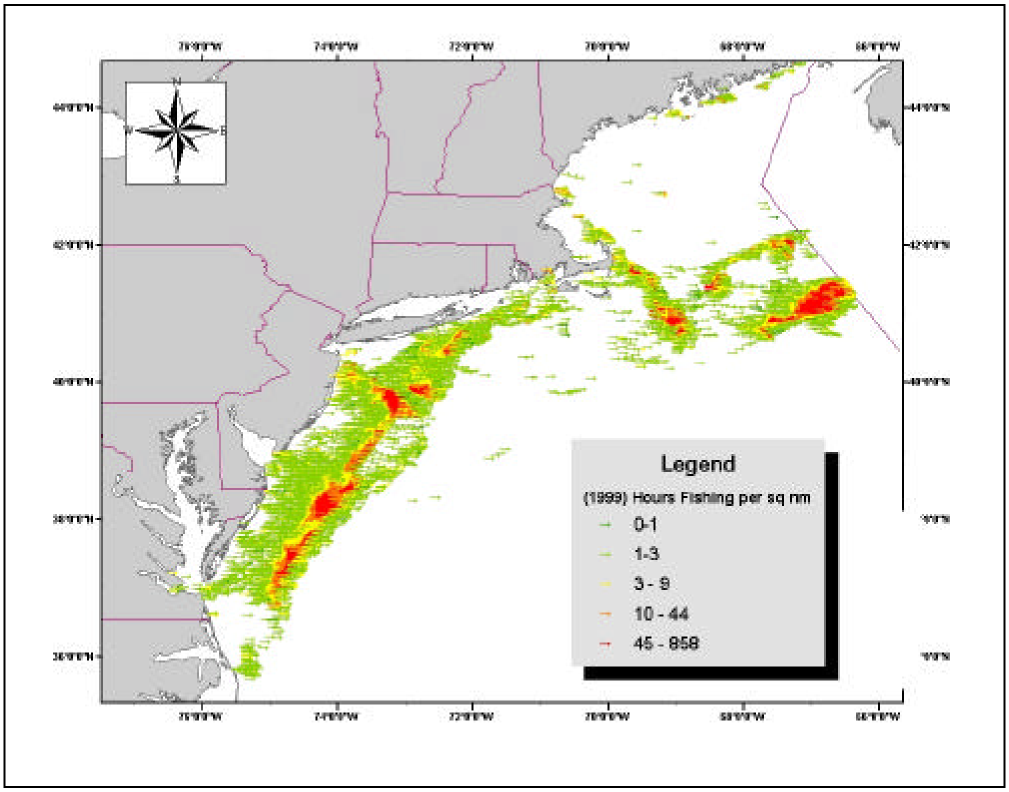
The areas designated as Closed Rotation are open to fishing with other gear types, and will eventually be reopened to higher than normal levels of scallop fishing intensity. The specific impacts of these temporal intensity shifts will depend on the environments they take place within. For example, closed rotation and recently re-opened areas along the southern portion of Georges Bank, which is comprised primarily of sand and gravely sand bottom sedimentation, are considered “high energy” environments that recover from the effects of fishing relatively quickly. [Areas deeper than 65 m on eastern GB are considered “low energy” – this includes most of the southern portion of CAII]. The same is true for the rotational management areas occurring in similar sandy, “high energy” environments along the continental shelf from waters south of Long Island and extending southward to the shelf areas east of the DELMARVA peninsula.

Rotational areas occurring in deeper water along the northern areas of Georges Bank and off of Cape Cod, where bottom sediments contains more gravelly sand and gravel and support more prolific epifaunal communities. These environments are generally thought of as “lower energy” and may not recover as fast, if at all, from the elevated levels of fishing intensity expected while in a Recently Re-opened stage. Such elevated, short-term fishing intensities in these areas (specifically GB15, GB7, GB6, GB2 and GB1) may in fact have more detrimental effects on EFH than the consistent lower fishing effort levels associated with either an Open Area designation or those areas that lie outside the rotational management’s proposed scope. There is no literature available on potential impacts of “pulse” fishing; i.e. elevated fishing intensity over limited spatial and temporal scales, followed by a period of lower fishing intensities.

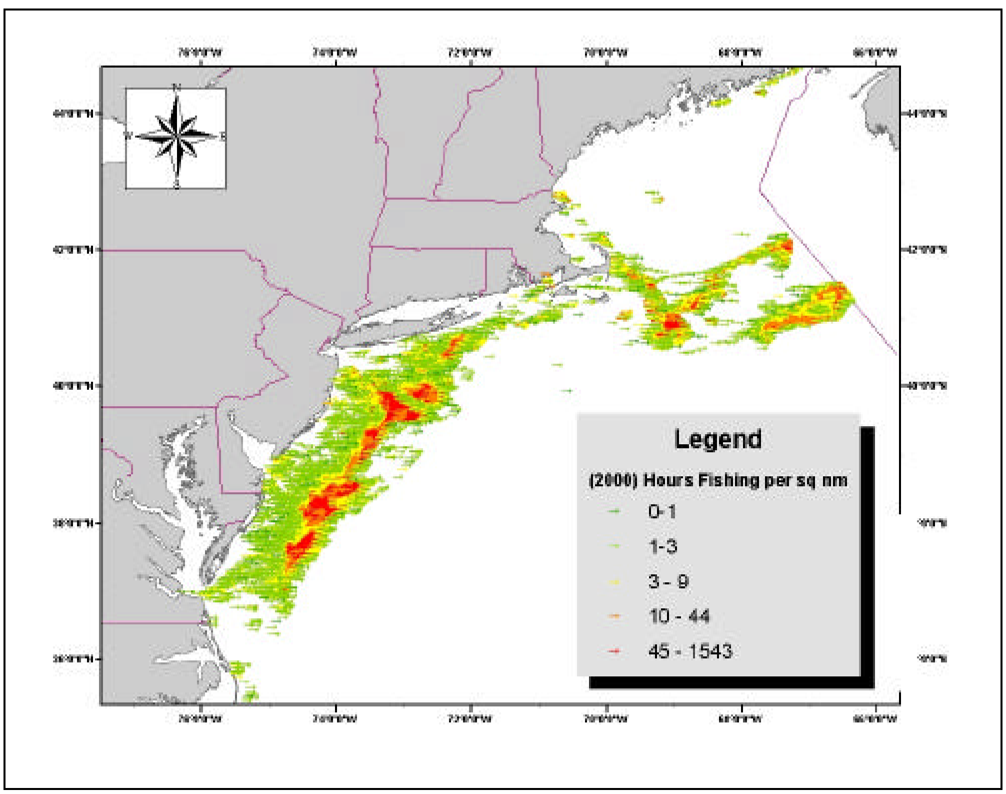
Vessel Monitoring System data from 1998-2000, however, indicates that the scallop fishery currently operates on a somewhat limited spatial scale. Vessels tend to fish only productive areas, and these at high levels of intensity.



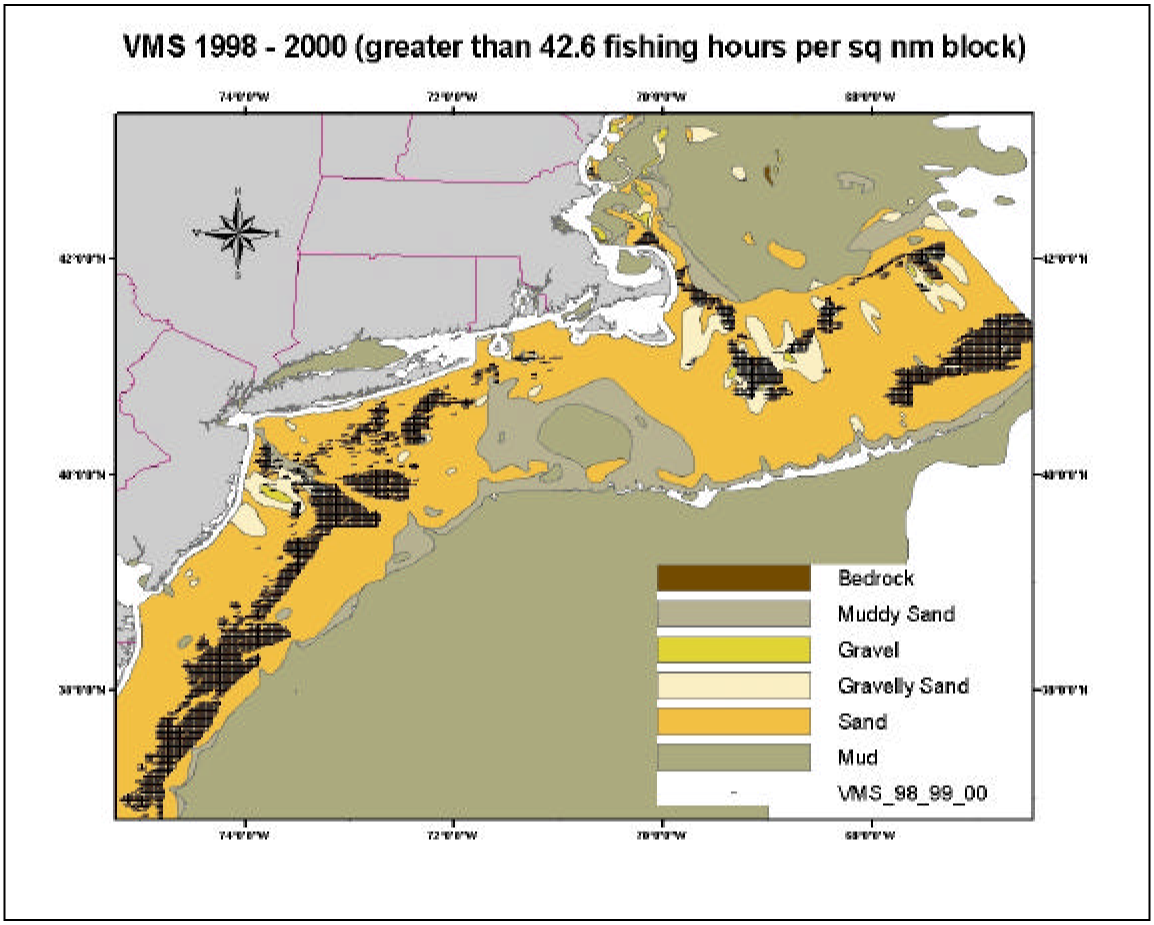
Map 60. Distribution of scallop fishing effort in 1998.



Map 61. Distribution of scallop fishing effort in 1999.



Map 62. Distribution of scallop fishing effort in 2000.



Map 63. 1998-2000 VMS activity data (greatest 80% of fishing time) overlaid with sediment categories (summarized from Poppe et al. 1989).

Map 60 through Map 62 show the limited spatial extent of the bulk of the fishery. Map 63 shows the spatial range of the highest 80% of scallop fishing activity. This cutoff corresponds to greater than 42.6 hours fished within a 1 nm block; this truncation eliminates positions where little scalloping occurred, as well as transiting positions.

The fishery is primarily one of intense fishing pressure over a relatively small area. The areas of greatest fishing pressure change over time (as seen even over the limited three-year time series). Furthermore, as resource conditions improve the fishery may have become even more spatially constrained. There is likely an inverse relationship between abundance and total bottom contacted. This concept is strengthened by the relationship between swept area and total effort analyzed in Section 8.5.4.14.2.1. In an analysis of VMS data and scallop fleet behavior, scientists also observed contracting fishing areas between 1998 and 1999 (Rago et al. 2000).

8.5.7.2.1.1 Habitat evaluation of rotational area management

8.5.7.2.1.1.1 Methods

To examine the effect that rotation area management is likely to have on essential fish habitat, the past and probable future distribution of limited access scallop fishing effort (contributing about 95-98 percent of total landings) were compared to the distributions of two metrics that were used to evaluate habitat closures: a summary of six sediment classifications (bedrock, mud, muddy sand, gravel, gravelly sand, and sand) and EFH designations for the juvenile and adult life stages of 23 species that have been classified as having EFH that is moderately or highly vulnerable to scallop dredges or otter trawls (see Section 7.2.6.2.5). Species with EFH that were judged to be moderately or highly vulnerable to the effects of trawls and dredges may be adversely impacted by fishing. These species and life stages are listed in Table 138. Note that the EFH of juvenile scallops has been determined to have low vulnerability to bottom tending gear and is therefore not included in this analysis (See Section 7.2.6.2.5). The six sediment categories are based on nine classifications used in U.S. Geological Survey sediment maps (Poppe et al. 1986, 1989). (See Appendix IV for more details). This analysis used the same EFH designation and sediment data that the Council's Habitat Technical Team used to evaluate the effectiveness of habitat closure alternatives.

EFH distribution data for species with EFH moderately or highly vulnerable to bottom tending gear are already classified into ten-minute squares of latitude and longitude. For juvenile and adult life stages individually, the number of species that had an EFH designation for a ten-minute square were summed, the total ranging from zero to 16. There were no ten-minute squares with more than 16 different species with vulnerable EFH. Within this group of sixteen species, there are some that might be thought to be more highly vulnerable to habitat alteration by scallop dredges, for example, which could be highlighted and evaluated more thoroughly.

To be consistent with the data, the six-classification sediment distribution data were summed for area within each ten-minute square. A square that had more than one sediment type classified in it, for example, had a sum of area for each sediment classification, the total adding up to the area of the total ten-minute square. The sum of sediment areas in each ten-minute square were preserved when comparing the projected effort in each ten-minute square and then summed across sediment types to estimate the proportion of effort that occurred over each sediment type. For a historic analysis, more direct comparison might be possible with better sediment distribution data, because the VMS scallop effort data are collected continuously by polling the vessel every 30 minutes and classifying the effort since the previous polling to the nearest nautical mile. For analysis of projections, however, a ten-minute square is probably the best resolution that can be expected to be meaningful.

The 1998 – 2000 VMS effort distribution data (See Section 8.5.4.14.2.1) were compared with both the sediment and EFH data described above, and used to derive the expected future distribution of fishing effort within the rotation management area used for analysis and projections. Projections of scallop biomass, catch, and effort were averaged within each rotation management area and then the effort data and area swept calculations were applied as if the effort distribution within each ten-minute square was the same as it had been in 1998 – 2000. This is appropriate because the effort distribution in rotational management areas is associated with the relatively constant distribution of scallop biomass within those areas. Used in this way, the projected effort distribution within rotation management areas is expected to remain stable, but the effort distribution among rotation management areas is allowed to vary according to the biomass dynamics projection model in Section 8.2.1. Projections were averaged for 2004, an annual average for 2005-2007, and a long-term annual average for 2022-2031.

VMS data require considerable processing to be suitable for further analysis. At the present time, the 2001 and 2002 VMS data have not been processed in this way to audit the information, distinguish fishing time from steaming time, combine the data with catch and revenue information from dealer data, and classify/sum the data by one nautical mile blocks in appropriate time increments.

Although there could be some small changes in resource distribution and corresponding fishing effort within a rotation management area during this time, it is not believed to be a critical factor in this analysis, except possibly to compare historic impacts across the entire fishery with another time period in history. For example, the 1998 – 2000 period included the time when the Hudson Canyon and VA/NC Areas were closed to fishing and area access to the Georges Bank closed areas occurred in 1999 and 2000. To the extent that more EFH designations or hard bottom substrates occur within the Framework 13 access areas, the historic data for 1998 – 2000 overstate the impacts on these habitats relative to scallop fishing conditions that will prevail without access.

Historic effort distributions were compared with EFH designation density and sediment distributions by summing the scallop fishing time[92] over ten-minute squares. The total fishing time in a ten-minute square was then allocated according to the proportion of the six sediment types in each ten-minute square, then summed over the six sediment classifications. The total fishing time in a ten-minute square was also classified according to the number of EFH designations in the ten-minute square and then summed with other ten-minute squares having the same number of EFH designations, although the mix of species within various ten-minute squares with equal EFH ranks vary.

A substantial portion of total fishing time occurs in a relatively few one nautical mile blocks (see Figure 130). Even though the most substantial habitat impact is thought to occur with the first pass of a dredge, the most complete coverage by fishing activity occurs in areas (in this case one nautical mile blocks) where fishing effort is highest. One cutoff or criteria that may be used to distinguish high effort blocks from low effort blocks is the amount of effort that would completely sweep a one nautical mile block, if the tows were distributed side by side and end to end, with no overlap. Based on a 30-foot dredge towed at 4 knots, this takes slightly more than 50 hours of bottom contact time. Assuming no reduction in bottom contact time due to tending the gear, shucking scallops, or other effects, this criteria were used to distinguish one nautical mile blocks as being “intensely fished” vs. “lightly fished”.

Averaged over the three years, 21 percent (range 20 to 23 percent) of the one nautical mile blocks had more than 50 hours of fishing time per year. The effort in each ten-minute square that was “intensely fished” was then summed to compare the habitat effects, measured by the sediment type and EFH designation metrics, where effort was highest.

[92] Scallop fishing time was determined by classifying the VMS pollings that implied a velocity of less than 5 nm/hr. During these times, vessels could be actively fishing, drifting or anchored while shucking scallops caught in prior tows, searching for fishing locations, or drifting or anchoring to wait out weather, eat, or repair equipment, etc. These totals are very different from the estimated bottom contact time and area swept in the projection data which reduces the amount of the implied fishing time with gear on the bottom by the ratio of the estimated catch rates and the crew’s shucking capacity.

Table 257. Percent of one nautical mile blocks classified by whether it had more than 50 hours of fishing time derived from VMS pollings and whether it fell within the boundaries of rotation management areas used for analysis and projections.

Percent of one nm blocks		Fishing year			
Fishing time greater than 50 hours per year?	Inside RMA?	1998	1999	2000	Grand Total
No	No	14.91%	17.44%	17.75%	16.70%
	Yes	65.07%	59.14%	61.55%	61.96%
No Total		79.98%	76.58%	79.29%	78.66%
Yes	No	1.04%	0.19%	0.29%	0.51%
	Yes	18.98%	23.23%	20.42%	20.83%
Yes Total		20.02%	23.42%	20.71%	21.34%
Grand Total		100.00%	100.00%	100.00%	100.00%

Some fishing effort occurs outside of rotation management areas, 16.7 percent for one nautical mile blocks having less than 50 hours of fishing time and 0.51 percent for one nautical mile blocks having more than 50 hours of fishing time. Although there are habitat impacts in these areas, less than three percent of the intensively fished one nautical mile blocks occur there and the majority of habitat impacts occur within areas designated as rotation management areas for purposes of analysis and scallop biomass dynamics projection. It would be inappropriate to compare the projected effort distributions in rotation management areas with effort distributions for all areas, so a separate comparison with the EFH metrics was completed, using all 1998 – 2000 scallop fishing time derived from VMS reports within the boundaries of the rotation management areas.

The projected area swept within rotation management area was then distributed by ten-minute square in proportion to the amount of 1998 – 2000 scallop fishing effort within the rotation management area. With regard to Georges Bank closed area access, this method actually works out well, because the projection model rotation management areas coincide with the boundaries for access, and the historic fishing effort distributions were also analyzed using these boundaries.

Thus historic and future projected shifts in fishing effort under area rotation toward ten-minute squares having a greater proportion of bedrock, gravel, and gravelly sand are deemed to have greater habitat impact than shifts in effort that favor sand, mud, or muddy sand. Likewise, shifts in fishing effort toward ten-minute squares with greater amounts of EFH designations are also deemed to have greater habitat impacts than those that would favor ten-minute squares with fewer EFH designations.

The area-swept distributions for four future time periods were compared to the historic effort distributions, to examine the effect that area rotation and area access might have on habitat impacts, as measured by the two EFH metrics. These four periods are described in the table below:

Table 258. Summary of projected effects on habitat impacts, measured by changes in overlap of sediment and EFH designation habitat metrics.

Time period	Scallop management status
2004 fishing year without Georges Bank area access	Applies to period before implementation of Framework Adjustment 39
2004 fishing year with access	Applies to period after implementation of Framework Adjustment 39, allowing access to the Framework 13 portions of the Nantucket Lightship Area and Closed Area I
2005 – 2007 fishing year averages	Southern part of Closed Area II open; Nantucket Lightship Area and Closed Area I closed
Long-term	Long term effects of area rotation and access to the Framework Adjustment 13 portions of the three Georges Bank closed areas

8.5.7.2.1.1.2 Results

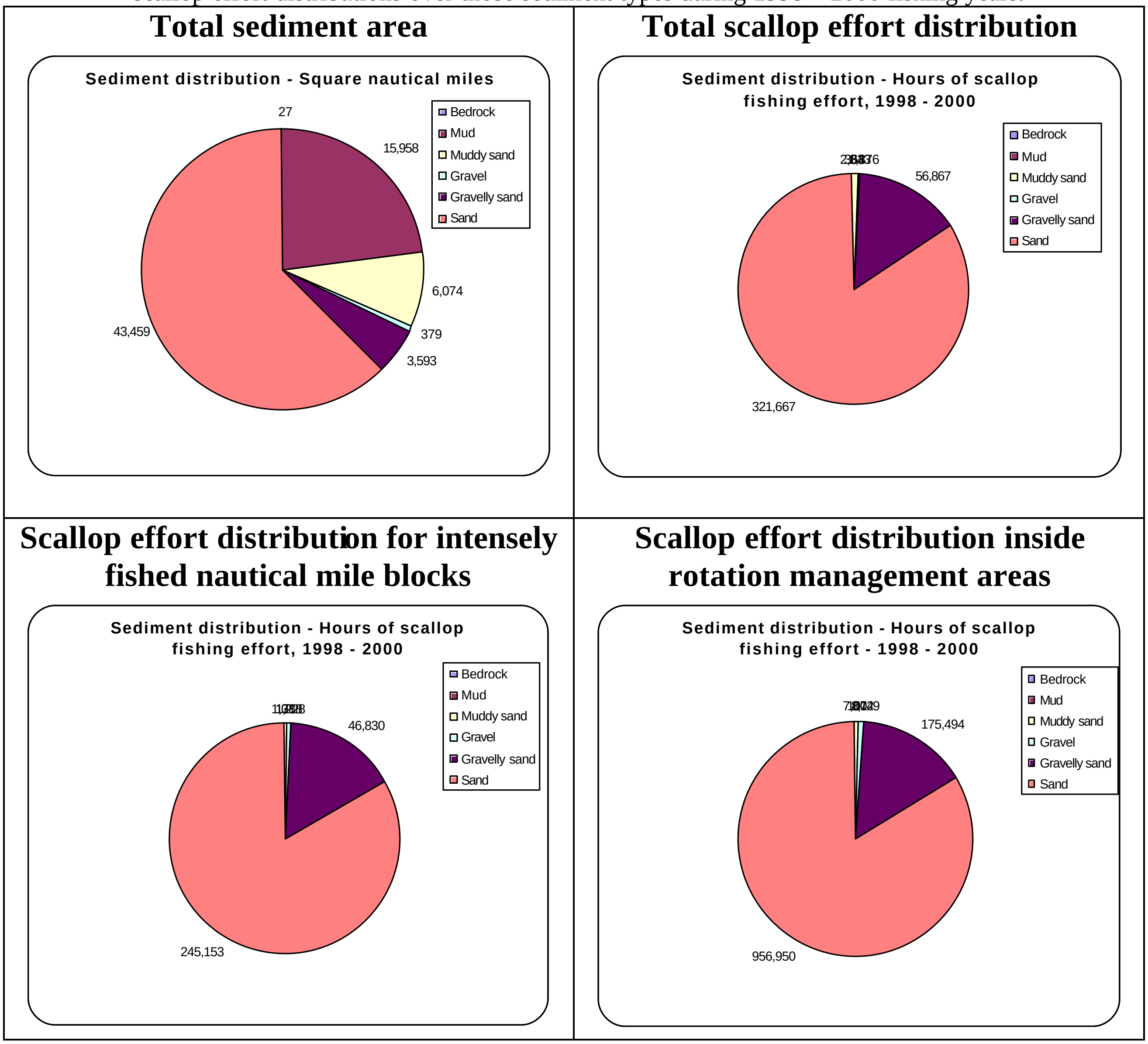
8.5.7.2.1.1.2.1 Sediment Analysis

Overall, sand is the primary sediment type in the total Northwest Atlantic Analysis Area (NAAA). It is also the primary sediment type where total scallop effort took place in 1998-2000, and was the primary sediment in areas that were intensely fished by the scallop fleet in 1998 and 2000, as well as areas inside rotational management areas (RMAs). Gravelly sand was the second most common sediment type associated with scallop fishing effort. Table 259 shows that the majority of scallop fishing activity took place over sandy bottoms and some gravelly sand. The percent of sediment types do not change significantly when comparing the total area of scallop fishing activity, the area with high intensity of scallop effort, and the areas within RMAs. Figure 136 describes the amount of each sediment type in the same four areas in square nautical miles.

Table 259. Sediment distribution in the total Northwest Atlantic Analysis Area (NAAA), total scallop effort distribution, scallop effort distribution for intensely fished nautical mile blocks, and scallop effort distribution inside rotation management areas (RMAs).

	Sediment distribution in the NAAA (nm2)	Sediment Distribution in the NAAA (Percent)	All 1998-2000 effort distribution (hours fished)	High intensity effort distribution, 2000 only (hours fished)	Scallop effort in rotation management areas (hours fished)
Bedrock	0	0.0%	0.0%	0.0%	0.0%
Gravel	6074	0.5%	0.5%	0.4%	0.7%
Gravelly sand	379	5.2%	14.8%	15.9%	15.3%
Sand	3593	62.5%	84.0%	83.2%	83.3%
Muddy sand	15958	8.7%	0.6%	0.4%	0.7%
Mud	27	23.0%	0.1%	0.1%	0.0%
TOTAL	26033	100%	100%	100%	100%

Figure 136. Distribution of sediment classifications derived from Poppe et. al. 1989 and limited access scallop effort distributions over those sediment types during 1998 – 2000 fishing years.

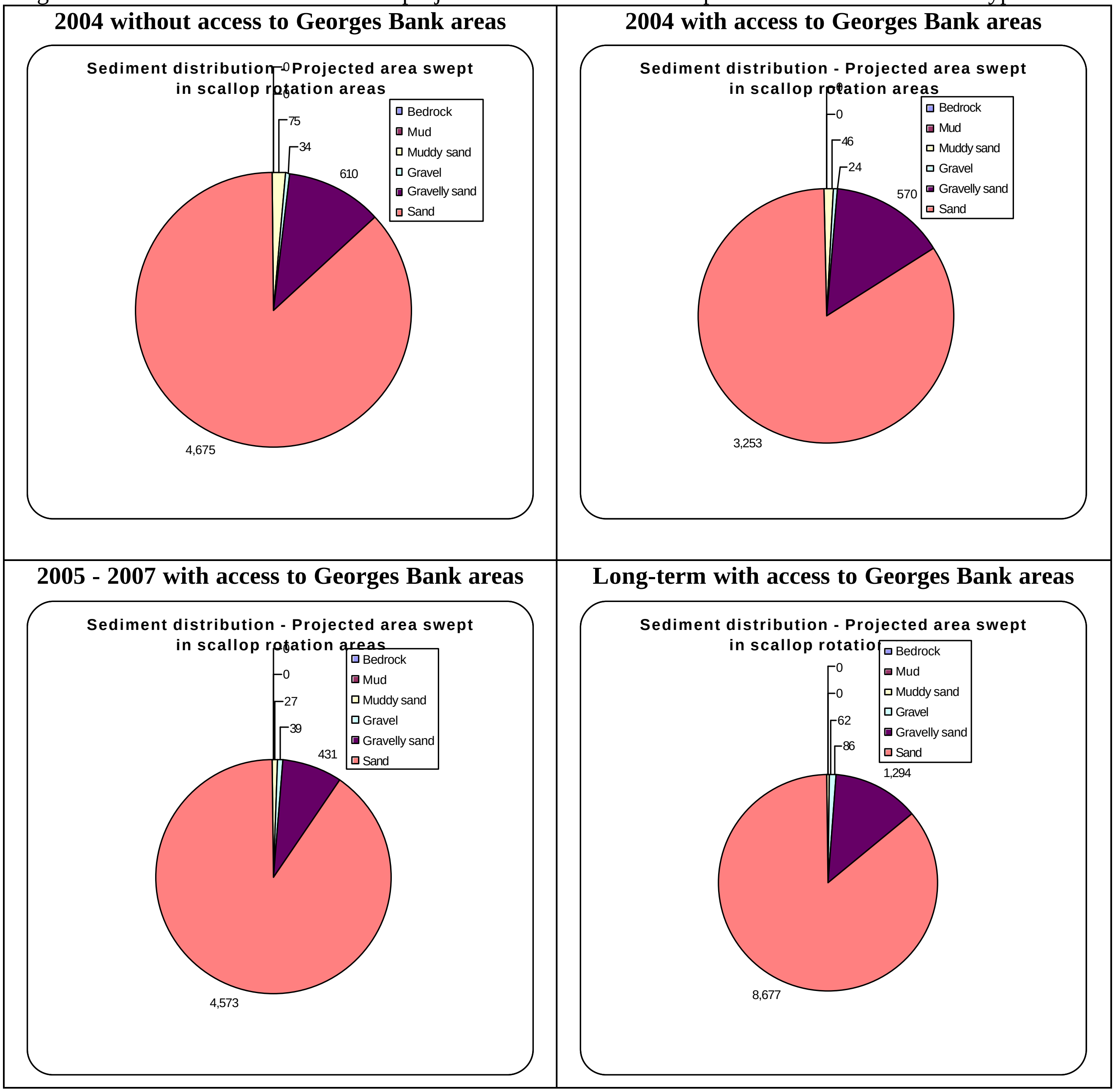


As predicted by the simulation model, area rotational management will shift effort during the next ten years into specific areas where scallop biomass is expected to be highest. The sediment compositions of these areas are presented below (Table 260). Once again, the sediment composition does not differ significantly for areas projected to be available for scallop fishing in 2004 without access to the groundfish closed areas on Georges Bank, as well as with access to portions of these areas. Over 80% of projected effort is expected to be in sandy areas in either case, and less effort is expected over gravelly sand as compared to the amount of gravelly sand within all the RMAs. The shift of scallop fishing effort into sandy bottom areas that is projected to occur during 2005-2007 and over the long-term is actually greater than in 2004. This projected reduction in effort over gravel is significantly greater for both these time periods, compared to 2004. Figure 137 describes the swept area for each sediment type in the projected 2004 RMAs, the 2005-2007 RMAs, as well as the long term rotational management area strategy, and the percent change from the 1998-2000 effort distribution in the RMA's (column 1). The sediment distribution of sediments associated with projected fishing effort is mot significantly different from those associated with current fishing effort. Although total effort on muddy sand remains low, there is a 100% increase (0.7% to 1.4%). ON the other hand, there is a 26% decrease of effort on gravelly sand and an 11% decrease of effort on gravel.

Table 260. Sediment distribution in the 2004 projected scallop effort areas, 2005-2007 projected scallop effort areas, and the long term projected scallop effort areas with access to Georges Bank. The projected change in sediment distribution from the historic (1998-2000) scallop effort within rotation management areas is presented as well.

	Scallop effort in rotation management areas (hours fished)	2004 projected effort distribution without access (total area swept)	Projected change	2004 projected effort distribution with access (total area swept)	Projected change	2005-2007 effort distribution (total area swept)	Projected change	Long-term with access to Georges Bank areas	Projected change
Bedrock	0.0%	0.0%		0.0%		0.0%		0.0%	
Gravel	0.7%	0.6%	-11.1%	0.6%	-14.4%	0.8%	9%	0.8%	20%
Gravelly sand	15.3%	11.3%	-26.0%	14.3%	-6.6%	8.5%	-44%	12.8%	-16%
Sand	83.3%	86.7%	4.0%	83.9%	0.7%	90.2%	8%	85.8%	3%
Muddy sand	0.7%	1.4%	109.2%	1.2%	75.0%	0.5%	-21%	0.6%	-9%
Mud	0.0%	0.0%	-70.6%	0.0%	-74.8%	0.0%	-89%	0.0%	-57%
TOTAL	100%	100%		100%		100%		100%	

Figure 137.   Estimated distribution of projected limited access scallop effort over each sediment type.



The distribution of sediment types associated with projected scallop fishing effort within rotational management varies depending on which RMAs are open, and which are closed. The figures below describe which areas are expected to have more effort than the historical (1998-2000) average, and which areas are expected to have less effort for several different rotational management strategies. Figure 138 and

Figure **139** show the specific RMAs that are expected to have more scallop effort than the 1998-2000 average without access to Georges Bank closed areas, and with access to Georges Banks closed areas. Several of the RMAs in the Mid-Atlantic region will receive more effort than the 1998-2000 average with or without access, particularly MA5, MA7, MA8, and MA9. Table 261 describes where each of these RMAs are located, and Table 263 describes the sediment distribution of each RMA. MA5 and MA8 are over 90% sand, and MA7 is over 75% sand, and MA9 is about 68% sand. Therefore, and increase in effort in these RMAs may not have a significant negative impact on sensitive sediment types. GB2 and GB6 are predicted to have more effort than the historical effort without access to Georges Bank, and GB6 is over 90% sand, while GB2 is about 50% sand and 45% gravelly sand (Table 263). On the other hand, GB12 and GB9 are expected to have increased scallop effort in 2004 with access to Georges Bank closed areas, and both of these areas are made up of about 50% sand and 50% gravelly sand. In general, the RMAs in the Georges Bank area are made up of more complex bottom types, but none of the RMAs contain bedrock, and only two in the Georges Bank area have over 20 nautical miles of gravel (GB4 and GB7), and MA6 is the only RMA in the Mid-Atlantic region with gravel (about 3.4% of the area) (Table 263).

The sediment distribution and overlap with future scallop effort under a rotational management strategy was also analyzed for the short-term (2005-2007) and long term. Figure 140 and Figure 141 show which RMAs are expected to have more effort in both time periods, as compared to the historical average of scallop effort in each area. In 2005-2007 GB6, GB7, MA5, MA6, MA8, and MA9 are expected to have more effort than the historical average, particularly MA5 and MA6 (200% increase). GB7 and MA6 do contain more gravel than most of the other RMAs, but all the areas that will have increased effort levels are mostly sand. For the long term, the analysis predicts that GB1, GB5, GB6, GB7, MA5, MA8, and MA9 will have increased effort levels. GB1 and GB6 increase the most, and according Table 263, GB1 is mostly sand and muddy sand and mud, while GB6 is over 90% sand. MA9 is expected to have increased effort levels, and this are is mostly sand and muddy sand.

Figure 138. Percent change in limited access scallop fishing effort by rotation management area in 2004 without access to Georges Bank closed areas, relative to the average effort distribution during 1998-2000.

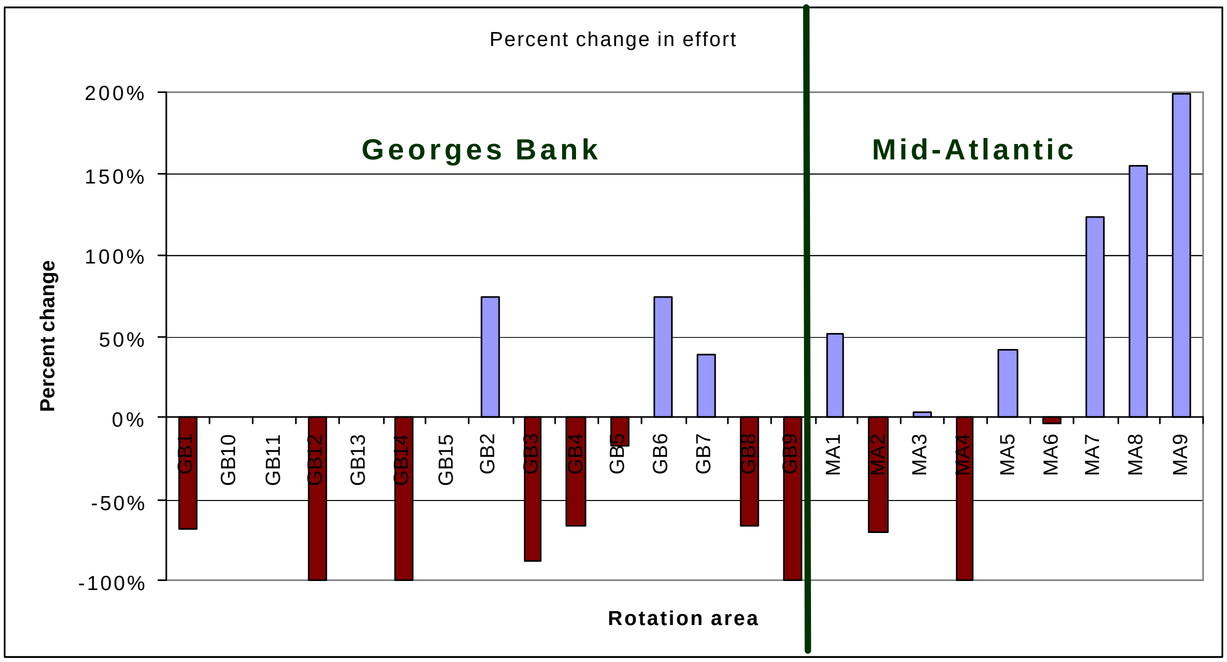


Figure 139 - Percent change in limited access scallop fishing effort by rotation management area in 2004 with access to Georges Bank closed areas, relative to the average effort distribution during 1998-2000.

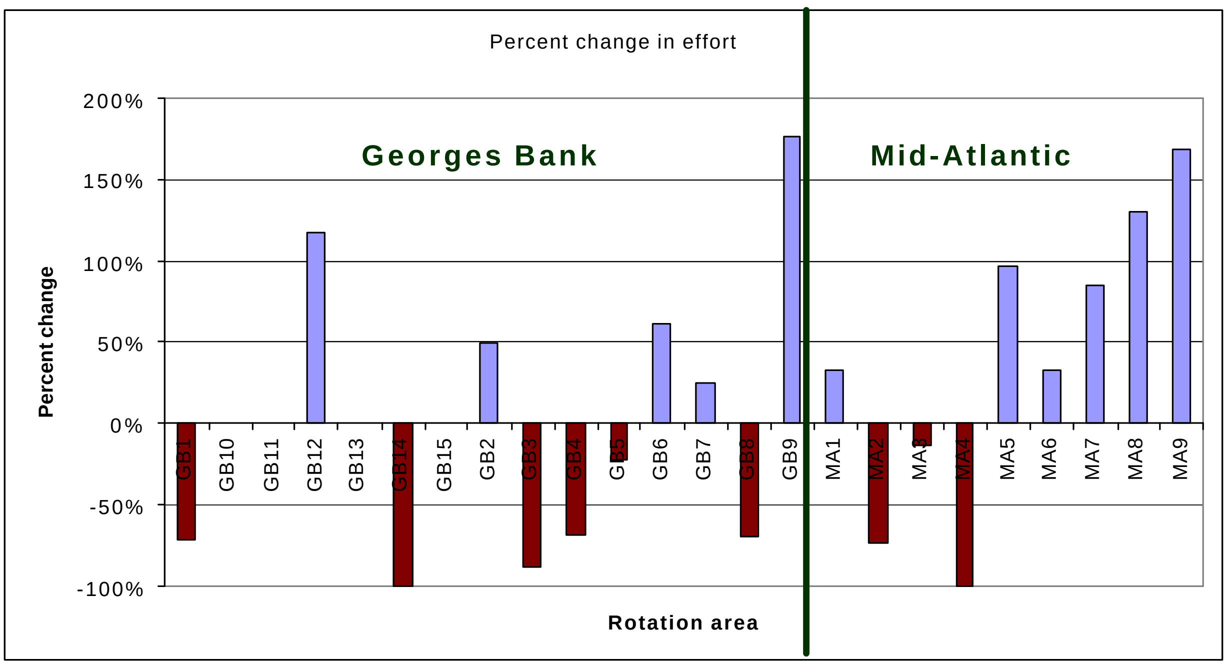


Figure 140. Percent change in limited access scallop fishing effort by rotation management area in 2005 - 2007 with access to Georges Bank closed areas, relative to the average effort distribution during 1998-2000.

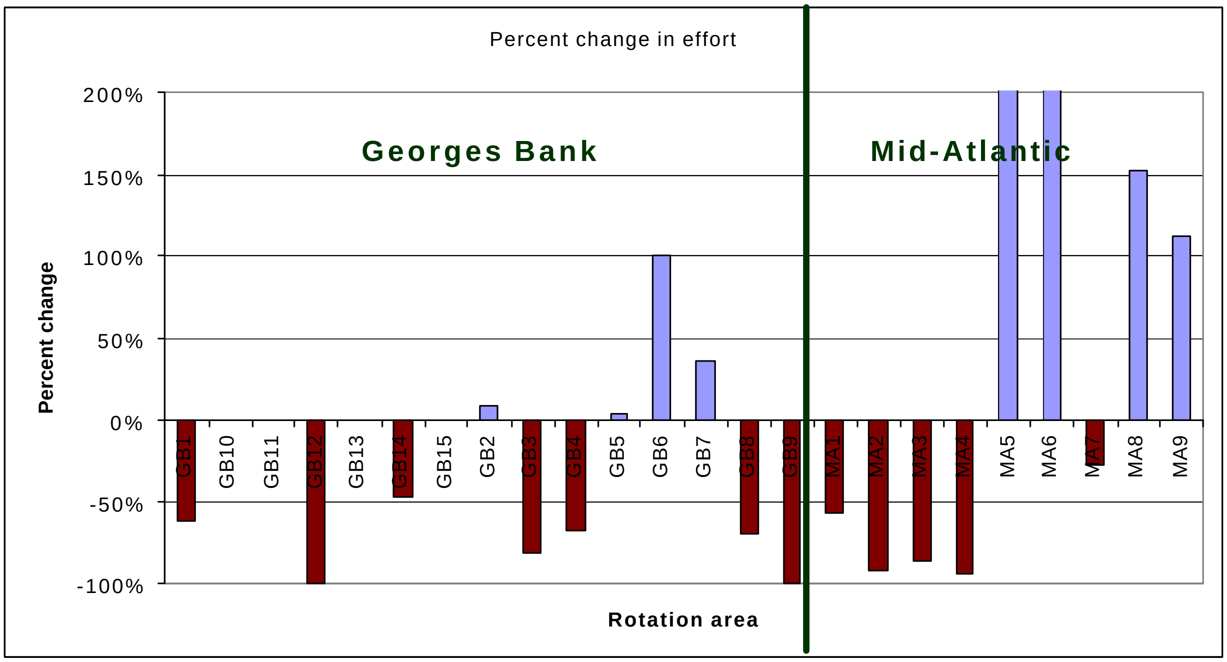


Figure 141 - Percent change in limited access scallop fishing effort by rotation management area for the long-term without access to Georges Bank closed areas, relative to the average effort distribution during 1998-2000.

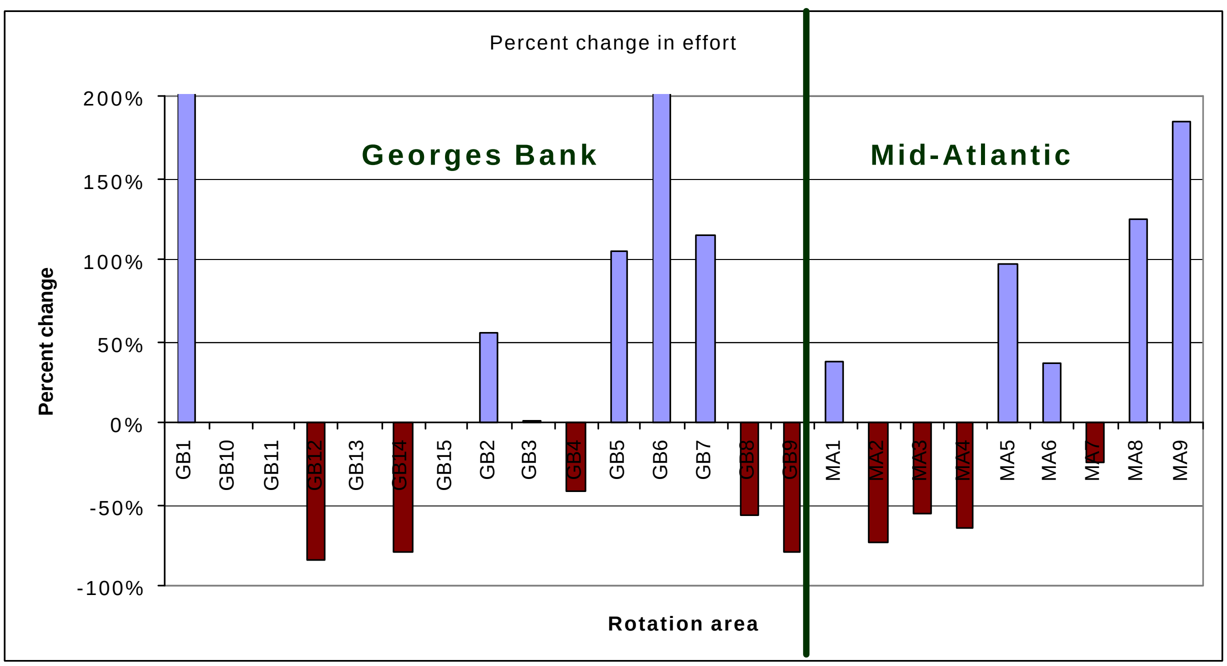


Table 261 - Description of general locations of rotation management areas used to project effects of area rotation. See Map 7.

Rotation management area designation	General location
MA1	East of NC/VA boundary; contains former VA/NC Area.
MA2	Delmarva region of the Mid-Atlantic
MA3	Delmarva region of the Mid-Atlantic
MA4	Delmarva region of the Mid-Atlantic; overlaps the proposed Mid-Atlantic closure area
MA5	NY bight region of the Mid-Atlantic; overlaps the proposed Mid-Atlantic closure area and the Hudson Canyon Area
MA6	NY bight region of the Mid-Atlantic; overlaps the Hudson Canyon Area
MA7	NY bight region of the Mid-Atlantic; overlaps the Hudson Canyon Area
MA8	NY bight region of the Mid-Atlantic
MA9	NY bight region of the Mid-Atlantic
GB1	South Channel region of Georges Bank
GB2	South Channel region of Georges Bank
GB3	South Channel region of Georges Bank
GB4	South Channel region and Southeast Part of Georges Bank
GB5	Southeast Part of Georges Bank
GB6	Southeast Part of Georges Bank
GB7	Northeast Edge and Peak of Georges Bank
GB8	Northeast Edge and Peak of Georges Bank
GB9	South Channel region of Georges Bank; coincides with the Framework 13 access area in Closed Area I
GB10 & 11	South Channel region of Georges Bank; coincides with portions of Closed Area I that remained closed to scallop fishing
GB12	South Channel region of Georges Bank; coincides with the Framework 13 access area in Nantucket Lightship Area
GB13	South Channel region of Georges Bank; coincides with portions of Nantucket Lightship Area that remained closed to scallop fishing
GB14	Southeast Part of Georges Bank; coincides with the Framework 13 access area in Closed Area II
GB15	Northeast Edge and Peak of Georges Bank; coincides with portions of Closed Area II that remained closed to scallop fishing

8.5.7.2.1.1.2.2 EFH Analysis

When the EFH designations of the species with vulnerable EFH are combined, almost all the ten-minute squares within the Northwest Atlantic Analysis Area contain EFH for at least one species. According to Table 262, about 47% of the entire NAAA contains EFH for 6 or more juvenile species with vulnerable EFH, as well as about 43% for adult species with vulnerable EFH. Almost 48% of all scallop fishing time occurs over areas with 6 or more juvenile EFH designations that are deemed vulnerable to bottom tending gear, and about 35% of the area fished is over EFH designations for 6 or more adult species with vulnerable EFH. The percent of area that overlaps with both juvenile and adult EFH designations for "intense" scallop fishing is lower than the percent of overlap for all scallop fishing. For example, about 38% of "intense" scallop fishing effort is over areas with 6 or more EFH designations for juvenile species with vulnerable EFH, while about 48% of all scallop fishing is over areas with 6 or more EFH designations for juvenile species with vulnerable EFH. Although "intense" scallop fishing effort occurs frequently over areas with 6 or more EFH designations (38% for juveniles, 27% for adults), the percent of effort for both life stages is significantly less than the percent of scallop effort over areas with 6 or more EFH designations for species with vulnerable EFH and it appears that intense scallop fishing effort favors areas with lower EFH ranks for both juvenile and adult stages as compared to the entire NAAA. Scallop fishing time in rotational management areas for 1998-2000 is distributed very similarly to the areas with "all scallop fishing", in terms of percent of effort in areas with vulnerable EFH. The percent of area for scallop fishing time in rotation management areas over EFH for 6 or more juvenile species with vulnerable EFH is 47%, and 34% overlap for adult species.

For FY2004 (with or without access to Georges Bank), the percent of area for scallop effort that overlaps with 6 or more juvenile species with vulnerable EFH increases compared to the historical scallop fishing effort within RMAs (1998-2000 baseline). On the other hand, the percent of area for scallop effort over adult EFH designations (6 or more) is less than the baseline average for effort in RMAs. The only projection estimate that has less effort over areas with 6 or more EFH designations, as compared to the baseline amount of effort in RMAs, is the 2005-2007 estimates with access to Georges Bank. The long-term averages with Georges Bank access are higher than the baseline in terms of percent of area that overlaps with 6 or more EFH designations for both adults and juveniles. According to the analysis, effort under a rotational area management strategy has a bias toward areas having more than 6 EFH designations for species with vulnerable EFH, since the percent of projected effort over these areas increases with all projections, except for the 2005-2007 with access to Georges Bank.

Bedrock, gravel, and gravelly sand are considered more complex than the other three sediment types in the data set. Since bedrock is such a small percentage of the total area, only gravel and gravelly sand have been included in the summary table below. A very small percentage of historic and projected scallop effort for each of the categories occurs over areas with gravel substrate (Table 262). About 15% of historic scallop effort (all, intense, and in RMAs) is in areas that are considered to be gravelly sand bottom. All of the projected effort values estimated for 2004, 2005-2007, and the long-term projections are in areas with less gravelly sand bottom than in the scallop effort within RMAs for 1998-2000 (15.3%). For example, the percent of area over gravelly sand bottom in RMAs for 1998-2000 was 15.3%, and the percent of area that is projected to contain scallop effort in the long-term within RMAs with access to Georges Bank is only 8.5%. Therefore, rotation area management is projected to shift effort onto less complex sediment types such as sand, with each of the projected rotational management area time periods (2004, 2005-2007, and long-term). For example, 15.3% of intense scallop fishing time is over gravelly sand bottom, while the percent of projected scallop effort in all three time periods ranges from 8.5% to 14.7%.

Table 262 – Comparison of percent of area in NAAA and percent of effort for historic baselines and rotation management area projections.

Note: It was realized later that the EFH values for juvenile whiting was inadvertently left out of this analysis. The values in this table would not change significantly with or without whiting EFH values because the EFH distribution of juvenile EFH is very widespread .

	Percent of area or fishing area swept within boundaries of EFH sediment classification		Percent of area or fishing area swept meeting EFH designation criterion	
	Gravel	Gravelly sand	Juvenile 6 or more species	Adult 6 or more species
EFH Designation area (Total NAAA)	0.5%	5.2%	47.0%	42.6%
Historic baselines				
All scallop fishing time	0.5%	14.8%	47.6%	34.9%
Scallop fishing time in square nautical mile blocks with 50+hours of annual fishing time (“intense” scallop fishing)	0.4%	15.9%	37.8%	27.3%
Scallop fishing time in rotation management areas (1998 - 2000 Baseline; 2002 = 6,773 nm^2; 2003 = 7,485 nm^2)	0.7%	15.3%	47.0%	33.9%
Rotation management area projections				
2004 without Georges Bank access (5,395 nm^2)	0.6%	11.3%	52.9%	28.0%
2004 with Georges Bank access (3,892 nm^2)	0.6%	14.7%	52.8%	31.4%
2005 - 2007 with Georges Bank access (5,070 nm^2)	0.8%	8.5%	42.8%	22.6%
Long-term averages with Georges Bank access (10,119 nm^2)	0.8%	12.8%	57.0%	36.6%

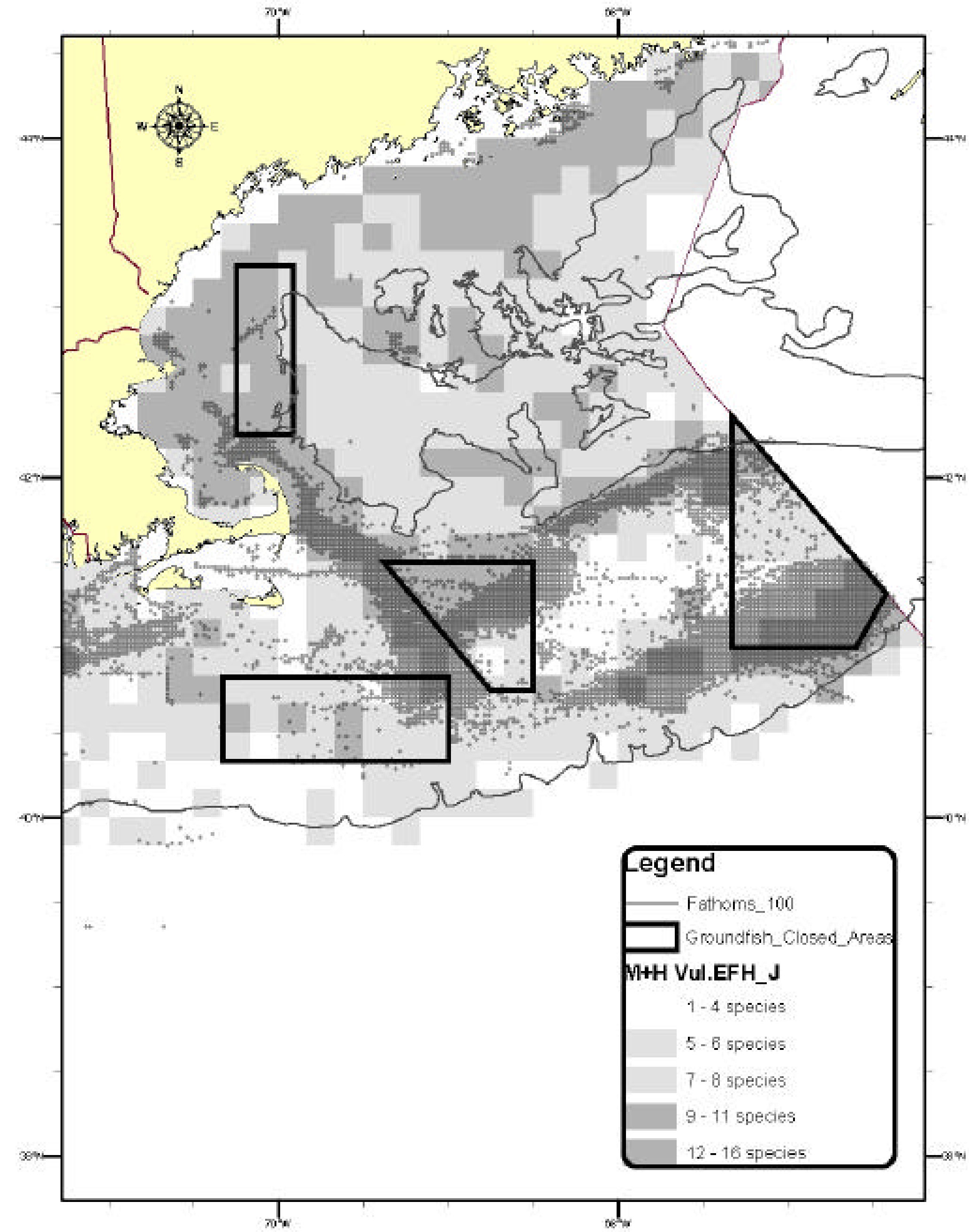
Map 64 and Map 65 show the overlap of all scallop fishing effort in 1998-2000 and the ten-minute squares with vulnerable juvenile EFH. The squares with nine or more EFH designations are shaded darker than the rest, and there does not seem to be as much direct scallop effort over these areas. According to Map 64, the majority of the effort in the Gulf of Maine region is distributed in the Great south channel and the southern portion of Closed Area II; these areas also have more juvenile EFH designations than the other areas (over 9 species in each ten-minute square). It is important to keep in mind that scallop vessels were only permitted inside the Framework 13 Access Areas of the groundfish mortality closures (the southern portion of Closed Area II, the middle of Closed Area I, and the northeast corner of the Nantucket Lightship closure) for some of the time during 1998-2000. Therefore, the effort is distributed differently depending on what areas were available to the scallop fleet. According to Map 65, the effort is more evenly distributed throughout the Mid-Atlantic region, but there are fewer ten-minute squares with over 9 juvenile EFH designations for species with vulnerable EFH. In fact, there are only about 15 ten-minute squares in this entire region that have over 9 juvenile EFH designations for species with vulnerable EFH.

Total fishing time, plotted in Map 64 and Map 65, can be a little misleading, however. Fishing time was determined from the number of 30-minute successive VMS pollings for a vessel that were 5 or less nautical miles apart from one another. Some of the fishing effort locations, plotted in Map 64 and Map 65 represent a mischaracterization of the VMS data as 'fishing'. For example, these data include times when vessels might be steaming slowly or making turns within the 30-minute intervals. The also include cooperative research trips that were conducted within areas otherwise closed to scallop fishing.

Examples in Map 64 of effort data that is probably not scallop fishing are points that are near New Bedford, MA (a major scallop port) and points running through Nantucket Sound, an important transit area for scallop boats from New Bedford. Also, closed portions of the Georges Bank groundfish areas include recorded VMS points from scallop vessels conducting research or surveys, as well as transiting. On the other hand, fishing effort points inside of Cape Cod Bay, on Stellwagen Bank, north of Cape Ann, MA on Fippinees Bank in the Gulf of Maine and along coastal Maine are accurate.

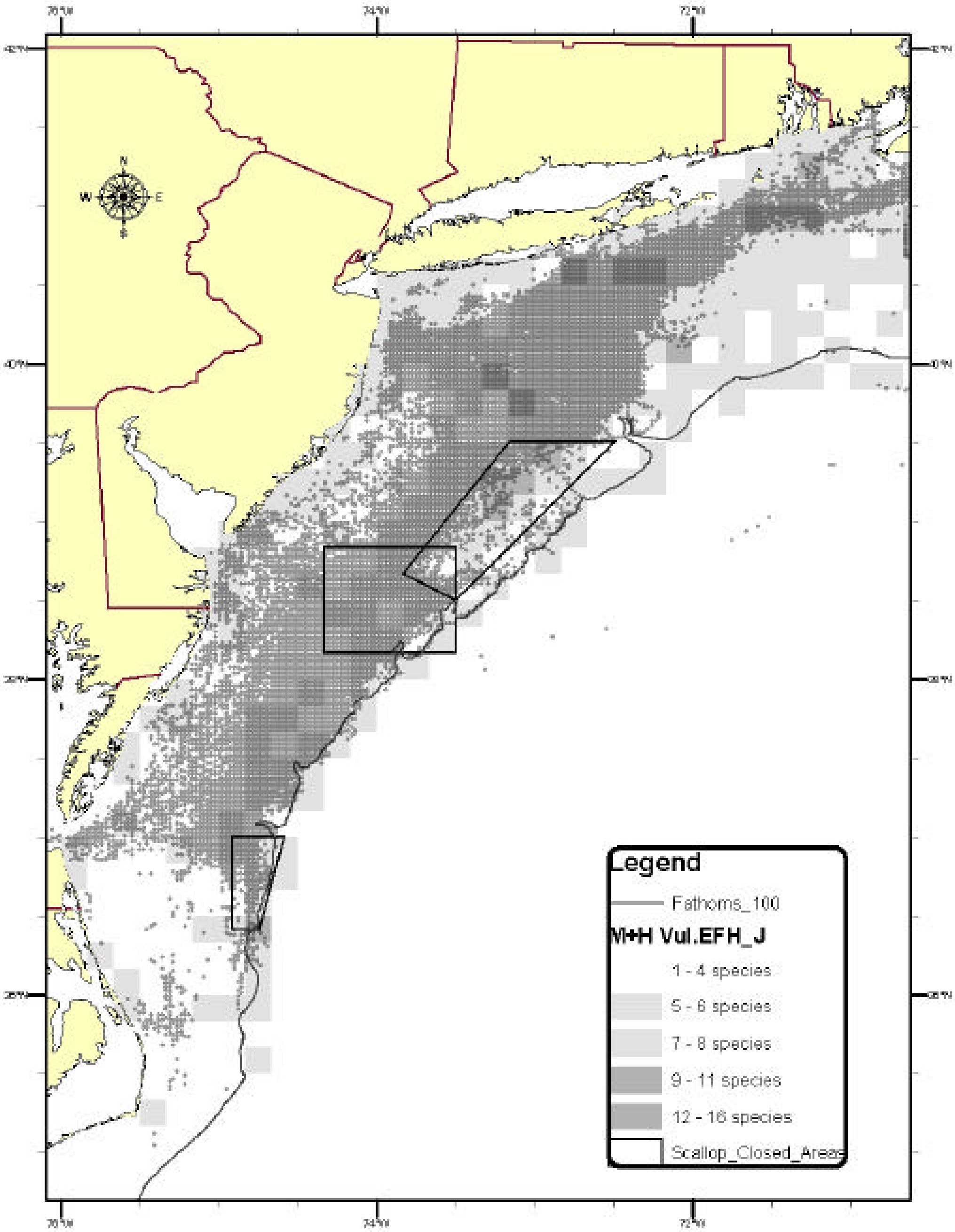
Examples in Map 65 of effort data that is probably not scallop fishing are points offshore of Oregon Inlet, NC; off of Chesapeake Bay, off Ocean City, MD and Cape May, NJ. Also points appear in the Hudson Canyon and VA/NC Areas which came from scallop vessels authorized to do research or special surveys during the time period (1998 – 2000). Because of uniform shading for EFH comparisons, these data represent low amounts of fishing time that cannot be distinguished from actual scallop fishing activity.

Map 66 and Map 67 depict the areas of *intense* scallop effort overlapped with vulnerable juvenile EFH. Intense is defined as areas of one nautical mile blocks that have more than 50 hours of scallop fishing time. Once again, in the Gulf of Maine, most of the intense effort in 1998-2000 was in the Great south channel and the southern portion of Georges Bank (Map 66). In the Mid-Atlantic region, the intense scallop effort is not in areas with over 9 EFH designations of species with juvenile EFH vulnerable to bottom tending gear, very few of these areas overlap spatially (Map 67).



Map 64. Overlap of direct scallop effort in 1998-2000 with juvenile EFH designations for species with EFH vulnerable to bottom tending gear (Gulf of Maine region only).

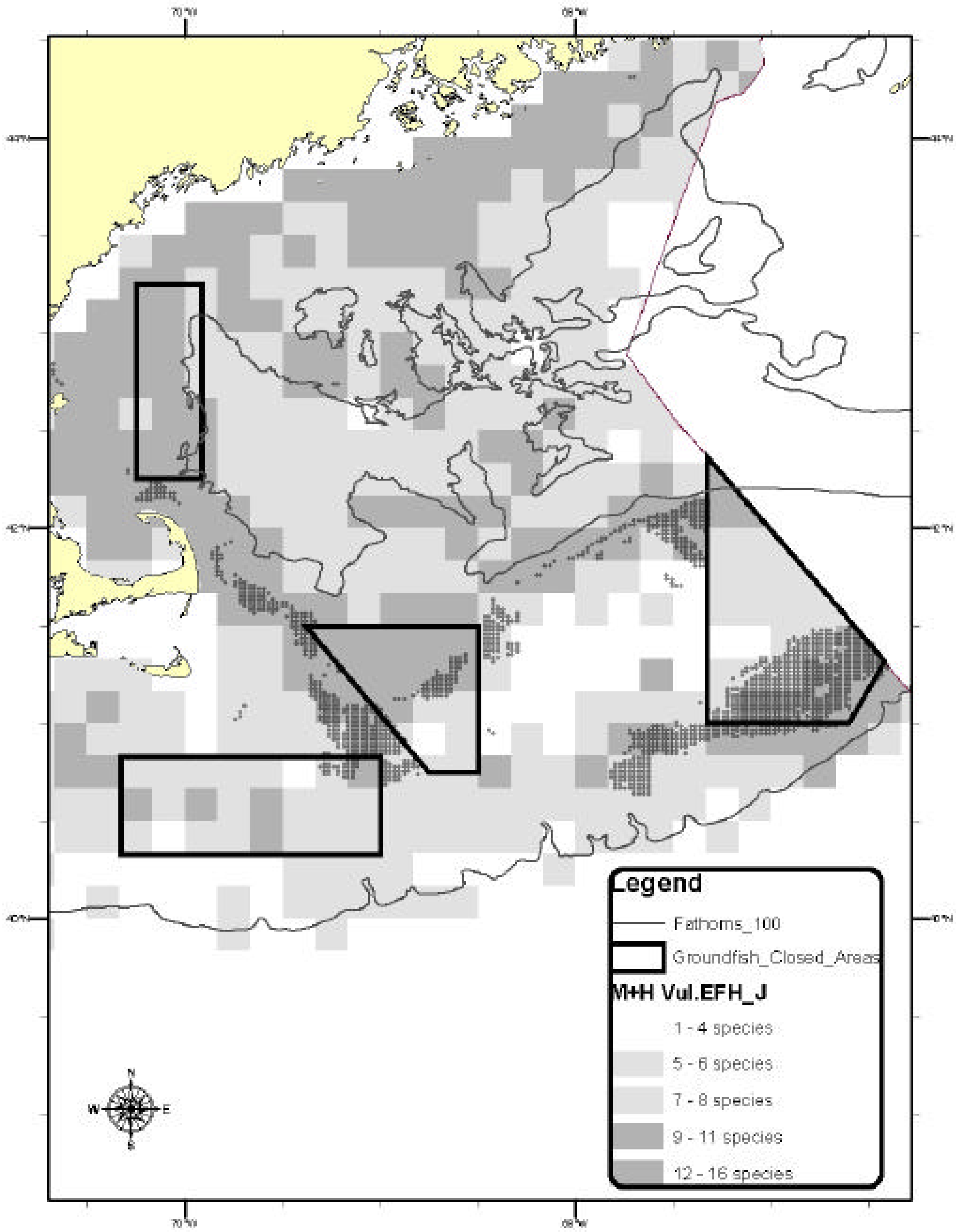
Note: Dots represent 1 nmi2 squares with >50 hours of fishing effort per year.
EFH designations are broken down into 5 categories in the legend, but for display purposes the map only has three categories (1-4 species (white), 5-8 species (light gray), and 9-16 species (dark gray)).



Map 65. Overlap of direct scallop effort in 1998-2000 with juvenile EFH designations for species with EFH vulnerable to bottom tending gear (Mid-Atlantic region only).

Note: Dots represent 1 nmi2 squares with >50 hours of fishing effort per year.

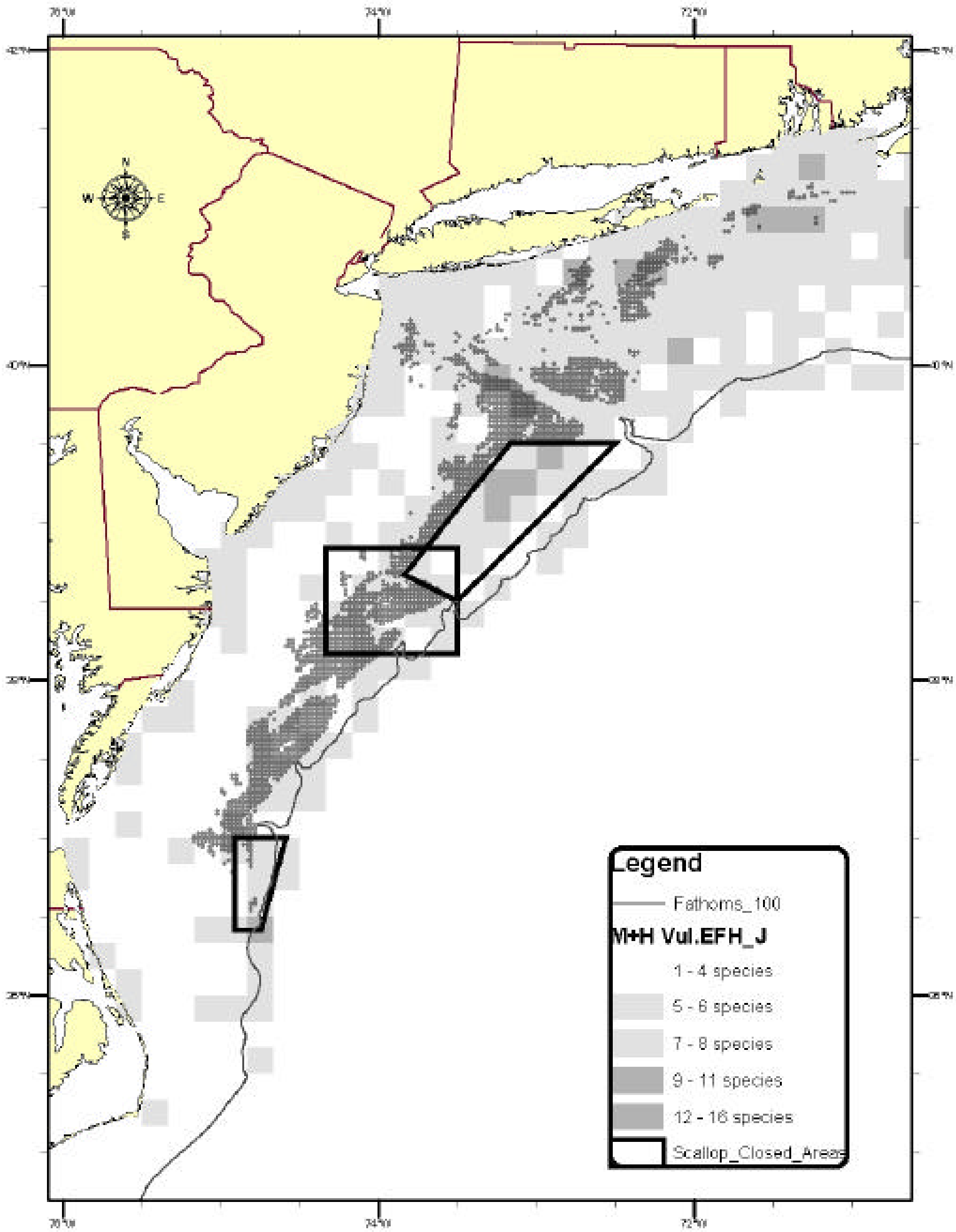
EFH designations are broken down into 5 categories in the legend, but for display purposes the map only has three categories (1-4 species (white), 5-8 species (light gray), and 9-16 species (dark gray)).



Map 66. Overlap of INTENSE scallop effort in 1998-2000 with juvenile EFH designations for species with EFH vulnerable to bottom tending gear (Gulf of Maine region only).

Note: Dots represent 1 nmi2 squares with >50 hours of fishing effort per year.

EFH designations are broken down into 5 categories in the legend, but for display purposes the map only has three categories (1-4 species (white), 5-8 species (light gray), and 9-16 species (dark gray)).



Map 67. Overlap of INTENSE scallop effort in 1998-2000 with juvenile EFH designations for species with EFH vulnerable to bottom tending gear (Mid-Atlantic region only).

Note: Dots represent 1 nmi2 squares with >50 hours of fishing effort per year.

EFH designations are broken down into 5 categories in the legend, but for display purposes the map only has three categories (1-4 species (white), 5-8 species (light gray), and 9-16 species (dark gray)).

The effort distribution under a rotational management area plan will shift into specific areas. The overlap of effort and EFH has been analyzed for fishing year 2004, 2005-2007, and the long-term projections for each area. For 2004 without access to Georges Bank, more effort is expected in GB2, GB6, and MA7-9, where sand sediments predominate. GB2 and GB6 have above average number of juvenile EFH designations, averaging 8 to 10 species per ten-minute square (compared to a mean of 6.8 for all rotation management areas). GB2 has above average number of adult EFH designations (10.5 vs. 5.8 species per ten-minute square for all rotation management areas). For more information on the percent of EFH in each rotation management area by individual species, please refer to Table 264 to Table 266.

For the 2005-2007 time period, more effort is expected in GB6, GB7, MA5, MA6, MA8, and MA9 are expected to have more effort than the historical average, particularly MA5 and MA6 (200% increase). Like 2004, the rotation management areas where higher effort is expected have predominately sand substrates. The number of EFH designations per ten-minute square is slightly higher than average in GB6 and GB7 for both juvenile and adult life stages of vulnerable species.

For the long term, the analysis predicts that GB1, GB2, GB5, GB6, GB7, MA5, MA8, and MA9 will have increased effort levels. The majority of these rotation management areas are predominately sand, with the exception of GB2, which is 50% sand, 45% gravelly sand and 3% gravel. GB1 and GB2 exhibit higher than average number of EFH designations per ten-minute square for both juvenile and adult life stages, roughly 10 to 12 species per ten-minute square. GB7 also has a higher than average number of adult EFH destinations per ten-minute square (9.0).

8.5.7.2.1.2 Sediment and EFH contained within RMA's

The sediment and EFH characteristics of the rotational management areas (RMA's) have been compiled for descriptive purposes. The distribution of sediment types contained within the 24 RMA's is described in Table 263. Furthermore, the percent of EFH contained within each RMA for species and life stages that have been determined to have EFH vulnerable to the bottom tending mobile gear have been calculated. Table 264 provides percent EFH values for the rotational areas in the Mid-Atlantic, while Table 265and Table 266 provide the same information for the rotational management areas on Georges Bank.

RMA	Size (nm^2)	Bedrock		Gravel		Gravely Sand		Sand		Muddy Sand		Mud	
		%	nm^2	%	nm^2	%	nm^2	%	nm^2	%	nm^2	%	nm^2
MA1	800	0.0	0	0.0	0	1.5	12	80.6	645	1.0	8	16.8	135
MA2	868	0.0	0	0.0	0	0.0	0	71.5	621	8.6	75	19.9	173
MA3	1433	0.0	0	0.0	0	0.0	0	83.3	1195	1.5	21	15.2	218
MA4	1659	0.0	0	0.0	0	0.0	0	69.4	1154	1.5	24	29.1	483
MA5	2124	0.0	0	0.0	0	0.1	3	90.7	1924	5.6	118	3.6	77
MA6	2058	0.0	0	3.4	69	8.9	181	86.3	1771	0.1	1	1.4	29
MA7	2897	0.0	0	0.0	0	10.5	304	76.5	2224	11.1	323	1.9	55
MA8	2465	0.0	0	0.0	0	2.3	57	97.6	2405	0.1	3	0.0	0
MA9	1830	0.0	0	0.0	0	1.2	21	67.9	1239	30.3	558	0.5	10
GB1	467	0.0	0	0.0	0	6.3	29	51.1	239	26.2	122	16.4	76
GB2	459	0.0	0	2.7	12	45.2	207	49.1	225	3.1	14	0.0	0

RMA	Size (nm^2)	Bedrock		Gravel		Gravely Sand		Sand		Muddy Sand		Mud	
		%	nm^2	%	nm^2	%	nm^2	%	nm^2	%	nm^2	%	nm^2
GB3	504	0.0	0	0.2	1	43.7	220	56.1	283	0.0	0	0.0	0
GB4	905	0.0	0	3.2	29	21.5	194	75.2	682	0.0	0	0.0	0
GB5	1701	0.0	0	0.0	0	2.6	45	96.7	1646	0.6	11	0.0	0
GB6	849	0.0	0	0.0	0	1.1	10	90.6	769	8.1	68	0.2	1
GB7	801	0.0	0	4.0	32	13.1	105	80.3	644	0.0	0	2.6	21
GB8	749	0.0	0	0.0	0	16.5	124	82.5	619	0.0	0	1.0	7
GB9*	357	0.0	0	1.5	5	48.9	174	49.6	177	0.0	0	0.0	0
GB10*	395	0.0	0	3.9	15	56.5	223	39.6	157	0.0	0	0.0	0
GB11*	398	0.0	0	0.0	0	36.9	147	63.1	252	0.0	0	0.0	0
GB12*	330	0.0	0	1.3	4	46.3	153	52.4	173	0.0	0	0.0	0
GB13*	1488	0.0	0	0.0	0	0.0	0	81.9	1222	17.0	253	1.1	16
GB14*	1124	0.0	0	0.4	4	4.1	46	95.5	1074	0.0	0	0.0	0
GB15*	873	0.0	0	0.0	0	21.2	184	78.8	687	0.0	0	0.0	0

*indicates RMA inside current groundfish year-round closed area.

Table 263. Total area and distribution of each sediment type contained within each of the rotational management areas (in percent and square nautical miles).

The rotational management areas in the Mid-Atlantic region range from roughly 800-2900 nm². By far the majority of these areas are made up of sandy bottom. The rotational management areas on Georges Bank range from roughly 330-1700 nm². The RMA's on Georges Bank are more diverse in terms of sediment type, but sand is still a significant portion of each area. None of the RMA's on Georges Bank contain bedrock, and only five of them are made up of one to four percent of gravel. A significant number of the RMA's on Georges Bank do contain gravelly sand; for example, over 40% of GB2, GB3, GB9, GB10, and GB12 are gravelly sand. GB14 and GB15 make up Closed Area II, and these areas are primarily sandy bottom. Furthermore, GB9, GB10 and GB11 make up Closed Area I, and these areas are mostly sand and gravelly sand. The Nantucket Lightship closed area is made up of GB12 and GB13, and according to the analysis GB 12 is mostly sand and gravelly sand while GB13 is mostly sand and muddy sand.

The percentage of EFH contained within each of the RMA's was also calculated for descriptive purposes. Table 264 describes the percent of EFH contained within each of the RMA's for species that have been determined to have EFH vulnerable to bottom tending gear. MA7 and MA8 contain a significant portion of juvenile Scup, Yellowtail flounder, and Winter flounder EFH. Furthermore, MA6, MA7, MA8, and MA9 contain a substantial portion of Ocean pout EFH for all three life stages (egg, larvae, and adult).

Table 264. Percent of EFH contained within each rotational management area in the Mid-Atlantic region as compared to the entire Northwest Atlantic Analysis Area (for species that have been identified as having EFH vulnerable to bottom tending gear)

	Rotational Management Areas in the Mid-Atlantic								
	MA1	**MA2**	**MA3**	**MA4**	**MA5**	**MA6**	**MA7**	**MA8**	**MA9**
AREA (nm2)	**800**	**868**	**1433**	**1659**	**2124**	**2058**	**2897**	**2465**	**1830**
American Plaice (A)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
American Plaice (J)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Atlantic Halibut (A)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Atlantic Halibut (J)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barndoor Skate (A)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barndoor Skate (J)	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1.7	3.0
Black Sea Bass (A)	1.3	1.7	6.7	4.4	5.6	5.1	9.5	3.0	2.3
Black Sea Bass (J)	1.5	1.1	2.7	1.6	2.8	1.8	7.1	3.7	5.5
Clearnose Skate (A)	3.8	2.6	3.1	1.0	1.6	1.9	2.2	0.5	0.7
Clearnose Skate (J)	3.9	2.9	3.4	2.1	0.4	2.4	1.6	0.7	0.4
Cod (A)	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2
Cod (J)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haddock (A)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haddock (J)	0.0	0.0	0.0	0.3	0.7	1.3	1.6	0.7	1.0
Little Skate (A)	0.4	0.3	1.2	0.9	2.6	2.6	4.9	4.9	3.9
Little Skate (J)	0.6	1.2	2.2	2.3	3.4	3.4	4.6	4.1	3.1
Ocean Pout (A)	0.0	0.0	0.0	0.2	1.7	4.3	6.8	6.9	5.2
Ocean Pout (E)	0.0	0.0	0.0	0.2	2.0	21.6	5.9	5.7	4.3
Ocean Pout (J)	0.0	0.0	0.0	0.0	2.0	5.1	7.7	7.7	5.3
Pollock (A)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Red Hake (A)	0.3	0.1	0.9	1.8	1.8	1.5	4.0	3.2	3.4
Red Hake (J)	0.4	0.7	0.6	0.9	1.7	2.6	4.2	4.0	3.3
Redfish (A)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Redfish (J)	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
Rosette Skate (A)	0.0	0.0	0.0	0.0	0.0	0.0	10.2	0.0	0.6
Rosette Skate (J)	7.3	6.1	8.8	8.8	8.8	5.7	4.3	3.6	0.0
Scup (J)	1.9	1.4	0.5	0.0	2.8	2.6	5.4	6.5	3.9
Silver Hake (J)	0.1	0.2	1.1	1.3	2.3	3.0	3.9	3.9	3.0
Smooth Skate (A)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Smooth Skate (J)	0.2	0.0	0.0	0.2	0.0	0.0	0.2	0.2	0.0
Thorny Skate (A)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thorny Skate (J)	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0
Tilefish (A)	2.6	3.2	0.0	0.0	0.0	0.0	7.7	0.0	0.0
Tilefish (J)	0.0	0.0	5.4	2.7	5.4	0.0	1.6	5.4	2.5
White Hake (J)	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.3	0.3
Winter Flounder (A)	0.0	0.0	0.0	0.3	1.0	2.2	5.6	4.3	2.5
Winter Skate (A)	0.0	0.0	0.8	0.8	1.8	2.7	4.1	3.3	2.5
Winter Skate (J)	0.3	0.2	0.5	1.3	1.9	3.1	4.6	3.9	3.3
Witch Flounder (A)	0.0	0.4	0.3	0.0	0.0	0.0	0.3	0.3	0.3
Witch Flounder (J)	1.1	1.4	1.7	2.1	1.3	0.1	1.3	0.2	0.9
Yellowtail Flounder (A)	0.0	0.0	0.0	0.3	2.5	5.3	8.1	7.4	5.0
Yellowtail Flounder (J)	0.0	0.0	0.3	0.6	4.5	6.5	8.1	7.5	4.4

The percent of EFH contained in the Georges Bank RMAs is obviously more than the percent of EFH contained in the Mid-Atlantic RMAs. For example, almost five percent of Atlantic halibut juvenile and adult EFH is contained in GB7. Adult and juvenile Barndoor skate have a significant portion of their

EFH in GB5. Closed area II (GB14 and GB15) contains more cod and haddock EFH than most of the other RMA's on Georges Bank, in terms of percent inside the RMA versus the entire analysis area. GB5 seems to contain more EFH than the other areas in the region, but note that it is significantly larger than the other RMA's on Georges Bank.

Table 265. Percent of EFH contained within each of the (1 through 10) rotational management areas in the Georges Bank region as compared to the entire Northwest Atlantic Analysis Area (for species that have been identified as having EFH vulnerable to bottom tending gear)

	Rotational Management Areas on Georges Bank (1-10)									
	GB1	**GB2**	**GB3**	**GB4**	**GB5**	**GB6**	**GB7**	**GB8**	**GB9***	**GB10***
AREA (nm^2)	**467**	**459**	**504**	**905**	**1701**	**849**	**801**	**749**	**357**	**395**
American Plaice (A)	1.55	0.49	0.03	0.00	0.00	0.31	0.85	0.80	0.82	0.00
American Plaice (J)	1.94	0.57	0.00	0.00	0.00	0.00	0.98	0.93	0.95	0.00
Atlantic Halibut (A)	1.66	1.26	1.80	0.62	0.66	0.00	4.91	0.42	1.51	0.31
Atlantic Halibut (J)	1.66	1.26	1.80	0.62	0.66	0.00	4.91	0.42	1.51	0.31
Barndoor Skate (A)	0.00	1.49	0.00	1.52	6.57	2.98	0.03	1.48	0.00	0.00
Barndoor Skate (J)	0.24	1.12	0.44	2.96	8.14	4.58	1.59	1.96	2.03	1.13
Black Sea Bass (A)	0.61	0.22	0.00	0.00	0.54	0.00	0.23	0.00	0.00	0.00
Black Sea Bass (J)	0.48	1.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Clearnose Skate (A)	0.00	0.10	0.00	0.00	0.00	0.00	0.05	0.57	0.59	0.00
Clearnose Skate (J)	0.42	0.42	0.42	0.00	0.00	0.00	0.04	0.47	0.48	0.00
Cod (A)	1.29	1.36	1.49	1.31	1.37	0.57	2.38	2.23	1.06	1.16
Cod (J)	1.20	2.24	2.45	2.44	1.90	1.09	2.64	1.86	0.52	0.93
Haddock (A)	1.53	0.95	0.76	1.31	1.16	0.62	1.53	1.51	1.28	1.41
Haddock (J)	1.56	1.41	1.24	2.55	5.41	3.02	2.17	1.63	1.49	0.78
Little Skate (A)	0.40	0.99	1.14	2.06	3.75	1.87	1.84	1.57	0.82	0.91
Little Skate (J)	0.36	0.76	0.86	1.54	2.88	1.42	1.38	1.28	0.61	0.67
Ocean Pout (A)	1.26	1.46	1.10	2.10	4.40	2.34	1.28	1.64	1.13	1.24
Ocean Pout (E)	1.03	1.20	0.90	1.73	3.62	1.92	1.05	1.35	0.93	1.02
Ocean Pout (J)	1.46	0.81	0.27	0.00	1.28	0.61	0.00	0.00	0.38	0.52
Pollock (A)	1.37	1.45	1.74	0.21	0.31	0.00	2.06	0.68	0.60	0.36
Red Hake (A)	1.14	0.28	0.17	0.73	3.06	2.03	0.68	0.82	0.77	0.09
Red Hake (J)	0.88	0.14	0.87	1.82	2.86	1.44	1.59	1.38	0.73	0.65
Redfish (A)	1.39	0.60	0.65	0.24	0.24	0.88	1.39	0.77	0.89	0.00
Redfish (J)	1.25	0.56	0.39	0.14	0.91	1.38	1.26	0.56	0.42	0.08
Rosette Skate (A)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rosette Skate (J)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Scup (J)	0.66	0.56	0.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Silver Hake (J)	0.77	0.12	0.24	0.92	2.74	0.52	1.21	1.09	0.61	0.32
Smooth Skate (A)	2.18	0.69	0.79	0.00	0.00	0.37	1.24	1.50	1.43	0.23
Smooth Skate (J)	1.46	1.05	0.92	0.01	0.65	1.28	1.21	0.90	0.79	0.13
Thorny Skate (A)	1.88	1.38	0.90	0.49	0.00	0.68	1.63	1.28	1.36	0.33
Thorny Skate (J)	1.17	1.14	0.90	0.88	2.42	1.97	1.53	1.15	0.83	0.50
Tilefish (A)	0.00	0.00	0.00	0.00	6.08	0.00	0.00	0.00	0.00	0.00

	Rotational Management Areas on Georges Bank (1-10)									
	GB1	**GB2**	**GB3**	**GB4**	**GB5**	**GB6**	**GB7**	**GB8**	**GB9***	**GB10***
AREA (nm^2)	**467**	**459**	**504**	**905**	**1701**	**849**	**801**	**749**	**357**	**395**
Tilefish (J)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
White Hake (J)	1.64	0.71	0.75	1.19	1.94	0.78	1.98	1.40	0.99	0.13
Winter Flounder (A)	0.58	1.85	2.13	1.71	0.16	0.00	2.23	2.38	1.15	1.51
Winter Skate (A)	0.95	1.54	1.68	2.48	3.14	0.78	2.57	2.48	1.13	1.31
Winter Skate (J)	0.85	0.98	1.07	1.91	3.40	1.61	1.73	1.61	0.76	0.84
Witch Flounder (A)	1.13	0.09	0.00	0.29	1.55	0.73	0.78	0.73	0.00	0.00
Witch Flounder (J)	1.05	0.00	0.00	0.42	0.10	0.69	0.30	0.08	0.00	0.00
Yellowtail Flounder (A)	0.91	0.93	1.07	3.29	4.04	1.95	1.12	0.87	1.25	1.45
Yellowtail Flounder (J)	1.05	1.07	1.23	3.16	4.66	2.90	1.29	1.00	1.10	1.09

*indicates RMA inside current groundfish year-round closed area.

Table 266. Percent of EFH contained within each of the (11 through 15) rotational management areas in the Georges Bank region as compared to the entire Northwest Atlantic Analysis Area (for species that have been identified as having EFH vulnerable to bottom tending gear)

Rotational Management Areas on Georges Bank (11-15)					
	GB11*	**GB12***	**GB13***	**GB14***	**GB15***
AREA (nm^2)	**398**	**330**	**1488**	**1124**	**873**
American Plaice (A)	1.59	0.00	0.00	0.33	1.16
American Plaice (J)	1.52	0.00	0.00	0.00	0.22
Atlantic Halibut (A)	0.70	0.00	1.23	0.01	1.50
Atlantic Halibut (J)	0.70	0.00	1.23	0.01	1.50
Barndoor Skate (A)	0.00	2.33	3.61	1.49	2.92
Barndoor Skate (J)	1.61	1.33	5.34	4.26	3.02
Black Sea Bass (A)	0.00	0.00	1.11	0.00	0.00
Black Sea Bass (J)	0.03	0.00	1.08	0.00	0.00
Clearnose Skate (A)	1.36	0.00	0.00	0.00	0.31
Clearnose Skate (J)	1.19	0.00	0.00	0.00	0.00
Cod (A)	1.18	0.56	0.32	2.30	2.38
Cod (J)	1.26	0.37	2.54	2.60	3.19
Haddock (A)	1.43	0.68	0.11	2.97	2.88
Haddock (J)	1.73	0.66	0.64	4.22	2.32
Little Skate (A)	0.27	0.75	3.39	2.58	1.91
Little Skate (J)	0.58	0.56	2.52	1.92	1.42
Ocean Pout (A)	1.02	0.80	4.16	2.63	2.24
Ocean Pout (E)	1.04	0.66	3.42	2.16	1.84
Ocean Pout (J)	0.87	0.27	1.76	1.10	0.39
Pollock (A)	1.10	0.17	0.13	0.33	0.33
Red Hake (A)	0.93	0.00	2.55	1.27	0.14
Red Hake (J)	0.81	0.31	2.45	1.68	1.40
Redfish (A)	1.24	0.00	0.00	0.00	0.61
Redfish (J)	1.13	0.00	0.22	0.06	0.66

Rotational Management Areas on Georges Bank (11-15)					
	GB11*	**GB12***	**GB13***	**GB14***	**GB15***
AREA (nm^2)	**398**	**330**	**1488**	**1124**	**873**
Rosette Skate (A)	0.00	0.00	0.00	0.00	0.00
Rosette Skate (J)	0.00	0.00	0.02	0.00	0.00
Scup (J)	0.00	0.00	3.19	0.00	0.00
Silver Hake (J)	0.56	0.45	2.48	1.45	1.26
Smooth Skate (A)	2.31	0.00	0.00	0.49	1.07
Smooth Skate (J)	1.28	0.24	0.24	0.22	0.59
Thorny Skate (A)	1.70	0.00	0.00	0.00	0.47
Thorny Skate (J)	0.99	0.33	0.78	1.29	1.63
Tilefish (A)	0.00	0.00	0.10	0.00	0.00
Tilefish (J)	0.00	0.00	0.05	0.00	0.00
White Hake (J)	1.08	0.26	1.83	1.53	0.95
Winter Flounder (A)	0.78	0.80	3.92	0.65	3.47
Winter Skate (A)	0.64	1.09	3.14	3.69	2.92
Winter Skate (J)	0.69	0.70	3.13	2.40	1.87
Witch Flounder (A)	0.57	0.00	1.72	0.00	0.17
Witch Flounder (J)	0.00	0.00	0.00	0.00	0.00
Yellowtail Flounder (A)	0.71	1.21	5.40	4.14	2.24
Yellowtail Flounder (J)	0.78	1.39	4.95	4.46	1.17

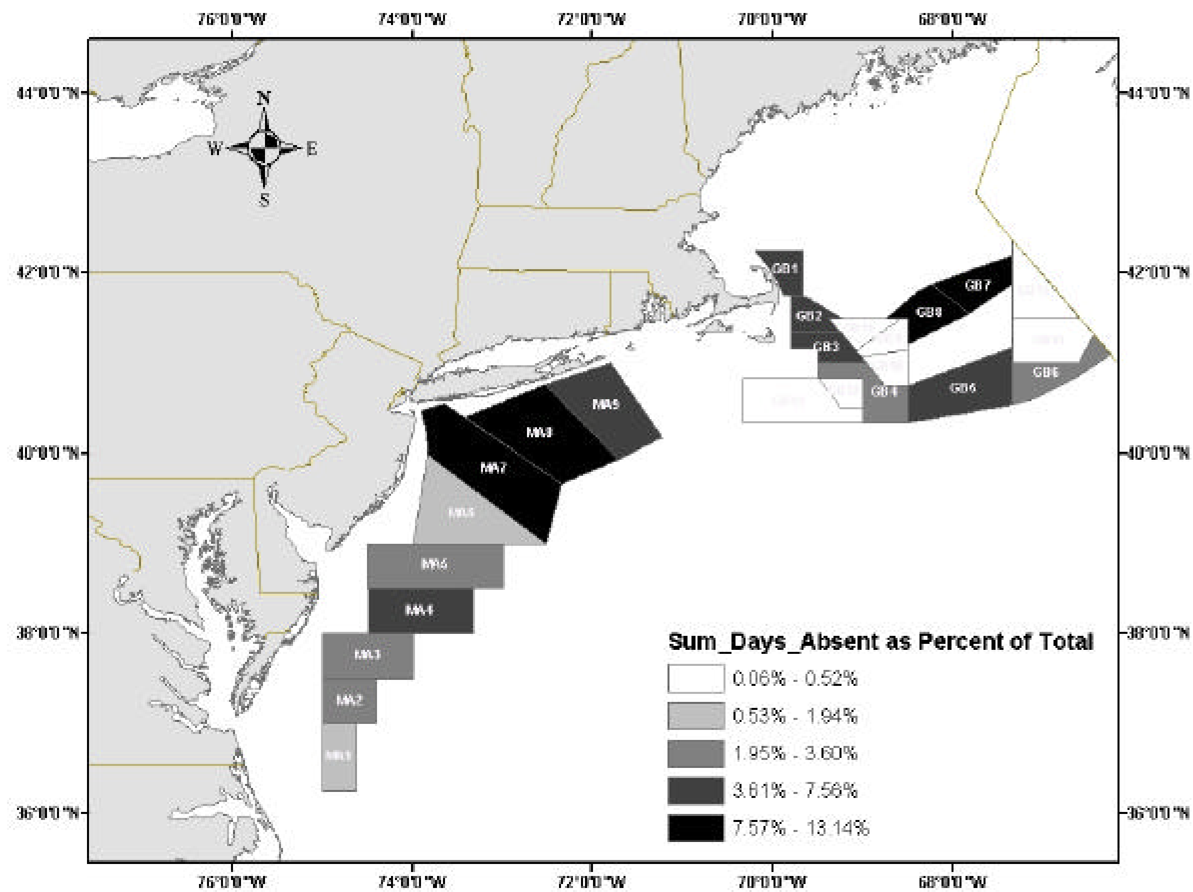
*indicates RMA inside current groundfish year-round closed area.

8.5.7.2.1.3 Baseline levels of otter trawl effort within RMA's

Rotational area management applies only to the scallop fishery. In order to qualitatively consider possible impacts to habitat through closure and re-opening of RMA's, it is critical to understand the level of non-scallop fishing pressure applied to these areas.

Otter trawl fishing pressure is highly variable throughout the RMA's, but it can generally be stated that intensity and frequency of otter trawling is greater in the Georges Bank areas than in the Mid Atlantic areas. While overall the Mid-Atlantic areas may see greater amounts of fishing days (Map 68), when scaled per-square-nautical-mile, the intensity of effort in the GB areas is clear (Table 267).

It can be inferred that the RMA's with the greatest amount of otter trawl fishing intensity will have see the smallest impacts from temporal and spatial changes in the scallop fishery.



Map 68. VTR data (1995 – 2001) for otter trawl trips reported inside the RMA's

Table 267. VTR data (1995 – 2001) for otter trawl trips reported inside the RMA's, Days Absent per square nautical mile.

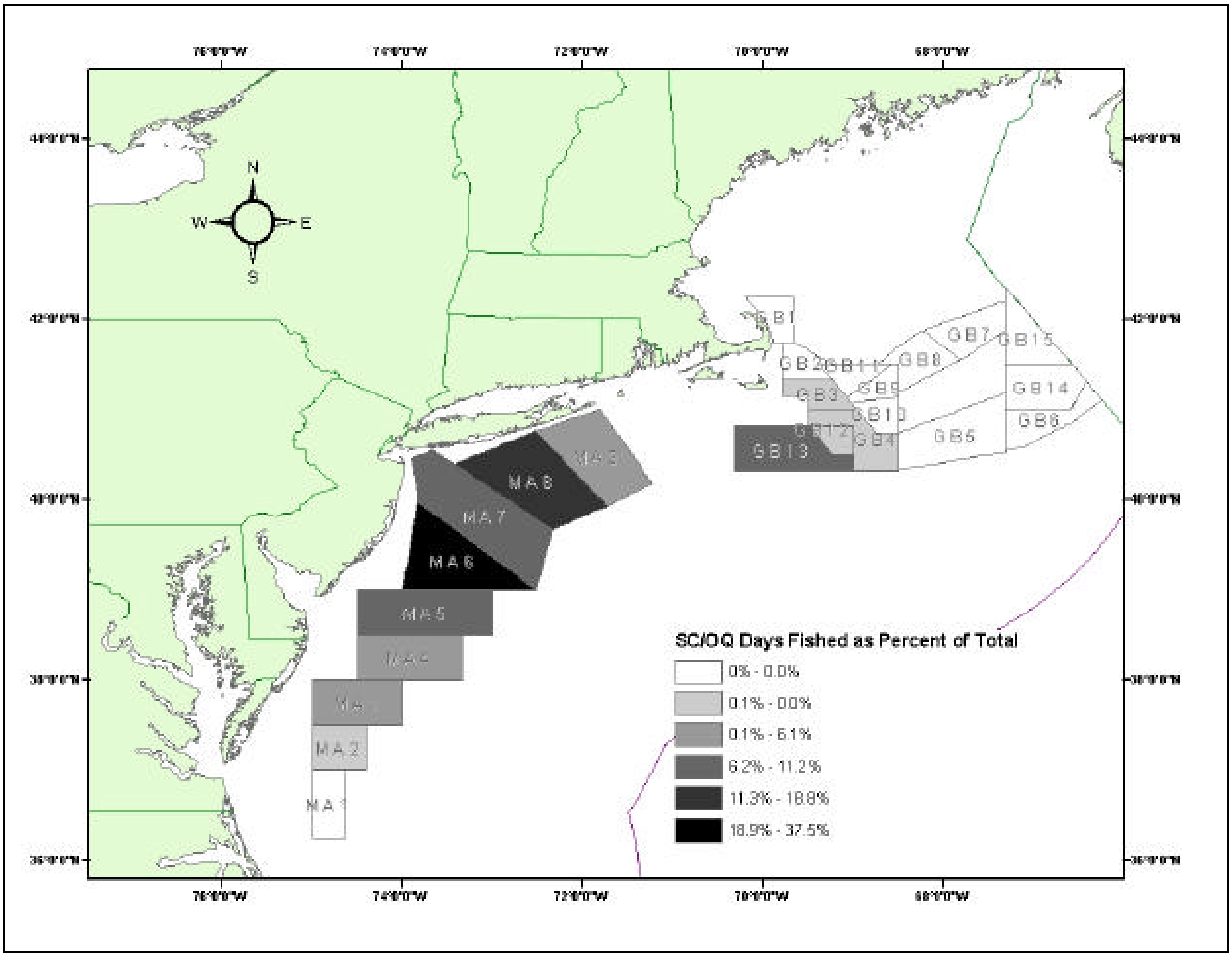
RMA	Avg. Days Absent Per Year (95-01)	Area (nm^2)	Avg DA/nm^2
MA1	299.6	800	0.3744
MA2	481.4	868	0.5546
MA3	466.8	1433	0.3257
MA4	976.7	1659	0.5887
MA5	653.4	2124	0.3076
MA6	332.8	2058	0.1617
MA7	2129.3	2897	0.7350
MA8	1488.5	2465	0.6038
MA9	1217.0	1830	0.6650
GB1	1146.1	467	2.4541
GB2	858.5	459	1.8703
GB3	1101.6	504	2.1858
GB4	429.9	905	0.4750
GB5	900.2	1701	0.5292

RMA	Avg. Days Absent Per Year (95-01)	Area (nm^2)	Avg DA/nm^2
GB6	467.9	849	0.5512
GB7	1565.6	801	1.9546
GB8	1545.4	749	2.0633
GB9*	67.5	357	0.1891
GB10*	15.5	395	0.0393
GB11*	84.6	398	0.2125
GB12*	10.3	330	0.0313
GB13*	79.5	1488	0.0534
GB14*	62.1	1124	0.0553
GB15*	70.0	873	0.0802

*Indicates RMA's wholly or partly inside current year-round closed areas

8.5.7.2.1.4 Baseline levels of clam dredge effort within RMA's

Surf Clam/Ocean Quahog fishing pressure is concentrated in the Mid Atlantic areas. This level of fishing pressure, however, is dramatically less (on a per-square-nautical-mile basis) than either scalloping or trawling. It can be inferred that the RMA's with the greatest amount of clam dredge fishing intensity will have see the smallest impacts from temporal and spatial changes in the scallop fishery.



Map 69. VTR data (1995 – 2001) for surf clam/ocean quahog trips reported inside the RMA's

	Avg. Days Fished Per Year (95-01)	Area (nm^2)	Avg DA/nm^2
All Surf Clam/Ocean Quahog Trips	2306.0	N/A	N/A
All SC/OQ Trips Inside RMA's	1546.6	27534	0.0562
MA 1	0.0	800	0.0000
MA 2	0.7	868	0.0008
MA 3	87.2	1433	0.0608
MA 4	30.4	1659	0.0183
MA 5	243.1	2124	0.1145
MA 6	623.2	2058	0.3028
MA 7	215.1	2897	0.0742
MA 8	308.6	2465	0.1252
MA 9	74.7	1830	0.0408
GB1	0.0	467	0.0000
GB2	0.0	459	0.0000
GB3	0.9	504	0.0018
GB4	0.3	905	0.0003

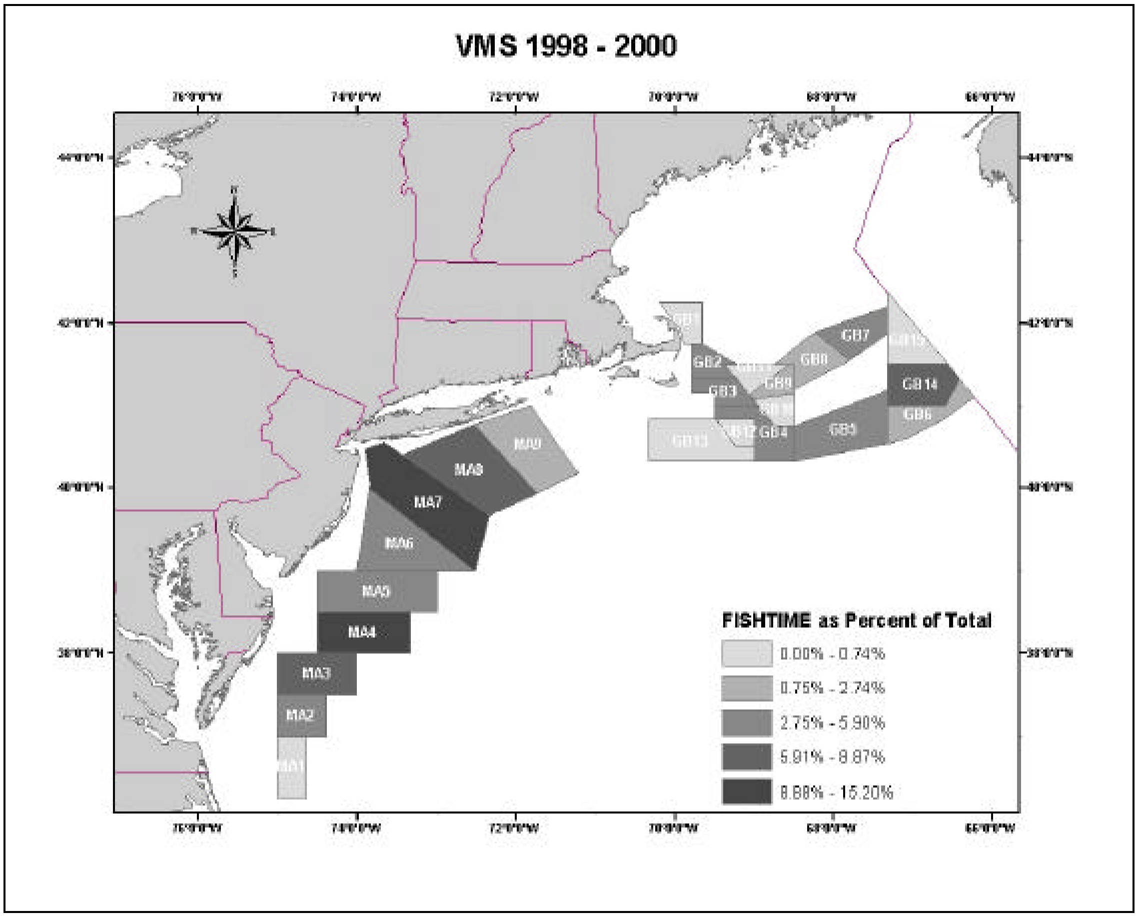
	Avg. Days Fished Per Year (95-01)	Area (nm^2)	Avg DA/nm^2
GB5	0.0	1701	0.0000
GB6	0.0	849	0.0000
GB7	0.0	801	0.0000
GB8	0.0	749	0.0000
GB9*	0.0	357	0.0000
GB10*	0.0	395	0.0000
GB11*	0.0	398	0.0000
GB12*	4.4	330	0.0134
GB13*	135.6	1488	0.0912
GB14*	0.0	1124	0.0000
GB15*	0.0	873	0.0000

*Indicates RMA's wholly or partly inside current year-round closed areas

Table 268. VTR data (1995 – 2001) for surf clam/ocean quahog trips reported inside the RMA's, Days Absent per square nautical mile.

8.5.7.2.1.5 Baseline levels of scallop dredge effort within RMA's

Scallop fishing activity is currently greatest in the mid-Atlantic RMA's. Closures of certain RMA's will trigger shifts in fishing effort that will centralize impacts on open and newly re-opened areas. Map 70 provides a gross-scale look at the amount of scalloping effort potentially displaced by closures of one or another RMA.



Map 70. 1998-2000 VMS activity data for RMA's.

NAME	Avg FishTime	Avg FishDays	area (nm^2)	Avg FishDays/nm^2
MA1	2839.8	145.6	1830	0.0796
MA2	19361.2	992.9	2465	0.4028
MA3	33953.6	1741.2	2897	0.6010
MA4	58216.1	2985.4	2058	1.4507
MA5	19875.3	1019.2	2124	0.4799
MA6	20883.6	1071.0	1659	0.6455
MA7	54453.0	2792.5	1433	1.9487
MA8	25716.4	1318.8	868	1.5193
MA9	8365.2	429.0	800	0.5362
GB1	2071.2	106.2	1488	0.0714
GB2	14258.8	731.2	330	2.2158
GB3	13347.0	684.5	1124	0.6090
GB4	22606.3	1159.3	873	1.3279
GB5	14631.0	750.3	395	1.8995
GB6	4540.4	232.8	398	0.5850
GB7	13655.2	700.3	357	1.9615
GB8	10475.7	537.2	749	0.7172
GB9*	7102.4	364.2	801	0.4547
GB10*	1505.5	77.2	849	0.0909

GB11*	341.0	17.5	1701	0.0103
GB12*	2722.6	139.6	905	0.1543
GB13*	16.7	0.9	504	0.0017
GB14*	31275.6	1603.9	459	3.4943
GB15*	693.5	35.6	467	0.0762

*Indicates RMA's wholly or partly inside current year-round closed areas

Table 269. VMS data (1998 – 2000) for scallop trips reported inside the RMA's, Average FishDays per square nautical mile. FishDays defined as FishTime (measured in hours) divided by 19.5.

	VTR 95-01 Avg Days Absent – Otter Trawl	**VTR 95-01 Avg Days Absent – Clam Dredge**	**VMS 98-00 Avg Days Fishing – Scallop Dredge**
All trips	51,669.1	2,306.0	16,498.4
Trips occurring inside RMA's	15,875.5	1,546.6	15,954.5
%	30.73%	67.06%	96.70%

Table 270. Summary table of Otter trawl (VTR), clam dredge (VTR) and scallop (VMS) trips inside and outside of the RMA's

8.5.7.2.2 Mechanical area rotation with fixed area boundaries

Four of the six rotational area management permutations employ fixed rotational area boundaries. These boundaries are included in Map 68 to Map 70.

8.5.7.2.2.1 Potential habitat impacts of mechanical area rotation with fixed boundaries

It is not possible at this time to draw conclusions regarding the habitat impacts of the effort shifts anticipated by rotational area management strategies. Closure options ranging from 3 years closed and 3 years open (3/3) to 5 years closed and 1 year open (5/1) are proposed. Based upon the information summarized in Section 8.2.1, it can be stated that longer-term closure options (5/1) offer a better chance of habitat recovery than shorter-term (3/3) scenarios. This conclusion is mitigated somewhat by the implications of data contained in Table 267, which show that certain RMA's are intensely fished and are not likely to benefit substantially even from longer-term closures to scallop gears.

The sensitivity and recovery rates of affected habitats are not known, but are significant factors in determining actual impacts of rotational management on habitat. It is generally believed that sandy, "high-energy" environments will recover faster from fishing impacts (NEREFHSC 2002). Such environments comprise large percentages of the MA RMA's as well as GB5, GB6, GB14, GB13 and GB12.

8.5.7.2.3 Adaptive closures, for a fixed duration and with fixed area boundaries

This alternative utilizes the same RMA's as described above. RMA closure durations range from 3/3 to 5/1 as well. With no currently defined closure scenarios, impacts to EFH are assumed to be identical.

8.5.7.2.4 Adaptive closures and re-openings, with fixed area boundaries

This alternative utilizes the same RMA's as described above. Under this alternative, RMA's will open and close based upon pre-defined biological conditions. The minimum closure/opening time is 1 year, and there is no defined maximum. Impacts on habitat do not differ significantly from those summarized in Section 8.5.7.2.2.1.

	No Action Alt			Status Quo			Adaptive RAM		
	SweptAr	DAS	Land(MT)	**SweptAr**	DAS	Land(MT)	**SweptAr**	DAS	Land(MT)
2003	**5,871.8**	30,532.5	23,439.3	**5,871.8**	30,532.5	23,439.3	**5,871.8**	30,532.5	23,439.3
2004	**6,684.7**	30,686.0	24,566.9	**6,684.7**	30,686.0	24,566.9	**6,684.7**	30,686.0	24,566.9
2005	**1,281.4**	9,259.1	9,668.5	**7,632.5**	30,972.1	23,758.9	**2,243.9**	13,115.4	13,177.6
2006	**1,318.2**	9,285.5	9,650.2	**8,168.3**	30,304.7	20,653.0	**2,312.7**	11,746.0	11,419.4
2007	**1,467.2**	10,291.3	10,759.6	**9,151.3**	30,100.6	16,991.1	**2,637.1**	12,180.5	11,444.1
2008	**1,436.1**	10,308.5	10,867.9	**9,781.2**	30,780.9	17,285.9	**1,808.4**	13,110.8	13,582.8
Total:	**18,059.4**	100,363.0	88,952.4	**47,289.7**	183,376.9	126,695.1	**21,558.6**	111,371.2	97,630.0

Table 271. Projections based on this alternative reveal a significant decrease in swept area relative to the Status Quo.

8.5.7.2.5 Adaptive closures and re-openings, with fixed boundaries and mortality targets or frequency of access that vary by area

See Habitat Alternative 13 for the habitat impacts of this alternative.

8.5.7.2.6 Adaptive closures and re-openings, with adaptive boundaries identified by survey when the areas are closed

This alternative does not employ fixed boundaries for area closure. Criteria are set for minimum closure area sizes and maximum percentages of total fishing area/biomass closed to scalloping. However, no conclusions can be drawn regarding habitat impacts beyond the general statements in Sections 8.5.7.2.1 and Section 8.5.7.2.5.

8.5.7.2.7 Area based management-with specific fishing mortality targets without formal area rotation

This alternative relies on area-specific differential effort allocations, rather than area closures, to prevent targeting strong year classes. The concept of differential effort allocations may reduce localized overfishing and the consequent adverse impacts of localized high fishing intensity. It is unclear how effort allocations are likely to be made, which areas/habitat types would likely be affected, and how the effort allocations may change fishing patterns relative to the No Action Alternative, Status Quo, or Rotational area management alternatives. Therefore, specific impacts of this alternative on EFH cannot be assessed. Given the relatively constrained geographic range of the fishery, the impact of this alternative is not likely to be significantly different than the impacts of other management alternatives. This alternative is not expected to increase fishing intensity or frequency, nor are expansions of fishable bottom (aside from potential access to the year-round closed areas) expected.

8.5.7.2.8 Georges Bank access to groundfish closed areas

This alternative allows for periodic access to the current year-round closed areas, either as part of a rotational strategy (similar to past closed area access programs) or as a regular rotation management area. Three options are proposed under this alternative: access to all non-HAPC areas, access to areas opened by Framework Adjustment 13, and no access.

Access to the groundfish closed areas would reduce, to an unknown degree, benefits accrued over the duration of the area closures. These benefits have been mitigated by authorized surf clam/ocean quahog dredging in the NLCA as well as the Framework Adjustment 13 scallop access program, which permitted scalloping in portions of the NLCA, CAI and CAII. On the other hand, access to the groundfish closed areas has the potential to greatly reduce total fishing effort and area swept in other areas that may or may not have sensitive habitat. In general, the area access program is designed to reduce overall effort and area swept by fishing in areas where the scallop catch per tow is high. Summaries of the affected habitats, including the sediment and EFH contained inside these areas, can be found in Section 7.3.2.3.

Scallop biomass inside the closed areas has increased to the point where relatively little bottom contact time is required to capture a large amount of scallops. Swept area projections (Table 272) for scalloping inside these areas demonstrate that fishing in these areas, relative to fishing in less productive areas, would affect much less area per day spent fishing and metric ton harvested.

Table 272. Projected impacts of fishing inside current groundfish closed areas.

Year	CA region	Bms	CatchMT	LPUE	DAS	AreaSwpt (nm^2)
2005	CLII-S	33583	10348	2759	8258	292
2005	CLII-N	4373	1127	2130	1089	244
2005	CLI-Acc	8759	1082	2758	850	117
2005	CLI-S	27185	2430	2667	1893	82
2005	NLS-AR	23116	941	2835	686	37
2005	NLS	5719	1283	2297	1120	209
2005	**TOTAL**	**16453**	**17214**	**2724**	**13898**	**984**
2006	CLII-S	30184	9374	2817	7340	297
2006	CLII-N	4153	1050	2101	1051	242
2006	CLI-Acc	7569	918	2651	752	116
2006	CLI-S	24514	2160	2649	1715	82
2006	NLS-AR	19234	775	2795	574	37
2006	NLS	5006	1111	2240	1004	210
2006	**TOTAL**	**14732**	**15390**	**2723**	**12438**	**986**
2007	CLII-S	27184	8335	2825	6551	297
2007	CLII-N	4048	1006	2084	1029	241
2007	CLI-Acc	6702	797	2537	682	115
2007	CLI-S	22558	1955	2627	1587	81
2007	NLS-AR	16324	646	2749	490	36
2007	NLS	4431	971	2161	921	209
2007	**TOTAL**	**13322**	**13713**	**2686**	**11263**	**982**
2008	CLII-S	24811	7497	2804	5992	296
2008	CLII-N	4022	985	2072	1023	239
2008	CLI-Acc	6103	711	2434	632	113

2008	CLI-S	21151	1810	2609	1495	81
2008	NLS-AR	14187	551	2701	431	36
2008	NLS	3962	865	2078	857	208
2008	**TOTAL**	**12246**	**12423**	**2636**	**10432**	**977**

The closed areas that were not opened up under the FW 13 access program and the traditional clam dredge fishing grounds in the NLCA have not been trawled by bottom tending mobile gear since their closure in December 1994. Even though less bottom time would be required to harvest the same amount of scallops in previously-closed areas on Georges Bank than in areas that have remained open to scallop fishing and scallop fishing would be reduced in open areas as effort shifts into the previously-closed areas, impacts to habitat that has not been disturbed in 7 years (1995-2002) could be substantial. It is impossible, however, to quantify the impacts of opening these areas, or to estimate how severe they could be.

The impacts of opening only those areas previously opened in the FW 13 access program are likely to be less severe due to the fact that scallop fishing has been active in these areas for 2-3 years. In fact, the transfer of effort from less productive (open area) grounds to these more productive grounds would result in a substantial reduction in bottom contact time and may have a positive impact on the EFH found within traditional scallop grounds outside the closed areas.

Additional analysis of the impacts of opening the year-round closed areas to scalloping is contained in Framework Adjustment 14 to the Atlantic Sea Scallop FMP (NEFMC 1999).

8.5.7.2.9 Increasing the minimum ring size to 4-inches in all or select areas

See Habitat Alternative 11 for impacts of this alternative on EFH.

8.5.7.2.10 Gear specific day-at-sea allocation adjustments based on equal mortality per day-at-sea.

This alternative proposes to allocate DAS between authorized trawl and dredge scallop vessels at a differential rate. The magnitude of this DAS differential is not addressed. The potential impacts of scallop trawl and dredge gear on EHF are not known at this time. Therefore, it is not possible to reach any conclusions on potential impacts of this alternative on EFH. Given the relatively constrained geographic range of the fishery, the impact of this alternative is not likely to be significantly different than the impacts of other management alternatives. This alternative is not expected to increase fishing intensity or frequency, nor are expansions of fishable bottom (aside from potential access to the year-round closed areas) expected. It is not expected to have a direct effect on the habitat of the region.

8.5.7.3 Alternatives for allocating effort (Section 5.3.3)

These alternatives are intended to apply to the approved alternative from the Alternatives to Improve Scallop Yield.

Individual day-at-sea allocations by management area

This alternative allocates separate DAS to recently re-opened areas and open areas, allowing vessels greater flexibility in how they chose to fish their allocated DAS while taking advantage of closed area access programs. Potentially affected areas, durations of fishing activities, and potential magnitudes of DAS allocations in the different areas are undetermined at this time. It is not clear how this alternative could re-distribute fishing effort, and what the potential impacts of these shifts on EFH may be. Given the relatively constrained geographic range of the fishery, the impact of this alternative is not likely to be significantly different than the impacts of other management alternatives. This alternative is not expected to increase fishing intensity or frequency, nor are expansions of fishable bottom (aside from potential access to the year-round closed areas) expected. It is not expected to have a direct effect on the habitat of the region.

Area-specific trip allocations with possession limits and day-at-sea tradeoffs

This alternative is similar to present management of the Hudson Canyon and VA/NC scallop areas. A complete analysis of the habitat impacts of this management structure was performed for Framework Adjustment 14 to the Atlantic Sea Scallop FMP (NEFMC 2001).

One-to-one exchanges of area-specific allocations (days-at-sea or trips)

This alternative allows vessel owners to exchange area-specific DAS or trip allocations on a one-to-one basis. No specific impacts can be anticipated at this time. In general terms, however, the impacts of one-to-one DAS or trip exchanges will differ slightly by area. Vessel production is limited in the scallop fishery by the shucking capacity of the vessels; therefore, exchanges of fishing effort between vessels of differing harvesting capabilities will have a reduced impact on bottom contact time and swept area relative to a fishery that is limited by resource abundance/harvesting capability. In the current scenario, where scallop abundance is relatively high, effort shifts from vessels with less harvesting capabilities (less horsepower, smaller vessels) to those with greater harvesting capabilities may actually decrease bottom contact time. The impact of this would be greater in areas of less resource abundance, as harvesting rates become more similar amongst different vessels with greater resource abundance. Therefore, the impacts of effort exchanges on habitat are likely to be greater in the open areas than in newly re-opened areas or under closed area access programs. If effort shifts from less to more efficient vessels, these impacts would likely be positive (reduced bottom contact time and swept area). However, if effort shifts from more to less efficient vessels, these impacts would likely result in increases in bottom contact time and swept area. The magnitude of these impacts cannot be gauged. Similarly, the degree to which these impacts are felt varies tremendously by substrate type and natural disturbance regime.

8.5.7.4 Alternatives for reducing bycatch and bycatch mortality (Section 5.3.5)

Increase minimum twine top mesh to 10 inches in all or select areas, and/or specify how twine tops should be installed in dredges

This alternative is not likely to have any impact on the intensity or frequency of fishing effort, nor is it likely to have any appreciable impact on bottom contact time or swept area. It is not expected to have a direct effect on the habitat of the region.

Gear modifications based on recent research

This alternative would require the use of a finfish excluder device if further research proves such a modification would be appropriate to this fishery. This alternative is not likely to have any impact on the intensity or frequency of fishing effort, nor is it likely to have any appreciable impact on bottom contact time or swept area. It is not expected to have a direct effect on the habitat of the region.

Area-specific possession limits for some finfish species

This alternative is not likely to have any impact on the intensity or frequency of fishing effort, nor is it likely to have any appreciable impact on bottom contact time or swept area. It is not expected to have a direct effect on the habitat of the region.

Area-specific TAC's for some finfish species

This alternative is not likely to have any impact on the intensity or frequency of fishing effort, nor is it likely to have any appreciable impact on bottom contact time or swept area. It is not expected to have a direct effect on the habitat of the region.

Area-specific seasons to avoid bycatch

This alternative provides for seasonal closure of six RMA's and 9 one-degree blocks to scallop gears in order to minimize bycatch. The proposed closures range in duration from 3 to 9 months. Ambient levels of trawling effort in these areas (see Map 70 and Table 269) will mitigate to a large degree any benefits to habitat that may be imparted by these seasonal closures, with the exception of impacts on RMA's GB9 (inside CAI) and GB15 (inside CAII), which are closed to all bottom tending mobile gears. More significantly, the proposed closure areas are, with the exception of RMA's GB7, GB8 and MA9, either areas of low scalloping effort or areas entirely bounded by year-round closed areas. High levels of otter trawl effort in those areas, and the potential adverse impacts of the displaced scalloping effort mitigate any potential benefits from a seasonal closure of RMA's GB7 and GB8 (closure is proposed to run from July to December for these areas).

Long-term, indefinite closures to avoid areas with high bycatch levels

The areas targeted by this alternative, GB10, GB11, GB13 and GB15, are currently part of the year-round groundfish closed areas. This alternative applies only to scallop dredge gear; if these areas were to open to groundfish fishing in the future, there would be little consequent impact on the habitat of the region.

Develop a proactive protected species program

This alternative is not likely to have any impact on the intensity or frequency of fishing effort, nor is it likely to have any appreciable impact on bottom contact time or swept area. It is not expected to have a direct effect on the habitat of the region.

8.5.7.5 Alternatives for managing scallop fishing by vessels fishing with a general category permit or fishing for scallops when not on a day-at-sea (Section 5.3.6)

Incidental catch permit with a reduced possession limit; General category permit for targeting scallops and enhanced reporting requirements and area-specific or overall TAC's

This alternative would create a new general category permit for vessels targeting scallops that renders current limited access scallop permit holders ineligible for a general category permit. A second permit would enable vessels to retain a small amount of scallop bycatch, and to sell it commercially.

The combined impacts of these two new permits on fishing time or effective effort are unclear. The intention of the former is to tighten restrictions on the general category (open access) scallop fishery, but the tradeoff for this may be increased DAS allocated to limited access vessels. With no data on general category scalloping effort, and no specifics on potential increases in effort allocations for limited access permits, impacts (positive, negative or neutral) cannot be ascertained.

This permit would require VMS for all general-category scallop vessels, which would provide valuable effort data for this fishery. Such information would be very valuable in attempting to understand the potential impacts of this fishery on EFH.

Increased scallop bycatch quotas and authorized commercial sale of bycatch scallops, the second permit created by this alternative, are not likely to have any appreciable impact on bottom contact time for mobile gear fisheries. This second permit is not anticipated to have a direct effect on the habitat of the region.

Open access for vessels to obtain either an incidental or general category scallop permit; no TAC would apply except possibly in re-opened scallop management areas; possession limits for each open access permit

Similar to the above alternative, two open access permits would be created: an incidental catch permit with a low scallop possession limit and a newly-defined general category permit for vessels that target sea scallops while not on a scallop day-at-sea.

Vessels with a limited access scallop permit may or may not be eligible for the new general category permit. TAC's may apply to general-category scalloping within RMA's, depending on management options selected by the Council. VMS would be required for vessels fishing more than 45 days under this permit.

The use of VMS for certain general-category scalloping vessels may provide valuable effort data for this fishery. The number of vessels intending to participate in this fishery is unknown, as is the number likely to be impacted by an additional VMS requirement. The use of a RMA-specific TAC's for the general category fishery may create derby-style incentives, increasing fishing pressure for a limited duration. Without data on the number of vessels likely to participate, the magnitude of such an impact, if it is even likely, cannot be quantified.

Increased scallop bycatch quotas and authorized commercial sale of bycatch scallops are not likely to have any appreciable impact on bottom contact time for mobile gear fisheries. This second permit is not anticipated to have a direct effect on the habitat of the region.

Bag tags and standard bags – Alternative 1

This alternative is not likely to have any impact on the intensity or frequency of fishing effort, nor is it likely to have any appreciable impact on bottom contact time or swept area. It is not expected to have a direct effect on the habitat of the region.

Bag tags and standard bags – Alternative 2

This alternative is not likely to have any impact on the intensity or frequency of fishing effort, nor is it likely to have any appreciable impact on bottom contact time or swept area. It is not expected to have a direct effect on the habitat of the region.

Require vessels to make daily reports of vessel trip report (VTR) data through the vessel monitoring system

This alternative is not likely to have any impact on the intensity or frequency of fishing effort, nor is it likely to have any appreciable impact on bottom contact time or swept area. It is not expected to have a direct effect on the habitat of the region.

Replacement of vessel trip reports with effort reporting via VMS, real-time landings reporting by dealers, and discard characterization by enhanced observer coverage

This alternative is not likely to have any impact on the intensity or frequency of fishing effort, nor is it likely to have any appreciable impact on bottom contact time or swept area. It is not expected to have a direct effect on the habitat of the region.

Require all limited access vessels to operate a vessel monitoring system (VMS)

Currently occasional scallop permits are not required to operate a VMS unit when fishing for scallops on a limited access permit. This alternative would provide valuable effort data for this fishery. Such information could be very valuable in attempting to understand the potential impacts of the occasional scallop fishery on EFH.

Scientific resource surveys conducted with industry vessels and crew, funded by the TAC/day-at-sea set-aside and authorized as scientific research

This alternative is designed primarily to increase sampling intensity and support area rotation. It is unclear what, if any, benefits to habitat may result, though research targeting habitat concerns is not expressly prohibited and may occur.

8.5.7.6 Alternatives for enabling scallop research (Section 5.3.8)

While there may be some benefit to habitat through the research itself, and research may result in additional bottom contact time for fishing gears, these alternatives address only mechanisms for enabling research. They have direct effect on the habitat of the region.

8.5.7.7 Alternatives for adjusting management measures (Section 5.3.9)

These alternatives are intended to streamline the framework adjustment process. They have no direct effect on the habitat of the region.

8.5.8 EFH Assessment

8.5.8.1 Description of the Action

For a full description of the action, please refer to Section 5.1.

8.5.8.2 Assessing Potential Adverse Impacts

8.5.8.2.1 Experts Opinion

See Section 7.2.6.2.4 (Types of Gear Effects in Gear Effects Evaluation) and Section 7.2.6.2.4.5 (Vulnerability of Benthic EFH to Bottom-Tending Fishing Gears). To summarize, positive and negative effects of otter trawls, scallop dredges, and hydraulic clam dredges from 32 of these publications are listed by substrate type in Table 273 - Table 276 along with recovery times (when known). Without more information on recovery times, it is difficult to be certain which of the negative effects listed in these tables last for, say, more than a month or two. In fact, it is difficult to conclude in some cases (e.g., furrows produced by trawl doors) whether the habitat effect is positive, negative, or just neutral. Despite these shortcomings in the information, the scientific literature for the NE region does provide some detailed results that confirm the previous determinations of potential adverse impacts of trawls and dredges that were based on the ICES (2001), NRC (2002), and Morgan and Chuenpagdee (2003) reports.

Table 273. Effects and Recovery Times of Bottom Otter Trawls on Mud Substrate in the Northeast Region as Noted By Authors of Eight Gear Effect Studies.

Physical Effects	**Recovery**
Doors produce furrows/berms	2-18 months
Repeated tows increase bottom roughness	
Re-suspension/dispersal of fine sediments	
Rollers compress sediments	
Smoothing of surface features	
Biological Effects	
Reduced infaunal abundance	Within 3 ½ months (1 of 2 studies)
Reduced number of infaunal species	Within 3 ½ months
Reduced abundance of polychaete/bivalve species	Within 3 ½ months (1 of 2 studies)
Increased food value of sediments	
Increased chlorophyll production of surface sediments	
Removal/damage of epifauna	
Reduced abundance of brittlestars	
Increased number of infaunal species	
Increased abundance of polychaetes	
Decreased abundance of bivalves	
Altered community structure	18 months

Table 274. Effects and Recovery Times of Bottom Otter Trawls on Sand Substrate in the Northeast Region as Noted By Authors of Twelve Gear Effect Studies.

Physical Effects	Recovery
Doors produce furrows/berms	Few days – a year
Smoothing of surface features	Within a year
Re-suspension/dispersal of fine sediments	No lasting effects
Biological Effects	
Mortality of large sedentary and/or immobile epifaunal species	
Reduced density of attached macrobenthos	
Removal/damage of epifauna	
Reduced abundance of polychaetes	
Reduced abundance/biomass of epibenthic organisms	
Reduced biomass/average size of many epibenthic species	
Epifauna (sponges/anemones) less abundant in closed areas	

Table 275. Effects and Recovery Times of Bottom Otter Trawls on Gravel and Rock Substrate in the Northeast Region as Noted By Authors of Three Gear Effect Studies.

Physical Effects	Recovery
Displaced boulders	
Removal of mud covering boulders and rocks	
Groundgear leave furrows	
Biological Effects	
Reduced abundance of attached organisms (sponges, anemones, soft corals)	
Damaged sponges, soft corals, brittle stars	12 months

Table 276. Effects and Recovery Times of Chain Sweep Scallop Dredges on Sand Substrate in the Northeast Region as Noted By Authors of Three Gear Effect Studies.

Physical Effects	Recovery
Disturbed physical/biogenic structures	
Loss of fine surficial sediments	More than 6 months
Reduced food quality of sediments	Within 6 months
Biological Effects	
Reduction in total number of infaunal individuals	Within 6 months
Reduced abundance of some species (polychaetes/amphipods)	
Decreased densities of two megafaunal species	

The following conclusions can therefore be reached:

1. Adverse and potentially adverse habitat impacts from bottom trawling occur throughout most of the NE region on a variety of substrates;

2. Adverse and potentially adverse habitat impacts from scallop dredging occur primarily in the Mid-Atlantic and secondarily on Georges Bank on sand, gravelly sand, and gravel substrates;

8.5.8.2.2 Determinations

New Bedford scallop dredges and Otter trawls will have a potential adverse effect on the EFH of species and benthic habitat types listed in Table 277. These species and life stages have been determined to be moderately or highly vulnerable to these gear types. In some cases the adverse effects may be significant (high vulnerability) and are denoted in Table 277 as well. For a detailed look at the full gear effects evaluation and adverse impacts determination, refer to 7.2.6.2.

Table 277. Summary species and life stage's EFH adversely impacted by otter trawling and scallop dredging (gears that adversely impact EFH used in the Scallop fishery).

Species	Lifestage	Vulnerability to Otter Trawling	Vulnerability to Scallop Dredging	Depth in meters (EFH Designation)	Substrate (EFH Designation)
American Plaice	A	High	High	45-150	sand or gravel
American Plaice	J	Mod	Mod	45-175	sand or gravel
Atlantic Cod	A	Mod	Mod	25-75	cobble or gravel
Atlantic Cod	J	High	High	10-150	rocks, pebble, gravel
Atlantic Halibut	A	Mod	Mod	20-60	sand, gravel, clay
Atlantic Halibut	J	Mod	Mod	100-700	sand, gravel, clay
Barndoor Skate	A	Mod	Mod	0-750, mostly <150	mud, gravel, and sand
Barndoor Skate	J	Mod	Mod	0-750, mostly <150	mud, gravel, and sand
Black Sea Bass	A	High	High	20-50	structures, sand and shell
Black Sea Bass	J	High	High	1-38	rough bottom, shell and eelgrass beds, structures and offshore clam beds in winter
Clearnose Skate	A	Mod	Mod	0-500, mostly <111	soft bottom along shelf and rocky or gravelly bottom
Clearnose Skate	J	Mod	Mod	0-500, mostly <111	soft bottom along shelf and rocky or gravelly bottom
Haddock	A	High	High	35-100	pebble gravel

Species	Lifestage	Vulnerability to Otter Trawling	Vulnerability to Scallop Dredging	Depth in meters (EFH Designation)	Substrate (EFH Designation)
Haddock	J	High	High	40-150	broken ground, pebbles, smooth hard sand, smooth areas between rocky patches
Little Skate	A	Mod	Mod	0-137, mostly 73-91	sand or gravel or mud
Little Skate	J	Mod	Mod	0-137, mostly 73-91	sand or gravel or mud
Ocean Pout	A	High	High	<110	soft sediments
Ocean Pout	J	High	High	<80	smooth bottom near rocks or algae
Ocean Pout	L	High	High	<50	close to hard bottom nesting areas
Ocean Pout	E	High	High	<50	hard bottom, sheltered holes
Pollock	A	Mod	Mod	15-365	hard bottom, artificial reefs
Red Hake	A	Mod	Mod	10-130	sand and mud
Red Hake	J	High	High	<100	shell and live scallops
Redfish	A	Mod	Mod	50-350	silt, mud, or hard bottom
Redfish	J	High	High	25-400	silt, mud, or hard bottom
Rosette Skate	A	Mod	Mod	33-530, mostly 74-274	soft substrates including sand/mud and mud
Rosette Skate	J	Mod	Mod	33-530, mostly 74-274	soft substrates including sand/mud and mud
Scup	J	Mod	Mod	0-38	inshore sand, mud, mussel and eelgrass beds
Silver Hake	J	Mod	Mod	20-270	all substrate types
Smooth Skate	A	High	High	31-874, mostly 110-457	soft mud, sand, broken shells, gravel and pebbles
Smooth Skate	J	Mod	Mod	31-874, mostly 110-457	soft mud, sand, broken shells, gravel and pebbles
Thorny Skate	A	Mod	Mod	18-2000, mostly 111-366	sand gravel, broken shell, pebble, and soft mud
Thorny Skate	J	Mod	Mod	18-2000, mostly 111-366	sand gravel, broken shell, pebble, and soft mud
Tilefish	A	High	Low	76-365	rough, sheltered bottom
Tilefish	J	High	Low	76-365	rough, sheltered bottom

Species	Lifestage	Vulnerability to Otter Trawling	Vulnerability to Scallop Dredging	Depth in meters (EFH Designation)	Substrate (EFH Designation)
White Hake	J	Mod	Mod	5-225	pelagic during pelagic stage and mud or fine sand during demersal stage
Winter Flounder	A	Mod	Mod	1-100	estuaries with mud, gravel, or sand
Winter Skate	A	Mod	Mod	0-371, mostly <111	sand, gravel, or mud
Winter Skate	J	Mod	Mod	0-371, mostly <111	sand, gravel, or mud
Witch Flounder	A	Mod	Low	25-300	fine-grained sediment
Witch Flounder	J	Mod	Low	50-450	fine-grained sediment
Yellowtail Flounder	A	Mod	Mod	20-50	sand and mud
Yellowtail Flounder	J	Mod	Mod	20-50	sand and mud

8.5.8.3 Minimizing or Mitigating Adverse Impacts

In order to minimize and mitigate the adverse effects of the fishery on EFH the Council will implement Habitat Alternative 2 (Benefits of other Amendment 10 alternatives), Alternative 6 (Closed areas consistent with the Framework 13 Scallop Closed Area Access Program) Alternative 11 (Increasing dredge ring size to 4-inches in all areas) and Alternative 12 (Habitat research funded through scallop TAC set-aside) under Amendment 10 to the Atlantic Sea Scallop fishery. Habitat Alternative 6 will prohibit scallop gear from fishing in vulnerable areas containing the above benthic habitat types. Additionally, Alternative 2, 11 and 12 will be implemented to further mitigate the adverse effects of the fishery on EFH.

8.5.8.3.1 Habitat Alternative 2

Table 278. Characterization and summary of potential impacts of Amendment 10 management measures on EFH.

Management Measure	Impact[93]	Explanation
Status quo overfishing definition	– w/o access + with access	Use of SQ definition will increase scallop fishing effort in open access areas, which could lead to resource depletion, reduced catch rates and increase in bottom time, but not if fleet has access to closed areas; with access, total bottom time will probably decrease because of high catch rates in closed areas.

[93] Impacts are evaluated for juvenile scallops and other federally-managed species relative to the status quo as positive (+), negative (-), none (0), or unknown (unk). Ranks in parentheses indicate impacts relative to the no action alternative, i.e., the provisions of Amendment 7 to the Scallop FMP, which was implemented in 1998.

Management Measure	Impact[93]	Explanation
Flexible boundary (adaptive) area rotation based on survey data	unk	Opening and closing criteria are based solely on scallop biomass and growth parameters, not habitat values. Impacts of area rotation will vary depending on the type and vulnerability of habitat types present in the area, its size, the intensity of scallop fishing prior to closure, recovery times for critical habitat features, etc. Habitat impacts will have to be evaluated on a case-by-case basis.
Controlled access to Framework 13 areas in Closed Area I and Nantucket Lightship Area in 2004 and Closed Area II in 2005-2007[94]	–	These areas were closed to groundfish gear (including scallop dredges) in 1995 and opened to scallop dredging on a limited basis in 1999 and 2000. Opening them to scallop dredging will negatively affect EFH, particularly in Closed Area I because hard bottom habitat in this area is more vulnerable to fishing than sandy bottom in other areas.[3]
Continue controlled access to Hudson Canyon Area in 2004/2005	0 (-)	On one hand, continuing controlled access in the Hudson Canyon Area will reduce bottom contact time and allow fishing effort to be more concentrated than outside the area. This may reduce EFH impacts where EFH is more complex outside of the Hudson Canyon Area. Relative to the no action alternative where the Hudson Canyon Area would open to general scallop fishing, however, this action decreases scallop fishing effort. Effort therefore would be higher elsewhere than without controlled access, potentially increasing effort where more complex EFH exists.
Open VA/NC Area closed area to regular scallop fishing in 2004	0 (-)	This area has been open to controlled access scallop fishing since 2001; Amendment 10 will open it to regular scallop fishing in 2004. Relative to the status quo, this change in status will have no habitat impact because scallops are not currently being harvested there. Relative to no action, the impacts, may be positive if the effort would have occurred in areas with more complex EFH.
Initial area rotation area closure in Mid-Atlantic in 2004 for three years	0	Closure will benefit EFH in this area, but benefits will be negligible due to high energy nature of the environment and because effort will be displaced into other areas[95]
Area-specific DAS allocations	unk	Effects may be both positive or negative, depending on the area. Positive impacts occur when the result is to reduce fishing effort by lower bottom contact time, while negative impacts may occur from access in areas with more sensitive habitat.
Exchange of DAS and trips between vessels	0	No predictable effect on EFH.
Broken trip DAS and trip adjustments	+	Could reduce effort in controlled access areas. Under a broken trip adjustment, vessels will actually loose some controlled access DAS allocations as part of the penalty. They would not be able to finish the trip, unless they had sufficient days remaining.
Four inch rings and 10 inch twine tops	+	Four inch rings will slightly increase dredge efficiency for larger scallops, thus reducing bottom contact time in recently-opened areas where large scallops are abundant, but will reduce catch rates and increase bottom time in areas where medium-small sized scallops are prevalent. Ten-inch twine tops will reduce by-catch, but have no direct habitat effects.

[94] Georges Bank area access alternatives will be implemented in a later management action (Framework Adjustment 16/39).
[95] There is no analysis of habitat attributes in the EIS to support a quantitative evaluation of the habitat impacts of this management measure.

Management Measure	Impact[93]	Explanation
Reduced possession limit for limited access vessels fishing outside of scallop DAS	+	Vessels with limited access permits are currently allowed to possess and land up to 400 lbs per trip of shucked scallop meats when not required to use allocated DAS; this measure will reduce possession limit to 40 lbs/trip) and reduce fishing effort by vessels that have been targeting scallops under the higher general category possession limit. Scallops harvested under this provision cannot be sold.
Access for general category vessels to controlled access areas	0	General category vessels will be allowed to fish in controlled access areas, subject to a 400 lbs/trip possession limit. Previously, the limit was 100 lbs. for the Hudson Canyon and VA/NC Areas and zero for the Georges Bank area access programs in past framework actions. This measure will increase fishing effort in certain areas that are accessible to general category vessels, but the incremental effect on EFH will probably be negligible given much higher effort by limited access vessels.
Framework measures for controlled access	0	Do not include adjustable habitat management measures.
2% set-aside from TAC and/or DAS allocations to fund research and surveys	+	Could indirectly benefit habitat when habitat research is funded and provides better information for future management decisions
Mandatory observer coverage on a suitable number of trips	0	Objective is to monitor by-catch and capture of protected resources, not assess or monitor habitat effects that would be difficult to do without special expensive equipment.
Bi-annual framework mechanism for setting DAS allocations and making other management adjustments	0	No habitat effects; Council can take action under a framework action to protect EFH.

8.5.8.3.2 Habitat Alternative 6

In this alternative the year-round groundfish closed areas (WGOM, CA I, CA II and NLCA) that were in place during the 2001 fishing year are considered habitat closures with the exception of those areas opened under the Scallop FW 13 Closed Area Access Program (See Map 71).

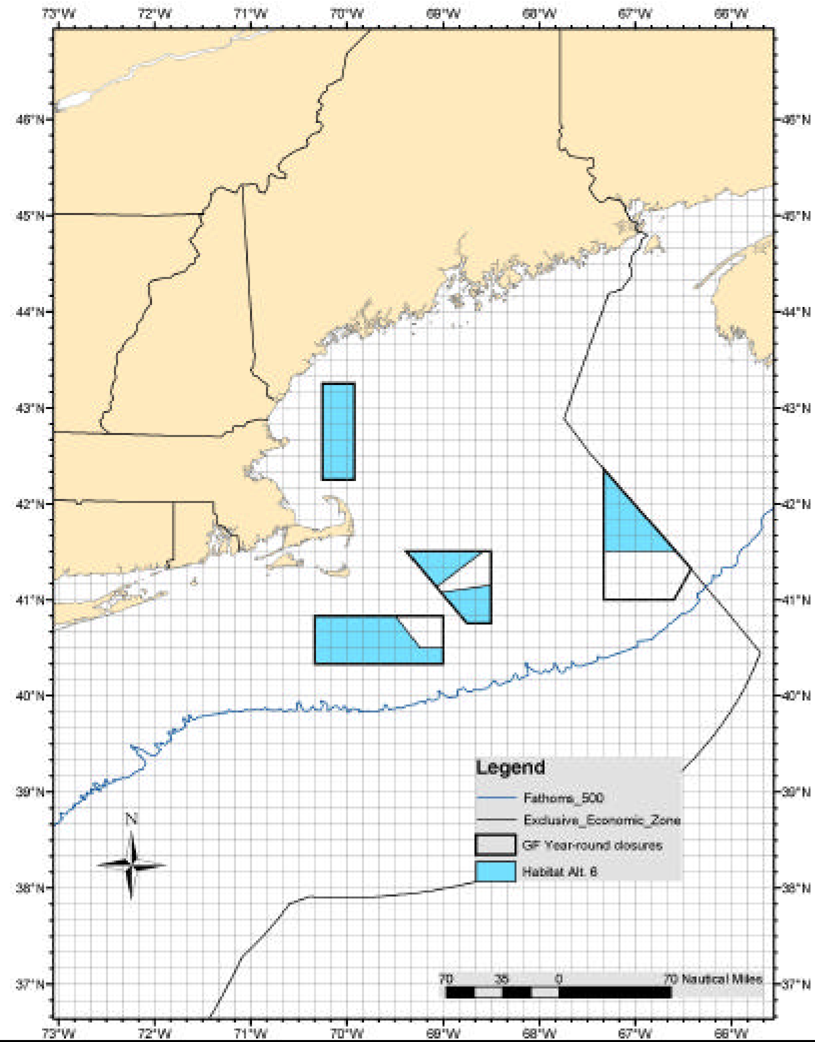


Table 279

	LONGITUDE (°W)		LATITUDE (°N)	
	deg	min	deg	min
CAI	69	1.2	41	4.5
	68	30	41	9
	68	30	40	45
	68	45	40	45
	69	23	41	30
	68	35	41	30
	69	4.3	41	8
CAII	67	20	42	22
	66	34.8	41	30
	67	20	41	30
Nantucket Lightship	69	0	40	20
	69	0	40	30
	69	14.5	40	30
	69	29.5	40	50
	70	20	40	20
	72	20	40	50
WGOM	69	55	42	15
	69	55	43	15
	70	15	43	15
	70	15	42	15

Map 71. Map and Coordinates for Habitat Alternative 6. Current Groundfish closed areas included for reference.

8.5.8.3.3 Habitat Alternative 11

Scallop dredge ring size would be required to be at 4-inches everywhere. This measure will reduce mortality on small scallops where scallops are of mixed sizes. Research has determined that the efficiency for catching larger scallops (e.g., greater than 110 mm shell height) also improves. Thus the improved dredge efficiency has the potential for reducing bottom time, non-catch mortality, bycatch, and possibly habitat effects. Option 2 is proposed because requiring the use of 4-inch rings throughout the resource could actually increase fishing time in areas where fewer large scallops are available.

8.5.8.3.4 Habitat Alternative 12

Scientists conducting habitat research that is related to the effects of scallop fishing could apply for funding through the research TAC/day-at-sea set aside. Research is needed to quantify or evaluate the long-term effects of scallop fishing on the essential fish habitat and to estimate habitat recovery rates. Some of the funds from a TAC set-aside would promote such research. This alternative would broaden the range of research types that could be funded through the scallop research TAC set aside (Section 5.1.8.3). Research funded through this mechanism could identify fishing gear or methods that have fewer habitat impacts, or might be useful to identify ways that fishing is managed to minimize related habitat impacts.

8.5.8.3.5 Analysis of Alternatives to Minimize Adverse Effects of Fishing on EFH

For a full analysis of the alternatives selected to minimize or mitigate adverse effects from fishing on EFH in Amendment 10 to the Atlantic Sea Scallop FMP, see Section 8.5

8.5.8.4 Conclusion

The management measures, implemented through this action, minimize the adverse effects of fishing on EFH, to the extent practicable pursuant to Section 303(A)(7) of the MSA).

8.6 Scallop Research via Experimental Fishing Permits

Some types of scallop research, conducted with legal commercial scallop gear or equipment that does not cause additional scallop mortality or environmental effects, could be conducted by obtaining an Experimental Fisheries Permit (EFP) and requesting an allocation of scallops from the TAC set aside. Since this activity as described would otherwise occur during a normal scallop fishing day-at-sea, the Regional Administrator may approve the EFP without an associated Environmental Assessment or Environmental Impact Statement, provided that the applicant can show no additional environmental effects or scallop mortality beyond that that would occur during the course of a normal scallop fishing trip.

Reliance on this analysis in this SEIS document does not prevent the Regional Administrator from approving research in an otherwise closed area or with non-compliant gear – provided that the research applicant satisfactorily demonstrates that it would cause no more scallop mortality or environmental effects than if those scallops were caught in open fishing areas with legal commercial fishing gear.

Positive cumulative impacts are likely to result from improved scallop research capabilities assuming that research results in ways to reduce environmental impacts of scallop fishing, minimize bycatch and bycatch mortality, and improve scallop yield. The research conducted under the research alternatives may provide information to managers in order to incorporate new management measures into the FMP. Provided research activities continue to be considered as part of the overall management action under the FMP, adverse cumulative effects on the environment should be avoided.

8.7 Economic Impacts (E. Haksever)

8.7.1 Introduction

The economic analysis of the Amendment 10 alternatives are presented in three subsections and the economic model and methods are described in Appendix IV.

Section 8.7.2 evaluates the economic impacts of the final alternatives selected by the Council including rotation with 4-inch rings, habitat closures, controlled access to the protected areas of Georges Bank and Hudson Canyon, area-specific DAS schedules, and trip limits. Section 8.7.3 provides a cost/benefit analysis of the broad-range alternatives for improving the yield from the scallop stock from a long-term perspective. The analyses include scenarios considered by the Council during the development of Amendment 10 with various rotational and non-rotational options, fixed or adaptive area boundaries, mechanical and adaptive rotations with different closure duration or maximum biomass closed, and with 3.5 or 4-inch rings. The short-term economic impacts of various measures including rotation, area-access options, overfishing definitions, habitat closures, trip limits and other proposed measures are analyzed in Section 8.7.4

The results of the long-terms analyses show that the rotational management will have positive impacts on the scallop industry. Overall, all options that allow access to the Georges Bank (GB) groundfish areas significantly increase fleet revenues, consumer and producer surpluses, and the employment. The impacts of these alternatives on fleet revenues for the first 10 years of the program are discussed in detail in Section 8.7.3.3, and on producer and consumer surpluses, total benefits and employment in Section 8.7.3.4. The long-term impacts are discussed further in Sections 8.7.3.5 and 8.7.3.6.

Although habitat closures will have negative impacts on scallop revenues and net national benefits (as measured by the total economic benefits comprising consumer and the producer surpluses), the positive impacts of rotation and area access alternatives will offset these negative impacts. As a result, the total economic benefits relative to the no action and status quo (except in conjunction with habitat alternative 1) levels will be positive even when additional areas are closed under the various habitat alternatives. A more comprehensive discussion of the short-term impacts of rotation, area access, habitat closures, trip limits and other proposed measures is provided in Section 8.7.4.

The final area rotation alternatives, with or without access to the Georges Bank Groundfish Areas, will result in larger landings, lower prices, larger fleet revenue, producer and consumer surpluses, and greater total benefits during the first four years of the program (2004 to 2007) compared to no action. The annual fleet revenues will exceed no action levels by $58 million during the first four years of implementation (i.e., 2004-2007) with access, and by $37 million with no access. The cumulative value of the net benefits, measured by the sum of consumer and producer surpluses net of no action, will reach $371 million with access and $124 million without access during the first four years of the proposed implementation (2004 to 2007). The long-term impacts of the final alternatives are discussed in Section 8.7.2.

The economic model used in the estimation of the prices, costs, revenues, consumer and producer surpluses, and total economic benefits is described in Appendix IV. The same section also includes a historical analysis of the domestic and import prices of sea scallops.

8.7.2 Economic analysis of the final alternatives

The final alternatives proposed by the Council include rotation with 4-inch rings, habitat closures, controlled access to the protected areas of Georges Bank and Hudson Canyon, area-specific DAS schedules, and trip limits. The Council also decided to adopt the status quo overfishing definition to determine target F, the area specific DAS's and TACs. This section evaluates the cost and benefits of these alternatives with and without access to the Georges Bank closed areas, followed by an analysis of the trip limits and DAS tradeoffs for the controlled access areas.

8.7.2.1 Cost/benefit analysis of the final alternatives

The results of the cost/benefit analysis of the final alternatives proposed by the Council are shown in Table 280. The regulatory guidelines require that the economic impacts of the proposed options be compared relative to the impacts likely to occur if 'no action' is taken. No action here refers to continuation of the Amendment 7 days-at-sea schedule, which will remain in effect until these measures are amended. No action, as defined, includes no access to the Groundfish Areas and no new habitat closures. Since the areas closed to fishing under habitat alternative 6 will also remain closed under no action alternative as well, Amendment 10 will have no additional economic impacts on vessels with this closure compared to no action. The areas within the boundaries of habitat closure 6, however, contain valuable scallop biomass, and, as with any closure, they still represent a potential revenue loss to the scallop fishery.

Although Amendment 7 DAS-schedule would be implemented if it was not replaced by measures in Amendment 10, the recent assessments of the scallop resource abundance could still necessitate a change in the DAS allocations by Framework process in order to meet the target fishing mortality level of 0.2 even in the absence of Amendment 10. Table 280 shows the results for such a scenario, defined as "status quo" here, to provide some insight about the future trends in landings, revenues and economic benefits, if the Council continued to use the current policies for the management of scallop resource. Status quo scenario assumes that there will be no access to the groundfish areas, no new habitat closures and no change in the ring-size from 3.5 inches. The maximum fishing effort applied in a given year was restricted at 38,000 DAS, however, in scenarios with rotation as well with the status quo in order to keep the results within a reasonable range consistent with the current effort levels.

Table 280 shows that the proposed area rotation alternatives, with or without access to the Georges Bank Groundfish Areas, will result in larger landings, lower prices, larger fleet revenue, producer and consumer surpluses, and greater total benefits during the first four years of the program (2004 to 2007) compared to no action. Economic benefits with rotation and access will also exceed the status quo benefits both in the short- and in the long-term. During the following periods, however, rotation alternative without access to the Georges Bank Groundfish Areas will have negative economic impacts. These results can be summarized as follows:

- The estimated increase in fleet revenues for the proposed alternatives is due to the increase in annual landings, averaging 52 million pounds each year with access, and 37 million with no access. The annual landings with no action are estimated to be only 22 million pounds during the same period. Consequently, the annual fleet revenues will exceed no action levels by $58 million during the first four years of implementation (i.e., 2004-2007) with access, and by $37 million with no access. Table 280 also shows the values of the TAC set-aside for the final alternatives, which are equivalent to 3% of the estimated fleet revenues. Actual revenues to the industry could amount to 3% less than the values shown in Table 280 due to these TAC set-asides. However, vessel and crew may share a part of that set-aside while participating in the TAC set-aside activities. In that case, revenues to the fleet and producer benefits will approximate the values shown in Table 280, proportional to the share obtained by vessel and the crew from these activities.

Table 280. Economic impacts with status quo overfishing definition, with and without access to groundfish areas. (Dollar values are expressed in 1996 constant prices.)

Period/Alternatives	Annual Averages				Cumulative discounted values		
	Landings Million lb.	Ex-vessel price $/lb	Fleet Revenues Million $	TAC set-aside Million $	Producer Surplus Million $	Consumer Surplus Million $	Total Benefits Million $
2004-2007							
Rotation with access, 4-inch	52	3.25	168	5.0	477	340	817
Rotation with no access, 4-inch	37	4.03	147	4.4	371	199	570
Status quo, 3.5-inch	42	3.76	156	-	438	237	675
No Action, 3.5 inch	22	5.05	110	-	365	81	446
Impacts relative to no action (i.e., difference from no action values)							
Rotation with access, 4-inch	30	-1.80	58	-	112	259	371
Rotation with no access, 4-inch	15	-1.02	37	-	6	118	124
2008-2011							
Rotation with access	49	3.41	165	4.9	323	233	556
Rotation with no access	32	4.42	132	3.9	227	115	342
Status quo, 3.5-inch	33	4.21	140	-	264	127	391
No Action	35	4.16	146	-	359	143	503
Impacts relative to no action (i.e., difference from no action values)							
Rotation with access, 4-inch	14	-0.75	19	-	-36	90	53
Rotation with no access, 4-inch	-3	0.26	-14	-	-132	-28	-161
Long-Term							
Rotation with access	46.6	3.51	162.5	4.88	250	176	425
Rotation with no access	33.2	4.25	140.8	4.23	204	99	303
Status quo, 3.5-inch	19.3	5.13	98.9	-	116	40	155
No Action	32.8	4.29	141.2	-	245	85	330
Impacts relative to no action (i.e., difference from no action values)							
Rotation with access, 4-inch	14	-1	21	1	5	91	95
Rotation with no access, 4-inch	0	0	0	0	-41	14	-27

- The increase in the abundance of scallops available for consumption coupled with lower prices will increase the consumer benefits (measured by consumer surplus) by $260 million with access, and by almost $118 million with no access compared to no action during the first four years of the program (2004 to 2007).

- Producer surplus is estimated to exceed no action levels with the proposed alternatives in the short-term even if no access is provided to the Georges Bank Groundfish areas. Producer surplus shows the benefits to the vessel owners and the crew, as measured by total fleet revenues minus the total operating costs. The increase in the cumulative value of the producer surplus for the period 2004 to 2007 is estimated to be $112 million with access, but only $6 million with no access.

- The cumulative value of the net benefits will reach $371 million with access and $124 million without access during the first four years of the proposed implementation (2004 to 2007). The net benefits are measured by the sum of consumer and producer surpluses and estimated relative to the no action levels.

Table 281. DAS-used, LPUE and employment with status quo overfishing definition, 4 inch rings, no habitat closures and with and without access to Georges Bank groundfish areas.

Period/Alternatives	DAS-used	LPUE	Percent increase in employment from no action levels
2004-2007			
Rotation with access, 4-inch	25,492	2,038	169%
Rotation with no access, 4-inch	34,150	1,154	260%
Status quo, 3.5-inch	25,184	1,680	166%
No Action, 3.5-inch	9,473	2,306	0%
2008-2011			
Rotation with access	34888	1481	138%
Rotation with no access	37420	1009	146%
Status quo, 3.5-inch	34299	995	125%
No Action, 3.5-inch	15221	2305	0%
Long-term values			
Rotation with access	37336	1336	178%
Rotation with no access	37544	1017	180%
Status quo, 3.5-inch	38018	510	184%
No Action, 3.5-inch	13407	2450	0%

- The economic impacts during the following four years and in the long-term will also be positive if access is provided to the groundfish areas, although their levels net of no action will be somewhat lower compared to the short-term levels. This is because the landings for the no action scenario increase at a faster rate as the scallop resource grows due to the restricted fishing effort with no action and no access. Table 280 shows that landings for the no action scenario increase to almost 33 million in the long-term from 22 million pounds per year during 2004-2007 because of the low levels of fishing mortality. The estimated DAS-used for no action is assumed to be approximately 15,200 days for the period 2008 to 2011, and 13,400 days in the long-term (Table 281), resulting in an increase in LPUE above 2,300 pounds per day-at-sea. The LPUE for the proposed alternative with access declines below 2,000 pounds per day-at-sea during the long-term to 1,336 pounds per day-at-sea. The long-term landings for the rotation alternative with access, 46.6 million pounds per year, is still above the no action levels, however, due to the access to the Georges Bank Groundfish areas, and higher levels of effort in the open areas. As a result, the proposed alternative with access increases total benefits by $53 million during 2008-2011 and by $95 million over the long-term.

- Without no access to Georges Bank Groundfish areas, however, the economic impacts with rotation are estimated to be positive in the short-term (2004-2007) but negative in the following period and over the long-term compared to the no action levels. This is because the higher levels of fishing effort (about 37,500 DAS) concentrated in the open areas eventually reduce the overall LPUE to about 1,000 pounds per day-at-sea. As a result, the landings with no access, 33.2

pounds per year in the long-term, are almost equivalent to the value of the landings with no action (about 32.8 million). Although the proposed rotation with no access will generate revenues similar to the levels with no action, the fleet operating costs will be much higher for this option compared to no action. Consequently, the producer surplus net of no action will be negative during 2008-2011 and in the long-term, resulting in a decline in total net benefits by $161 million and by $27 million respectively.

- The increase in DAS-used with the final alternatives, both with and without access, will generate more employment (measured by CREW*DAS) compared to no action (Table 281).

- The overall impacts on regional revenues, however, will be greater than the revenue estimates shown in Table 280 because of the indirect and induced multiplier impacts. Indirect impacts include the impacts on sales, income, employment and value-added of industries that supply commercial harvesters, such as the impacts on marine service stations that sell gasoline and oil to scallop vessels. The induced impacts represent the sales, income and employment resulting from expenditures by crew and employees of the indirect sectors. An input/output analysis conducted by NMFS (1998) estimated that sales, income and employment multipliers for the sea scallop fishery in the Northeast Region. The sales multiplier for the coastal counties in Northeast was estimated to be approximately 1.8 in 1996 for the scallop dredge and trawls.[96] Currently, there is work underway to update this input/output model by incorporating the Mid-Atlantic coastal counties where a significant proportion of sea scallops are landed.[97] If the overall multiplier for both Northeast and Mid-Atlantic region were close to the value of Northeast multiplier, then the increase in overall sales for rotation alternatives compared to no action, on average, would range from $67 million with no access to $104 million per year with access to Georges Bank groundfish areas during 2004-2007.

- Status quo scenario results in lower landings, revenues and economic benefits compared to rotation with access but higher landings, revenues and economic benefits compared to rotation with no access in the short-term. Over the long-term, however, status quo management would lower landings, revenues and economic benefits drastically compared to rotation and no action. This is because status quo management applies a uniform fishing mortality to all areas, instead of a implementing a system that protect the areas with small scallops through area closures and other measures such as area-specific DAS allocations and use of 4-inch rings. As a result, LPUE declines to about 500 lb. per DAS over the long-term, increasing costs but lowering the fleet revenues and economic benefits (Table 281). In short, status quo management fails to maximize the yield and the net national benefits from the scallop resource.

8.7.2.2 Economic impacts of the controlled area trip allocations and proposed possession limits

Final proposals of Amendment 10 include area-specific DAS allocations and trips with possession limits for access to the controlled management areas of Georges Bank and Hudson Canyon. Because the DAS allocations are area-specific, the vessels will lose revenues if they are either unable or choose not to access these areas. The proposed one-to-one exchange provision for the controlled area

96 Scott Steinback (1998), Input/Output Model of the Northeast Region's Sea Scallop Harvesting Sector, NOAA/NMFS, Woodshole.
97 According to personal communications with Scott Steinback at Economics Branch, NEFSC, Woodshole, this work is expected to be completed within the next 3 months.

trips is expected to provide flexibility to vessels regarding which areas to fish, thereby reducing the possibility for revenue loss to those vessels that are unable to access some offshore areas due to their capacity constraints.

This section analyzes the impacts of various trip limit/DAS trade-off options on the net revenues of a full-time average vessel. The previous trip limit analysis (Section 8.7.4.9) showed that with rotational management and the trip limits in the controlled access areas higher than 13,650 pounds per trip for Hudson Canyon and higher than 13,300 pounds per trip for the Georges Bank controlled access areas at 10 days-at-sea trade-off will make access to these areas economically attractive compared to the open areas. Even with trip limits less than these amounts, however, fishing in the controlled access areas will benefit vessels and increase their profits since total revenues from these trips will exceed the costs of fishing in the these areas, especially because of the "use-it or loose-it" implication of the area-specific DAS allocations.

Net revenues from the controlled area trips measure total revenues minus operating costs, which include trip costs and half of repairs. In estimating the trip costs, the steam time to the controlled access areas is taken into account. It is estimated that with longer trips taken less frequently, the trip costs per pound of scallops will be lessened due to the reduction in the steam time. With longer trips and higher possession limits, gross revenues will be larger as well, resulting in greater net revenues with each trip compared to shorter but more frequent trips.

The proposed 18,000 lb. possession limit is slightly lower than the status quo trip limit of 21,000 lb. and could constrain larger vessels with capacity to land more scallops per trip. Because of the TAC constraints and rounding method in allocating trips to each limited access permit holder for each area, larger possession limits at higher DAS allocations sometimes result in a smaller number of trips per vessel. As result, Table 282 shows that, on average a 21,000 lb. and a 22,500 lb. possession limit generates lower net revenues for 2004-2007, compared to the other possession limit alternatives with the exception of the 12,000 lb./8 DAS scenario. The proposed alternative with 18,000 lb./12 DAS produces maximum annual net revenues from controlled area trips in 2004 and also during 2004-2007 as an average of these years. Another advantage of this option is that the scallop landings from controlled access areas fall within 101% of the TAC, on average, during the first four years of implementation (i.e., 2004 to 2007, Figure 142). On the other hand, it could be difficult for some vessels to land the possession limit within 12 days. In order to accommodate for this and to reduce the costs of controlled area trips to the vessels, the Council proposed that the limited access vessels should be charged no more than 12 days even of the actual trip length was longer.

In addition, Amendment 10 proposes a new broken trip procedure for controlled access area trips terminated prematurely due to an emergency, poor weather, or any other reason deemed appropriate by the captain as described in Section 5.1.2.4. This action will have positive economic impacts by reducing fishing costs and the losses from broken trips, and provide more incentive for vessels to take their controlled access trips.

Table 282. Impacts of controlled area possession limits (Economic values are expressed in terms of 1996 constant prices).

DAS charge Scallop possession limit	8 12000 lb.	9 13500 lb.	10 15000 lb.	11 16500 lb.	12 18000 lb.	13 19500 lb.	14 21000 lb.	15 22500 lb.
All controlled areas (totals)								
Total net revenues ($)								
Total net revenues -2004	316,246	356,874	348,141	383,654	419,150	323,854	349,143	300,213
Total net revenues -2005	400,558	407,952	405,996	391,561	428,476	465,335	359,109	385,426
Total net revenues -2006	210,495	239,060	213,928	236,501	259,002	211,090	227,901	244,692
Total net revenues -2007	245,545	222,936	249,252	275,451	226,180	245,731	265,253	284,752
Average net revenues (2004-07)	293,211	306,706	304,329	321,792	333,202	311,503	300,352	303,771
% TAC landed - 2004	85.80%	96.52%	93.03%	102.33%	111.64%	87.43%	94.15%	100.88%
% TAC landed - 2005	92.55%	93.10%	92.35%	88.11%	96.12%	104.13%	96.61%	86.86%
% TAC landed - 2006	85.82%	96.55%	84.60%	93.06%	101.52%	83.25%	89.65%	96.05%
% TAC landed - 2007	92.66%	82.21%	91.34%	100.47%	82.97%	89.88%	96.80%	103.71%
Average % TAC (2004-2007)	89.21%	92.09%	90.33%	95.99%	98.06%	91.17%	94.30%	96.88%
Average % TAC+%3 TAC aside	92.21%	95.09%	93.33%	98.99%	101.06%	94.17%	97.30%	99.88%
MAX % TAC-2004-2007	92.66%	96.55%	93.03%	102.33%	111.64%	104.13%	96.80%	103.71%
Number of trips -2004	8	8	7	7	7	5	5	5
Number of trips -2005	10	9	8	7	7	7	5	5
Number of trips -2006	5	5	4	4	4	3	3	3
Number of trips -2007	5	4	4	4	3	3	3	3

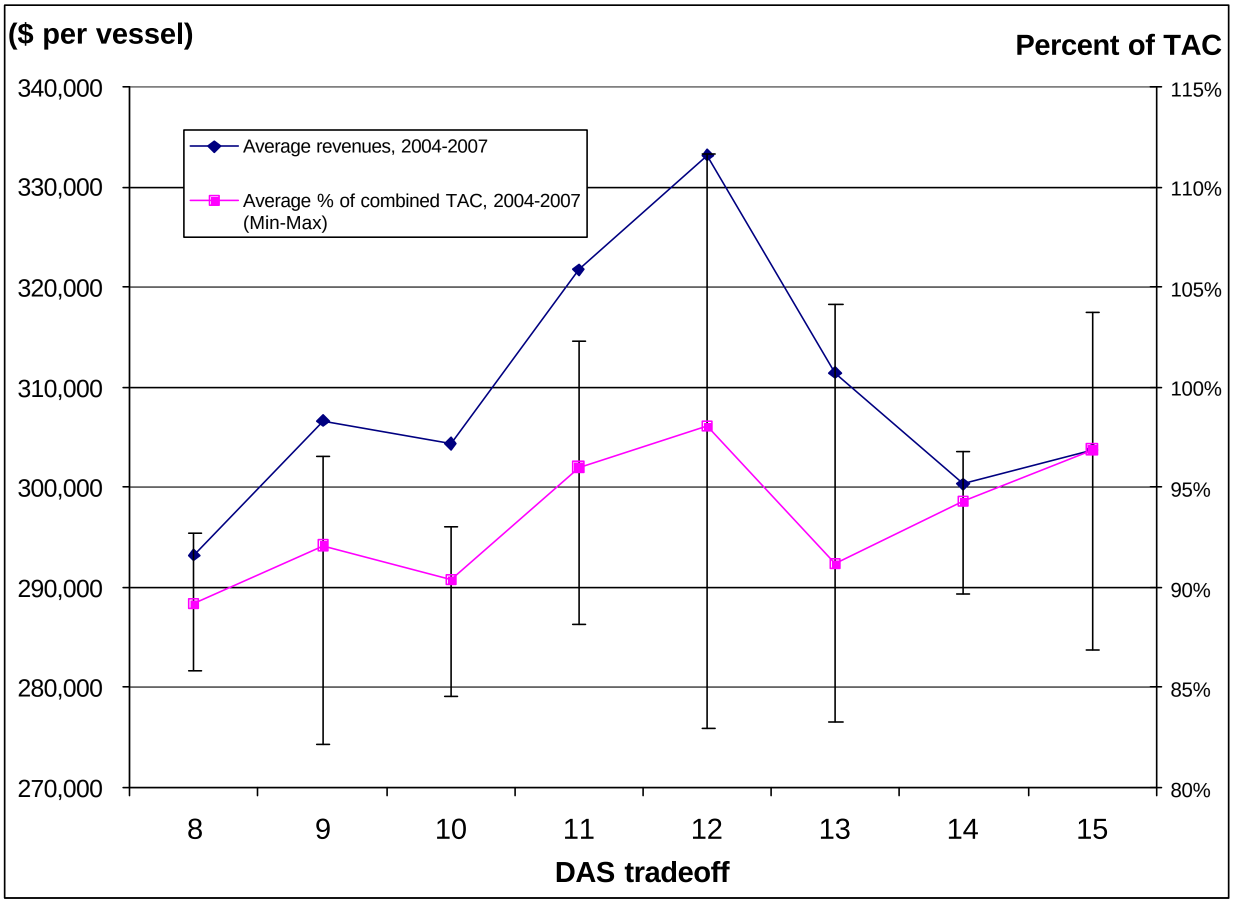


Figure 142. Comparison of average net revenues per vessel vs. controlled access DAS tradeoff with a trip possession limit equivalent to 1,500 lb./day. The maximum percent of the aggregate TAC that can be landed assuming that limited access vessels take all available trips and land the scallop possession limit.

8.7.2.3 Impacts of area-specific DAS options for controlled area access

This section provides an economic analysis of the area-specific DAS options that include the opportunity to trade the controlled access area trips. The majority of the full-time limited access permit holders used the opportunity to fish in the controlled access areas of Georges Bank and the Mid-Atlantic during the fishing years from 1999 to 2002. The possible impacts of the area-specific DAS allocations are analyzed in Table 283 by tracing the historical activity of the full-time vessels in two groups. Both groups include full-time limited access vessels that fished for more than 10 days during the years they were active. The table also shows the vessels according to their latest permit category status. For example, if a vessel changed its permit status from part-time to full-time, it was included in the sample for all fishing years. Although it is not explicitly shown in the tables, all of the full-time vessels included in these groups fished in the open areas as well. This is evident, however, from the percentage of DAS used in the controlled access areas, which is about 16% per vessel on average (Table 283).

Table 283. Controlled area access by full-time vessels during 1999-2002 fishing years (all vessels fished in the open areas).

Groups by Activity period	Data	Fished in both Mid-Atlantic and Georges Bank controlled access areas	Fished only in the Georges Bank controlled access areas	Fished only in Mid-Atlantic controlled access areas	Vessels that did not fish in any controlled access area	Grand Total
GROUP I. Active in all four years during 1999-2002	Number of vessels	159	21	19	6	205
	Percentage of vessels	78%	10%	9%	3%	100%
	DAS-used in controlled access areas as a % total DAS-used	19%	6%	6%	0%	16%
	Average Length	83	85	74	81	82
	Average GRT	161	162	116	138	156
GROUP II. Active in 2002 and in some years during 1999-2001	Number of vessels	170	23	44	21	258
	Percentage of vessels	66%	9%	17%	8%	100%
	DAS-used in controlled access areas as a % total DAS-used	20%	6%	14%	0%	16%
	Average Length	83	84	75	75	81
	Average GRT	161	157	118	137	151

Group I consists of 205 full-time vessels that participated in the sea scallop fishery during all four years from 1999 to 2002. The activity of the vessels in Group I reflects the spatial choices of the full-time fleet more accurately since all the vessels in this group were provided access to the groundfish areas of Georges Bank (i.e., Closed Areas I and II and the Nantucket Lightship area) as well as the Hudson Canyon and Virginia Beach controlled access areas during the 1999-2002 period when they were open to fishing. As Table 283 shows, the majority of the full-time fleet (78%) fished in the controlled access areas of both Georges Bank and the Mid-Atlantic. However, 19% of the full-time vessels chose to fish either in Georges Bank or in the Mid-Atlantic, while the remainder of the fleet (3%) fished only in open areas during the 1999-2002 period. These spatial choices were most likely affected by traditional fishing patterns, vessel capabilities, such as size and horsepower, and also the distance between the port of the vessel and the controlled access area. The imposed trip limits may also have affected these choices, making it more profitable for some vessels to fish in the open areas as compared to fishing in the controlled access areas. Table 283 indicates that the vessels that fished only in Georges Bank or both in Georges Bank and the Mid-Atlantic access areas were relatively larger vessels compared to those that fished only in the Hudson Canyon and Virginia Beach access areas or only in the open areas.

In comparison, Group II includes all full-time boats that participated in the scallop fishery in 2002, including those in Group I, plus an additional 53 boats that were not necessarily active during all years from 1999 to 2001. Since some of these vessels did not participate in the scallop fishery when some of the controlled access areas were open to fishing, their fishing activity does not accurately reflect their spatial choices in terms of controlled area access. However, the data for Group II is still useful in identifying the vessels that never fished in either any or in only a few of the controlled access areas, and which therefore represents those vessels that potentially could be more vulnerable to the negative impacts from area-specific DAS allocations. As Table 283 shows, whereas 66% of the active full-time vessels (170 vessels) in 2002 fished in both Georges Bank and the Mid-Atlantic access areas in the previous years, the remaining 34% of vessels, or 88 vessels, fished in only one of these access areas or only in the open areas (21 vessels).

Table 284. Fishing activity of the active full-time vessels in the controlled access areas by region of principal port (Group II vessels that participated in the scallop fishery in 2002 and in some or all of the years during 1999-2001).

Groups by Activity period	Data	Fished in both Mid-Atlantic and Georges Bank controlled access areas	Fished only in Georges Bank controlled access areas	Fished only in Mid-Atlantic controlled access areas	Vessels that did not fish in any controlled access area	Grand Total
Mid-Atlantic	Number of vessels	79	10	36	10	135
	Percentage of vessels	59%	7%	27%	7%	100%
	DAS-used in controlled access areas as a % total DAS-used	16%	6%	12%	0%	13%
	Average Length	80	79	74	79	78
	Average GRT	149	138	117	151	140
New England	Number of vessels	91	13	8	11	123
	Percentage of vessels	74%	11%	7%	9%	100%
	DAS-used in controlled access areas as a % total DAS-used	23%	7%	23%	0%	19%
	Average Length	86	87	78	72	84
	Average GRT	171	173	124	124	164
Total	Number of vessels	170	23	44	21	258

Again, vessels that fished either in Georges Bank or both in Georges Bank and the Mid-Atlantic access areas were relatively larger vessels compared to those that fished only in the Hudson Canyon and Virginia Beach access areas or only in the open areas. Table 284 shows the activity of the full-time vessels by the region of their principal port. It is evident that that 27% of the Mid-Atlantic vessels fished only in the Mid-Atlantic controlled access areas, or never fished in the Georges Bank Groundfish Areas, using, on the average, 12% of their DAS in the former areas. In comparison, only 11% of the New England boats never fished in the Mid-Atlantic controlled access areas. The majority of the full-time vessels, 74% of the New England and 59% of the Mid-Atlantic vessels, fished in controlled access areas of both Georges Bank and the Mid-Atlantic. The New England full-time vessels also used a higher percentage (19% on average) of their DAS for fishing in the controlled access areas as compared to the Mid-Atlantic boats, which used 13% of their DAS.98

Combining the empirical information based on full-time vessels included in Group I and Group II, it can be concluded that the majority of the full-time fleet will be relatively less impacted by the area-specific DAS allocations proposed by this Amendment because they have previous activity and an implicit capability for fishing in the controlled access areas of both the Mid-Atlantic and Georges Bank. Even though area-specific DAS allocations will limit the spatial fishing activity of these vessels and

98 Although Table 284 shows only the Group II vessels, these percentages are similar if only Group I vessels (i.e., those vessels that fished in all years during 1999-2002) were included in the sample.

impose costs by requiring them to fish in areas that they might not have otherwise accessed, the opportunity to exchange area-specific trips will alleviate these costs. Some vessels could even benefit from area-specific DAS allocations because by exchanging with other vessels they may be able to fish in the areas with which they are familiar and which are close to their principal ports.

In comparison, 22% of the full-time vessels that fished during all four years in 1999-2002 (Group I) fishing years fished either only in Georges Bank or only in the Mid-Atlantic controlled access areas, or fished only in open areas. The same proportion is 34% of the full-time vessels that were active in 2002 (Group II). About 9% of these full-time vessels never fished in the Mid-Atlantic controlled access areas and another 17% never fished in the Georges Bank Groundfish Areas, and about 8% never fished in any of these areas. These vessels could be impacted negatively from the area-specific DAS allocations since they will be allocated trips in areas that they have never fished or chose to access in the past and won't be able to use in the open areas. The opportunity to exchange controlled access area trips with other vessels will alleviate these impacts for some vessels, however. But some vessels in this group could face a significant reduction in revenue if they are unable to take their trips to specific controlled access areas due to the limitations in vessel size or equipment, safety concerns and/or cost factors, or if they are unable to find other vessels to exchange their DAS allocations for the areas they could fish. For example, in 2004, the estimated number of trips allocated for the controlled access areas is seven, four of which are for the Hudson Canyon area and three for the Georges Bank groundfish areas if these areas are allowed access by Framework 16. At an 18,000 lb. trip limit, the gross revenues from each trip are estimated to be about $66,600, assuming a value of $3.70 per pound of scallops if there is no access, and $60,300 assuming a value of $3.35 per pound of scallops if there is access to Georges Bank Groundfish Areas.[99] Obviously, these amounts would represent significant loss if some vessels could not take even one or two of these trips.

The magnitude of these losses will probably provide sufficient incentive for most vessels to use their trip allocations for the controlled access areas. In doing so, however, some full-time vessels that were active during the years the controlled access areas were open but which chose not to fish in these areas will still incur some costs. This is because not fishing in these areas indicates that accessing them was more costly or involved some intangible costs associated with fishing in nontraditional fishing grounds as compared to fishing in the open areas of choice. Further analysis on these vessel impacts is provided in Section 8.7.2.4 combined with the rotation alternatives with and without access to the Georges Bank Groundfish Areas.

Because controlled access trips cannot be exchanged for or used in the open areas, part-time and occasional vessels will also be impacted by the area-specific DAS allocations if they are unable to fish in these areas. Table 285 shows that out of the 27 part-time vessels that were active in 2002, only 7 vessels, or 26%, did not take any closed area trips. The occasional vessels were not included in the Table because only 3 vessels in this category were identified as active in the 2002 fishing year, and none of them took controlled access area trips. Therefore, about one fourth of the part-time and occasional vessels would incur a revenue loss if they are either unable or choose not to fish in the controlled access areas. The proposed option, however, provides a flexibility to part-time and occasional vessel for fishing in the controlled access areas. Since the part-time and occasional vessels will in general get only one or two trips to the controlled access areas, they will be able to choose which access area to fish up to the maximum number of trips allocated to each vessel. Therefore, in most cases, these vessels will not need to trade their controlled access area trips with other vessels. For example (Table 3), occasional vessels could be allocated one controlled access area trip per year in 2004, which they could take to any of the controlled access area open in a particular year. The part-time vessels could be allocated 2 trips to the

99 Rotation with access will result in higher landings and lower prices compared to rotation with no access.

controlled access areas, of which only one could be taken in Closed Area I (if opened via Framework 16) because that represents the maximum number of trips per vessel for that area. They would be allowed to take both of these trips in the Hudson Canyon or Nantucket Lightship Area, however. In short, because they will be allocated a smaller number of trips, part-time and occasional vessels will have more flexibility in choosing which controlled access area to fish. To some extent, this will alleviate the difficulties these vessels, which are smaller on the average than their full-time counterparts, could face in fishing some of the controlled access areas.

Table 285. Controlled area access by part-time vessels during 1999-2002 fishing years.

Activity period	Data	Fished in both Mid-Atlantic and Georges Bank controlled access areas	Fished only in Mid-Atlantic controlled access areas	Vessels that did not fish in any controlled access area	Grand Total
Active in 2002 and in some years during 1999-2001	Number of vessels	9	11	7	27
	Percentage of vessels	33%	41%	26%	100%
	DAS-used in controlled access areas as a % total DAS-used	32%	30%	0%	23%
	Average Length	74	75	70	74
	Average GRT	125	118	104	117

8.7.2.4 Overall economic impacts of the controlled area access, rotation and DAS-exchange alternatives on small business entities, vessels and crew

The proposed rotation alternatives, with or without access to the Georges Bank closed areas will benefit vessel owners and the crew compared to the no action levels during 2004-2007. The area-specific DAS allocations and controlled access area trips may have differential impacts on some vessels, however, depending on their ability to fish in those specific areas and/or to trade their area-specific trips with other vessels.

Permits, limited access vessels, vessel characteristics and revenues

As Table 286 shows, the number of limited access full-time scallop permits reached 270 in 2002 and 278 permits in 2003 as part of an increasing trend since 1999. The number of part-time and occasional permits stayed almost constant, although about 12 vessels changed their permit category to full-time small dredge in 2002.[100] The number of active vessels in each permit category by port are shown in Table 287, and annual scallop revenues, and vessel characteristics are shown in Table 288 through Table 290. According to the dealers' data there were about 256 full-time boats that landed any significant amount of scallops in 2002 fishing year. Average full-time vessel had a 150 GRT and an annual scallop revenue of $665,621 in the fishing year 2002, and of $578,801 in 1996 dollars after adjusting for the inflation.

The annual scallop revenues varied, however, by vessel size in both 2001 and 2002 fishing years (Table 289). The average revenues were below the fleet average for the group of smaller vessels with less than 151 gross tons and were above the fleet average for the group of vessels that have more than 151

100 Although in 2003, the number of occasional permits seemed to decline, the numbers for 2003 are preliminary and more vessels could apply for permits by the end of the year.

gross tons. Table 290 shows the annual revenues in fishing years 2001 and 2002 were by no means uniform across the vessels of the scallop fleet, and they are unlikely to be uniform in the future.

Table 286. Limited access and general category permits in the sea scallop fishery.

Permit category	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Full-time	227	227	214	203	202	207	219	223	229	230
Full-time small dredge	5	4	5	3	2	1	3	13	25	32
Full-time trawl	30	32	27	23	23	16	17	16	16	16
Total full-time	**262**	**263**	**246**	**229**	**227**	**224**	**239**	**252**	**270**	**278**
Part-time	26	21	18	16	11	11	15	14	13	9
Part-time small dredge	8	6	8	8	6	3	4	6	8	16
Part-time trawl	30	28	27	30	26	18	20	18	10	8
Total part-time	**64**	**55**	**53**	**54**	**43**	**32**	**39**	**38**	**31**	**33**
Occasional	4	3	2	2	3	4	4	5	4	2
Occasional trawl	28	26	25	20	19	20	16	15	15	8
Total occasional	**32**	**29**	**27**	**22**	**22**	**24**	**20**	**20**	**19**	**10**
Total limited access	**358**	**347**	**326**	**305**	**292**	**280**	**298**	**310**	**320**	**321**
General category	**1,960**	**2,067**	**1,984**	**1,993**	**1,930**	**2,074**	**2,247**	**2,293**	**2,493**	**2,257**
All scallop permits	**2,318**	**2,414**	**2,310**	**2,298**	**2,222**	**2,354**	**2,545**	**2,603**	**2,813**	**2,578**

Table 287. Limited access vessel by permit category and principal port (2002 fishing year).

Region of Principal Port	Data	Permit Category			
		Full-time	Occasional	Part-time	Grand Total
Mid-Atlantic	Number of vessels	133	3	22	158
	Average GRT	140	114	118	136
	Average Length	78	74	75	78
New England	Number of vessels	123	0	6	129
	Average GRT	159	116	95	156
	Average Length	83	65	65	82
	All vessels	256	3	28	287

Table 288. Revenues and characteristics of active limited access vessels.

Data	Permit Category			Grand Total
	Full-time	Part-time	Occasional	
Number of vessels—2001	250	28	4	282
Scallop revenue in fishing year 2001, current value	615,152	194,795	14,411	564,893
Scallop revenue in fishing year 2001, in 1996 prices	549,243	173,924	12,867	504,369

Data	Permit Category			Grand Total
	Full-time	Part-time	Occasional	
Number of vessels—2002	256	28	3	287
Scallop revenue in fishing year 2002, current value	665,621	209,755	42,518	614,633
Scallop revenue in fishing year 2002, in 1996 prices	578,801	182,396	36,972	534,464
Total revenue in fishing year 2002, current value	691,441	313,150	354,528	654,617
Total revenue in fishing year 2002, in 1996 prices	601,253	272,304	308,285	569,232
Average of GRT	150	113	115	145
Average of length	81	73	72	80

Table 289. Annual scallop revenues of the full-time vessels in fishing years 2001 and 2002 by tonnage group.

Data	Tonnage Group				
	£ 50 GRT	51–100 GRT	101-150 GRT	>150 GRT	Grand Total
Number of vessels—2001	4	21	84	141	250
Scallop Revenue in Fishing year 2001, current value	339,141	366,702	576,440	683,048	615,152
Scallop Revenue in Fishing year 2001, in 1996 prices	302,805	327,413	514,679	609,864	549,243
Number of vessels—2002	6	23	87	140	256
Scallop revenue in fishing year 2002, current value	221,319	401,764	621,481	755,441	665,621
Scallop revenue in fishing year 2002, in 1996 prices	192,451	349,360	540,418	656,905	578,801

Table 290. Characteristics of full-time vessels classified by annual scallop revenue .

Fishing Year	Annual average revenues ($)	Number of Vessels	Average Annual Scallop Revenue	Average GRT
2002	<200,000	18	105,295	109
	200,000-399,999	25	298,842	124
	400,000-499999	11	447,267	120
	500,000-699,999	78	617,268	146
	700,000-799,999	38	744,806	163
	800,000-899,999	45	851,335	166
	≥900,000	41	1,008,614	173
	All full-time vessels	256	665,621	150
2001	<200,000	20	76,608	118
	200,000-399,999	20	300,442	134
	400,000-499999	22	455,445	138
	500,000-699,999	95	612,000	154

Fishing Year	Annual average revenues ($)	Number of Vessels	Average Annual Scallop Revenue	Average GRT
	700,000-799,999	44	736,623	159
	800,000-899,999	22	841,784	166
	≥ 900,000	27	1,005,799	175
	All full-time vessels	250	615,152	150

The economic impacts of combined measures on limited access vessels

The economic analysis provided in this section assumes that the limited access vessels will use all of their trips allocations for controlled access areas, and their total DAS-used will be equivalent of the 2002 utilization rates. The estimated revenues and costs include revenues and costs for fishing both in the open and in the controlled access areas and they represent the revenues and costs of an average full-time vessel.

No action is defined as the continuation of the Amendment 10 DAS schedule, which allocated 34 to 43 days-at-sea per full-time vessel during the period 2004 to 2007. The initial DAS allocations proposed by this Amendment greatly exceed no action levels because the condition of the scallop resource allows a higher fishing activity at the sustainable levels. According to initial estimates provided in Table 3, if no access is provided to the Georges Bank Groundfish Areas, the allocations per full-time vessel would be 110 days in 2004 and over 150 days in 2005-2006. If there is access, however, the allocations would be about 126 days in 2004 and 124 in 2004 and 115 in 2006. As explained in Section 8.2.3, actual days-fished would be lower than these numbers because of the DAS-charge applied for the controlled access areas. Still, the fishing activity, estimated by overall DAS-used by the scallop fleet, is expected to significantly exceed the level that is possible under Amendment 7 regulations (Table 291). Higher DAS allocations will increase the vessels' landings and revenues as well as their operating expenses (defined below) as Table 291 shows.

Gross revenues will increase by 59% with the proposed alternative if there is no access and by 68% if there is access to the Georges Bank Groundfish Areas in 2004. The increase in revenues will also be positive during 2005-2007. Over the long-term, from 2008 to 2011, rotation with access will still have positive economic impacts, increasing the vessel revenues by 20%. Rotation with no access, however, is estimated to reduce the vessel revenues by 4% during the same period. This is because open areas are fished at a higher rate with no access to Georges Bank Groundfish Areas, reducing LPUE and consequently, lowering the landings compared to the no action levels (Table 291).

Table 291. DAS-used, LPUE and impacts on vessel revenues and costs from fishing in the controlled access and open areas (assuming %100 TAC is landed from the controlled area trips)

Data	Period	No action	Rotation with no access		Rotation with access	
			Values	Percent change from no action values	Values	Percent change from no action values
Estimated DAS-used	2004	8,963	24,315	171%	23,108	158%
	2005	8,989	37,370	316%	25,438	183%
	2006	9,963	37,598	277%	25,280	154%
	2007	9,979	37,317	274%	28,141	182%
	2008-2011	9,220	37,420	306%	34,888	278%

Data	Period	No action	Rotation with no access		Rotation with access	
			Values	Percent change from no action values	Values	Percent change from no action values
LPUE	2004	2,302	1747	-24%	2157	-6%
	2005	2,291	1099	-52%	2135	-7%
	2006	2,305	1022	-56%	2104	-9%
	2007	2,324	750	-68%	1759	-24%
	2008-2011	2,305	1009	-56%	1481	-36%
Revenue per vessel, in 96 prices (all areas)	2004	376,683	598,166	59%	631,940	68%
	2005	376,167	584,179	55%	645,243	72%
	2006	405,082	563,317	39%	641,564	58%
	2007	407,805	478,033	17%	629,234	54%
	2008-2011	518,142	498,535	-4%	624,131	20%
Operating costs per vessel, in 96 prices (all areas)	2004	30,689	99,927	226%	94,419	208%
	2005	30,787	161,247	424%	105,078	241%
	2006	34,522	162,345	370%	104,349	202%
	2007	34,586	160,992	365%	117,583	240%
	2008-2011	55,342	161,488	192%	149,591	170%

Gross profit and crew shares estimates are shown in Table 292. The gross profit estimates given in this Table, rather than corresponding to a specific accounting procedure, simply show the difference of gross revenue over variable (operational costs and crew shares) and fixed expenses. Operational costs consist of trip costs, such as food, fuel, oil and ice, which vary with DAS, as well as half of repairs, assuming that more vessel activity will increase repair costs. Other than these costs, the vessels will incur dockside expenses and overhead no matter how many days they fish. These expenses were included in the fixed costs for all options. The costs include insurance, license, half of repairs, office expenses, professional fees (for accounting etc.,), dues, utilities, interest, dock expenses, rent, employee benefits and bank, store, auto, travel expenses. Specifically, it was estimated that the fixed costs for an average scallop vessel amounted to $163,400 in 1996 constant dollars[101]. For further discussion of fixed and operational costs and gross profits see Appendix IV.

The gross profits, are estimated to be positive during the first four years of the proposed implementation with access, and both crew shares and gross profits are expected to exceed no action levels significantly during 2004-2007. Over the long-term from 2008 to 2011, the impacts on net revenues and crew shares will be positive as well, although the increase in net revenues compared to the no action values will be small. Rotation without access, however, will increase estimated net revenues only during the first there years from 2004 to 2006, but will have negative impacts starting as early as 2007 (Table 292). As explained above, this is due to the higher operating costs associated with higher fishing effort and lower revenues associated with lower LPUEs for the rotation without access compared with the no action amounts (Table 291).

101 The cost data collected by Daniel Georgianna et.al (1999) has similar results for the fixed costs. When half of the repairs were added to the overhead costs for the consistency of the fixed costs definition, the fixed costs for the large New Bedford and New England scallop boats amounted to $172,113 in 1997. This amount included, however, taxes, and the principal and interest payments on loans, whereas the fixed cost estimates used in the vessel impact analysis above did not include taxes and the principal payments. For the boats in Mid-Atlantic this amount was much less, around $115,000. Therefore, the estimates for fixed costs in these section are close to the amount of fixed costs ($163,403) estimated for the large vessels in New England.

Table 292. Impacts on crew shares and gross profits from fishing in the controlled access and open areas (assuming %100 TAC is landed from the controlled area trips).

Data	Period	No action	Rotation with no access	Rotation with access
Crew Shares per vessel	2004	195,321	276,137	299,948
	2005	194,914	230,737	301,107
	2006	208,528	217,591	299,361
	2007	210,097	167,196	283,695
	2004-2007 average	202,215	222,915	296,028
	2008-2011 average	258,452	179,213	261,743
Gross Profits	2004	(5,040)	58,705	74,176
	2005	(5,247)	28,797	75,661
	2006	6,302	19,984	74,457
	2007	7,391	(13,553)	64,559
	2004-2007 average	851	23,483	72,213
	2008-2011 average	48,524	(5,563)	49,399

Similarly, over the longer-term, the rotation with access is expected to have positive economic impacts for the vessels and the crew (Table 280) since the value of the producer surplus exceeds the likely value estimated to occur with no action. The rotation alternative with no access to the Georges Bank groundfish areas, will, however, have negative economic impacts on vessels over the long-term.

Amendment 10 includes other measures including 4-inch rings and 10-inch mesh twine top, TAC/DAS set-asides for sea sampling, scallop and habitat research, carry over DAS, increased observer coverage, bi-annual framework adjustment procedure and proactive protected species program. The economic impacts of these measures cannot be quantified. The expected benefits from these measures are discussed, however, in Section 5.1, and the impacts are summarized in IRFA, Section 9.0. Some qualitative analysis is also provided in Section 8.7.2.3 (Short-term impacts).

Cautions and uncertainties:

The results discussed above assumed that all vessels will be capable of fishing in the controlled access areas. There is uncertainty, however, regarding the number of vessels that will be able to fish in those areas, or will be able to trade their trips in one controlled access area for another area of their preference. As discussed in Section 8.7.2.3 above, about one-fourth to one-third of the full-time fleet did not fish one or more of the controlled access areas of Georges Bank and Mid-Atlantic and could be negatively impacted from the area-specific DAS allocations. Because controlled access area trip allocations could not be used or exchanged for open each trips, the ability and costs of fishing in the controlled access will greatly impact total vessel revenues and profits. Furthermore, the costs of those vessels that are able to fish in all areas could increase as well if in order to make full-use of its allocation a vessel has to fish in a suboptimal area with relatively higher operating expenses due to its location relative to the vessel's homeport. This is because if some vessels did not fish in some of the controlled access areas, the implication is that accessing them was either more costly or involved some intangible costs as compared to fishing in the open areas of their choice. Cost could also increase due to the transactions costs in exchanging the controlled area trips with another vessel.

Table 293. Estimated gross revenues from controlled access and open areas.

Data	Period	Rotation With No Access	Rotation With Access
Average ex-vessel price ($ per pound, in 1996 prices)	2004	3.71	3.34
	2005	3.84	3.13
	2006	3.99	3.18
Number of controlled access trips	2004	4	7
	2005	3	7
	2006	0	4
Controlled access gross revenue ($, in 1996 prices)	2004	267,251	420,667
	2005	207,409	393,947
	2006	-	229,121
Controlled access revenue as a percent of total scallop revenue	2004	44.68%	66.57%
	2005	35.50%	61.05%
	2006	0.00%	35.71%

As discussed in Table 3 allocations for controlled access areas will comprise a significant proportion of the DAS allocations especially in the first two years of implementation. For the same reasons, controlled access revenue is estimated to constitute 45% the total scallop revenue in 2004 if no access is given and 66% of the total scallop revenue if access is provided to Georges Bank Groundfish Areas. The same proportions in 2005 are estimated to be about 35% for no access and 60% with access (Table 293). For example, annual scallop revenue from all areas per average full-time vessel in 2004 is estimated to be $598,166 for final rotation alternative without access, and $631,940 with access to the Georges Bank groundfish areas. For the same year, the estimated number of trips allocated for the controlled access areas is seven, four of which are for the Hudson Canyon area and three for the Georges Bank groundfish areas if these areas are allowed access by Framework 16. One trip from a controlled access area trip would generate $66,600 with no access and about $60,300 with access (evaluated 18,000 lb and $3.70 per lb without access, and $3.35 with access), constituting more than 10% of the annual revenue without, and close to 10% of the annual revenue with access to Georges Bank Groundfish Areas. Therefore, the loss of revenue from controlled access trips could be significant, even if one or two of these trips could not be taken.

However, the proposed one-to-one exchange provision for the controlled access area trips is expected to provide flexibility to some vessels regarding which areas to fish, thereby reducing the possibility for revenue loss to those vessels that are unable to access some off-shore areas due to their capacity constraints. Nevertheless, there is no guarantee that every vessel seeking to exchange their controlled area trip allocations for the areas of their choice will be able to find another vessel willing to exchange its allocation.

In the same way, revenue estimates are useful only in comparing the economic impacts of alternatives relative to each other. The absolute values of the estimates should be interpreted with caution since they represent average revenues for the period 2004 to 2007 corresponding to the average LPUE estimates of the biological model. In other words, these estimates should not be used to forecast the absolute values of the future vessel revenues. In summary, the estimated numerical values of revenues, costs and gross profits should be interpreted with caution and these estimates should be used mainly to compare one alternative to another for the following reasons:

- The estimated gross revenues with no action and with rotation and no access are negative in some years but slightly positive in others. The existence of positive profits do not necessarily indicate, however, that the fleet would be financially sound at these levels of operation or that the profits for each vessel would be positive. Gross profits include fixed and operating costs, including repairs, and but not vessel replacement or depreciation costs. In addition, at the estimated levels of gross profits, there may be very little return on the owner's investment, let alone a rate of return that reflects the level of risk for scallop fishing. In other words, gross profits will be imperfect indicators of the financial viability of the vessels until more current and comprehensive data are obtained not only on vessel costs, but also on vessel owners' short-term and long-term liabilities (such as mortgage on vessels), and other fishery related income and assets generated from the fishing profits of previous years.

- The gross profit estimates are useful, however, in comparing one alternative to another. There is no doubt that including other items, such as opportunity costs of capital, would reduce the gross profit estimates for all options. But since this reduction would be in an equal amount for each alternative, the profitability of each option relative to the others would not change.

- The revenues and gross profits, costs, and crew shares were estimated for an average full-time vessel in the scallop fleet. They will vary according to the vessel size in terms of gross tons, horsepower, and vessel age (older vessels will have more repair costs). They will also vary because of the differences in the skills of the captains and the crew. For these reasons, the actual revenues of the individual vessels will diverge from the fleet averages shown Table 291 and Table 292. Some vessels in the fleet will have a higher fishing power, higher LPUE's and therefore, larger revenues than the others. Indeed, the dealer's database for fishing years 2001 and 2002 showed that annual vessel revenues were by no means uniform but increased with the size of vessels, i.e., GRT and HP (Table 289 and Table 290). The revenues in the future are also expected to vary according to the vessel size in terms of gross tons and horsepower and also because of the differences in the skills of the captains and the crew.

- These gross profit and revenues were estimated by assuming that the vessels will use all the trips allocated to them in the controlled access areas. Actual values of these estimates will be lower for some vessels if they were unable or choose not to fish in these areas.

- The costs and gross profits will change with the future fuel costs, and prices of other items, such as food, that comprise the variable and fixed costs.

- Change in import prices, meat count, change in the disposable income and preferences of consumers will affect prices and therefore the revenues, and gross profits for all alternatives.

- The number of active vessels are assumed to stay constant under all alternatives. No assumptions has been made about the redistribution of DAS and trip allocations if some vessels exited the scallop fishery, or the number of active vessels increased.

8.7.2.5 Impacts of General Category Rules

The proposed option would prohibit vessels with limited access scallop permits from targeting scallops under the general category rules when not fishing on a scallop day-at-sea. The objective is to prevent an increase in the overall fishing mortality of scallops by limited access vessels taking more general category rule trips to compensate for the reduction in DAS allocations. This action is expected to benefit most limited access vessels, since an increase in general category rule trips may lead to a further reduction in the DAS allocations, penalizing those vessels that do not take any general category trips.

The prohibition of such trips by the limited access vessels, however, is expected to reduce the overall fishing mortality of sea scallops, and thus allow for higher DAS allocations than if the limited access vessels could fish in both permit categories. Therefore, this measure may reduce the revenues of the limited access scallop vessels that were already landing scallops under a general category permit, but would increase the revenues of the other vessels that were landing scallops only when they are on a day-at-sea. This latter group of vessels would gain if they receive an extra DAS allocation from a readjustment of total DAS for the limited access vessels. In addition, the vessels holding general category scallop permits and limited access scallop vessels fishing under a multispecies or monkfish DAS would be subject to the 400 lb. scallop possession limit in open scallop fishing areas and reopened controlled access areas, including those reopened for species other than scallops. This exemption will limit the negative impacts of the proposed prohibition on a subset of vessels that catch scallops as bycatch while participating in multispecies and/or monkfish fisheries.

Table 294. Limited access vessels and revenues from general category trips by permit category in fishing year 2002.

Limited access vessel groups	Full-Time	Part-Time	Occasional	Total
No general category landings	179	0	0	179
General category revenues less than 1%	51	12	3	66
General category revenues greater than 1%	9	5	4	18
Subtotal: The number of vessels with general category landings	60	17	7	84
Total: All vessels	239	17	7	263

The impacts of this proposal are examined in Table 294 through Table 296. Only 84 vessels, out of a total 263 limited access vessels, landed scallops under the general category rules (i.e., less than or equal to 400 lb.) during the 2002 fishing year (Table 294). Of these, 60 were full-time, 17 were part-time and 7 were occasional vessels. Table 295 shows that the revenues obtained from the general category trips as a percent of the total fleet revenues were less than 1% for the full-time fleet, 2.6% for the part-time fleet, and 3.0% for the occasional fleet. In particular, for 66 out of the 84 vessels that took general category trips, scallop revenues obtained from these trips were relatively small, comprising less than 1% of their total revenues (Table 294). Therefore, the proposed prohibition to land under the general category rules will most likely have an insignificant impact on the revenues of these 66 limited access permit holders and no impact on the 179 vessels that took no general category trips in the 2002 fishing year. Together, this group of vessels comprises 93% of the vessels in the scallop fleet.

In comparison, 18 limited access vessels, comprising less than 7% of the scallop limited access fleet, derived more than 1% of their revenues from the general category trips. Table 295 provides detailed information about the revenues of the limited access vessels, both from general category and DAS trips. The data is presented as an aggregate of all the permit categories rather than by permit category in order not to violate the confidentiality requirements of data collection.[102] Half of these vessels had full-time permits, and the remaining 9 vessels had part-time and occasional permits. One half of these 18 vessels derived less than 5% (3% on average) of their revenues from 400 lb. or less trips, thus exhibiting a low dependency on the general category trips for their income. Another 3 vessels in the same group seemed to earn revenues only from the general category trips with no revenue from other trips or species. Although general category revenues accounted for 100% of revenues for these 3 vessels, these revenues were low, averaging less than $1,500 per vessel for the entire 2002 fishing year. This leaves only 6 vessels that derived almost 20% of their revenues from the general category rule trips, which are expected to be impacted rather significantly from the proposed prohibition to land scallops for limited access permits. These vessels would not be affected, however, if they fished under a monkfish or multispecies day-at-sea program, because of the proposed exemption to the prohibition rule.

Table 295. General category revenues by the scallop limited access fleet as a proportion of total fleet revenues (2002 fishing year).

Revenues	Full-Time	Part-Time	Occasional	Total
Scallop revenue from general category landings	177,540	29,967	298,512	506,019
Total scallop revenue from all trips	170,399,077	157,996	5,873,150	176,430,223
Total revenue from all trips	177,008,804	1,123,708	9,926,788	188,059,300
General category scallop revenue as a % of total revenue	0.10%	2.67%	3.01%	0.27%

Table 296. Revenues of limited access vessels from general category and DAS trips (2002 fishing year).

Scallop revenue from =400 lb. trips as a % of total revenue from all species	Active limited access vessels		Scallop revenue per vessel from <400 lb. trips		Total scallop revenue per vessel from all trips (fleet average)	Total revenue per vessel from all species and trips (fleet average)
	Numbers	As a % of all vessels	Revenue per vessel	% of total revenue		
0%	179	68%	-	0%	671,196	702,732
0.1%-0.9%	66	25%	1,319	0.2%	508,998	573,833
1.0% - 4.9%	9	3%	9,250	3%	246,761	298,597
5.0% - 99.9%	6	2%	55,227	19%	278,934	338,198
100%	3	1%	1,443	100%	-	-
Total	263	100%	1,924	0.3%	606,289	646,252

102 Providing the same information by permit category would result in too few, less than 3, vessels for some groups, violating the confidentiality requirements in presenting data.

As mentioned above, the prohibition of such trips by the limited access vessels is expected to reduce the overall fishing mortality of sea scallops, and therefore, allow higher days-at-sea allocations than if the limited access vessels could fish in both permit categories. Under the present conditions, however, these impacts are estimated to be small. For example, in 2000, 96 limited access vessels landed 204,657 lb. of scallop meats while not on a day-at-sea (Table 45). In terms of gross revenues, the trips of these 96 vessels would generate about $8,500 per vessel on average. The total pounds landed by the limited access vessels while fishing under the general category permit are equal to approximately an extra 133 days, assuming a 1500 lb/DAS LPUE. Spreading these days over approximately 280 vessels would only add about 0.5 days for each limited access vessel. Again, assuming an LPUE of 1500 pounds per day, and $3.75 per pound of scallops, the gain for the limited access vessels that were not fishing under the general category permit would be about $2,800, while the limited access vessels that took general category trips would loose about $5,800 on average ($8,500- 2,800). Such a prohibition is necessary, however, in order to prevent the potential increase in fishing mortality under the general category permit category. Significant increases in general category permits would undoubtedly cause the management plan to loose its limited access management controls, and would make it necessary to impose even more stringent effort controls on the limited access fishery.

8.7.3 Impacts of rotational area management and of non-rotational alternatives

This section provides a cost/benefit analysis of the alternatives for improving the yield from the scallop stock. The analysis includes various rotational area options with adaptive or mechanical closures, no-rotation options such as area specific effort reduction alternative and the options with 4 inch versus 3.5 rings. Alternatives that allow access to groundfish-closed areas are also analyzed. Overall, the economic analysis includes a total of 48 scenarios with the corresponding notation as follows:

- Non-rotational scenarios (4 scenarios)
  - Status quo: Amendment 7 fishing mortality schedule, i.e., F=0.2 and 3.5 inch rings (NR-1)
  - No-rotation with 4 inch rings: F=0.2 (NR-2)
  - No action: Amendment 7 DAS schedule and 3.5 inch rings (NR-3)
  - Area based management with area specific F targets (1-e): Uniform F=0.2 and 3.5 inch rings
- Mechanical rotation (2 scenarios)
  - 3-year closed, 3 year opened (M-1)
  - 5-year closed, 1 year opened (M-2)
- Adaptive rotational closures with fixed closure duration
  - (12 scenarios, AFCD-1 to AFCD-12).
  - Includes scenarios with various growth closure criteria, 3.5 or 4-inch rings and with increased closure duration or maximum biomass closed. In these scenarios, areas are closed for fixed duration (3 to 4 years) when growth rate exceeds a threshold. In most cases, the percent of biomass in a region that can be closed is also limited, and various between 25%, 50% or 100%.
- Adaptive rotational closures and re-openings, i.e., variable closure duration
  - (5 scenarios, ACR-1 to ACR-5).
    - In these rotation scenarios, areas are closed when the growth rate exceeds a threshold and reopened when it reaches a specified threshold.
- Reservoir rotations (6 scenarios, R1 to R6).
  - Open areas are managed by adaptive rotation assuming 20% growth rate threshold, 3-year closure duration, maximum 25% of biomass closed, and 3.5-inch rings. If open area landings fall below a specified target, groundfish closed area access will be granted to bring landings up to the target.

Groundfish closed area options (13 scenarios, OPEN-1 to OPEN-13).

For a more detailed enumeration of the scenarios, please see the appendix (Detailed Tables) given at the end of this section,

The estimates of landings, meat count, LPUE and DAS from the biological projections are combined with the economic model to estimate ex-vessel prices, revenues, consumer and producer surpluses and net economic benefits. The biological projections were run for a long-term period from 2003 to 2030 and are used for the economic analysis of the impacts. The economic analysis is conducted for two different time periods, however, to differentiate short- or medium-term impacts from the long-term impacts. The first period of analysis covers the first 10 years of the management plan, from 2003 to 2012. The first years of the program represent a transition period with relatively more drastic changes in landings. These changes will slowly stabilize afterwards as yields begin to increase with the rebuilding of the scallop resource. Therefore, the period 2013 to 2030 is used as the long-term period during which benefits from rotational area management and other alternatives will be more fully realized.

The summary of impacts are presented in the next section, followed by the presentation of the economic model utilized in the estimation of prices, revenues, consumer and producer surpluses, and total economic benefits. In the next sections following the economic model, the impacts of rotational area and non-rotational management options are analyzed separately for the first ten years and over the long-term.

8.7.3.1 Overview of impacts of rotational area management and of non-rotational alternatives

This section summarizes the impacts of rotational and non-rotational alternatives. The numerical results are shown in Table 297 through Table 300 and are summarized **Table 302**, at the end of the Economic Impacts section. Status quo corresponds to the Amendment 7 fishing mortality schedule and is based on the assumption that the vessels fish in the most productive scallop areas subject to traditional fishing location choices (i.e., assumes fleet dynamics).

The rotational and non-rotational alternatives have different impacts not only on the level of landings, prices and revenues, but also on the variability of landings from one year to the next. Variability in landings results in fluctuations in prices, revenues and net benefits as well. Examples of how various management options affect the variability in landings, prices and revenues are shown in Figure 143 to Figure 149 below in this and the following sections.

Figure 143 shows that rotational management with variable duration and mechanical rotation with 3-year closure duration exhibit higher variability in landings (annual mean values) compared a rotational area management with a 3-year closure and compared to status quo options. Figure 144 shows that no-rotation options with 3.5-inch (status quo) and with 4-inch rings exhibit less variability in landings compared to an adaptive rotational option with 3-year closures.

Figure 143: Rotational area management options and variability of landings

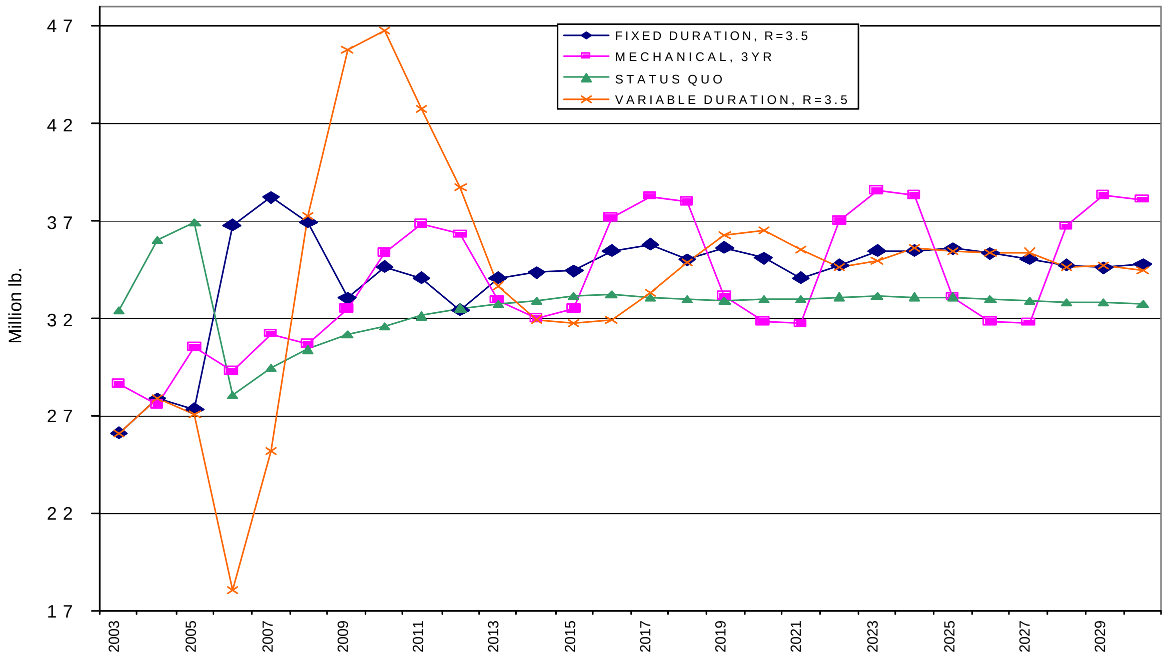


Figure 144 – Comparison of variability in landings for the fixed duration rotational management with landings under status quo (3.5 inch rings) and no-rotation alternative with 4-inch rings.

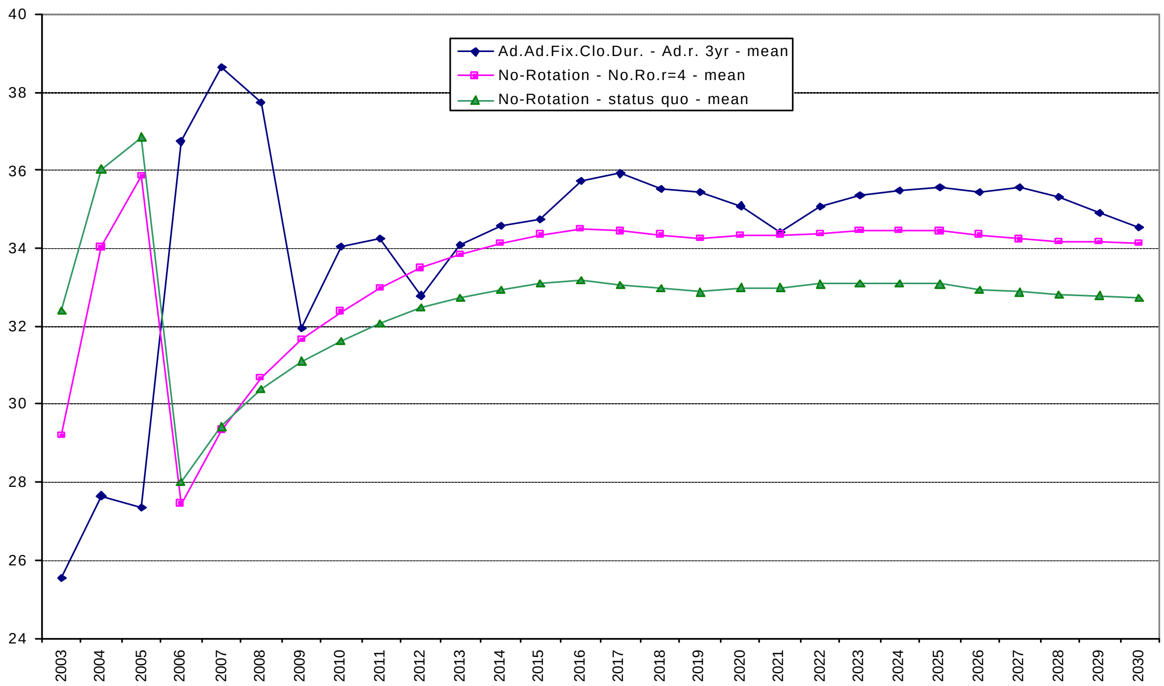


Table 297: Impacts on landings – No Access to Georges Bank Closed Areas

STRATEGY	Landings Million lb. First 10 yr. mean	Long-term mean	Landings Negative Variability First 10 yr.
Rotational alternatives			
Adaptive rotational closures and re-openings, variable closure duration	33-34	34-36	21% to 25%
Adaptive rotational closures with 3 year closure duration	32-33	34-36	13% to 18%
Adaptive rotational startegy with 4 year closure	33	35	16%
Adaptive rotational closure with 50% to 100% max. biomass closed	33	35	18%
Adaptive rotational 3 year closure with 3.5 inch rings	33	35	16%
Adaptive rotational 3 year closure with 4 inch rings	33	36	16%
Mechanical rotation with 3yr to 5 yr closure duration	32	35-36	13% to 19%
Non-rotational alternatives			
Status Quo	32	33	11%
No rotation with 4 inch rings	32	34	11%
No action	27	33	4%
Area-based management with uniform fishing mortality (1-e)	32	35	11%

- Almost all rotation alternatives with the exception of the mechanical rotation, result in an increase in landings compared to the status quo option over the first ten years of the management plan. For status quo option, the landings are estimated to average 32 million pounds per year, whereas rotational options are expected to increase average landings to 33 to 34 million pounds per year from 2003 to 2012 if groundfish areas remain closed (Table 297).

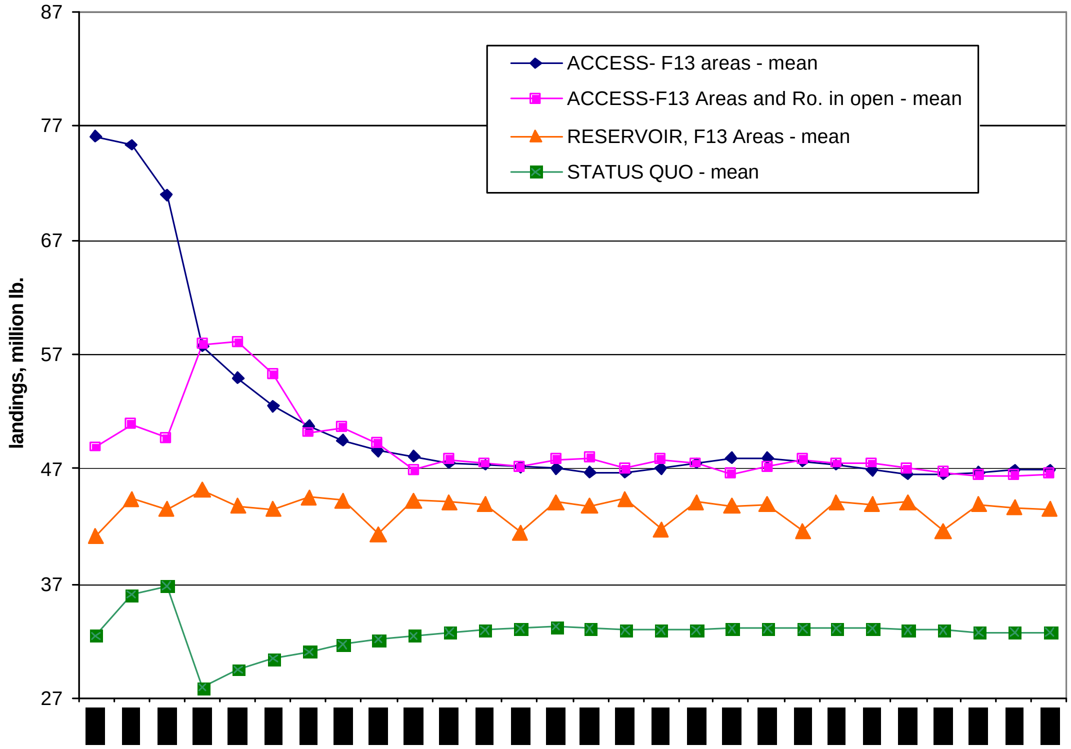
- The exceptions are options with a 4-year closure and with a 50% and 100% of the maximum biomass closed. In fact, during the first ten years, these options reduce annual average fleet revenues slightly (at the most by 1.5%) because of the high variability in landings and prices from year to year. In general, the rotational options which increase closure duration or maximum biomass closed result in higher variability in landings while they improve landings and revenues slightly if at all both in the short and in the long-term.

- The adaptive rotations with variable closure durations improve landings slightly compared to other rotational options. However, the same alternatives also result in higher variability from one year to the next. As a result, average annual fleet revenues could fall short of the status quo levels by about 0.2% to 1% under these options.

- The no-rotation alternatives with 4-inch rings and with uniform fishing mortality (Alternative 1-e) are expected to reduce average landings per year slightly by about 1% to 1.5% during the 10-year period 2003 to 2012. Over the long-term, however, the same options will increase landings by 4% to 4.9%. In addition, these options minimize fluctuations in landings in both the short and in the long-term compared to the rotational alternatives, which tend to substantially increase the variability of landings.

- Over the long-term (2013-2030), all rotation and no-rotation alternatives result in an increase in landings compared to the status quo option. The average annual increase in landings ranges from 4% to 9% per year for the rotational alternatives without access to the GB closed areas.

Figure 145. Landings with Access to Georges Bank Closed Areas with Rotational, Reservoir Options and Comparison with Status Quo Landings with No Access



- During the first 10 years, the options which allow access to the GB closed areas are expected increase average annual landings from 32 million pounds under status quo (no access) to 39 to 55 million pounds if only Closed Area 2 South (such as under Framework 11) were given access and up to 68 million pounds if all areas were opened to scallop fishing. The adaptive rotational closures with groundfish areas used as a stabilizing "reservoir" increase landings to 40 to 46 million pounds per year, or by about 25% to 44%, while at the same time reducing the variability (See Table 298 and also Figure 145).

Table 298 – Impacts on Landings – With Access to Georges Bank Closed Areas

STRATEGY			Landings Million lb. First 10 yr. mean	Long-term mean	Landings Negative Variability First 10 yr.
Groundfish closed area options with F=0.1 to F=0.2					
F13 areas or all areas open		F=0.1 to 0.2	52-68	47- 55	11% to 15%
F11 area open (CL2-south)		F=0.1 to 0.2	39-55	37- 47	13% to 22%
Reservoir rotations					
R1, R2, R3	F11 (Cl2-S) areas	18000-19000 mt	40-42	41-42	3% to 4%
R4, R5, R6	F13 areas	20000-21000 mt	44-46	43-46	3% to 4%

- The mechanical rotation options are estimated to reduce average landings and revenues per year during the first ten years from 2003 to 2012. These options also exhibit high variability in landings, prices, revenues and in total economic benefits during the first 10 years as well as in the long-term.

Table 299 – Predicted ex-vessel prices ($ per pound in inflation adjusted 1996 constant dollars)

Strategy	PERIOD	Average Price price per pound
No-Access to Georges Bank Closed Areas		
1. Adaptive Rotations with Variable Closures	2003-2012	4.29
	2012-2030	4.17
2. Adaptive Rotations with Fixed Closure Options	2003-2012	4.32
	2012-2030	4.16
3. Mechanical Rotation	2003-2012	4.38
	2012-2030	4.15
4. No-Rotation	2003-2012	4.45
	2012-2030	4.24
Access to Georges Bank Areas		
1. F11, F13 areas or all areas open	2003-2012	3.13
	2012-2030	3.44
Reservoir Strategy openings	2003-2012	3.73
	2012-2030	3.72

- The ex-vessel prices are estimated to average 3.13 per pound if during the first 10 years if Georges Bank areas are given access and landings increase over 50 million pounds. If landings were constrained by a reservoir strategy to around 40 to 45 million pounds, ex-vessel prices would be slightly higher, around $3.75 per pound. If no access were given to Georges Bank areas, the prices would be higher, above $4 per pound because landings would be lower, around 30 to 35 million pounds per year (Table 299).

- Most rotational area options (with no access to the GB areas) increase the cumulative present value of total benefits (net of status quo) slightly by 1% to 2%, or by $5 to $19 million as a total of the first ten years of the management plan compared to the status quo levels. Over the long-term, the total economic benefits net of status quo are expected to increase under all rotational and non-rotational options by 2% to 8%, or by a total of $12 million to $65 million for the 18 years from 2013 to 2030 if the groundfish areas remained closed (Table 300 and also see Table 306 and Table 310 for detailed results by scenario).

- The non-rotation options (NR-2 to NR-5) reduce total economic benefits slightly during the first 10 years from 2003 to 2012 compared to status quo. The decline under the uniform fishing mortality alternative (1-e) and 4-inch rings with no rotation is small, about 1% to 3%, or by $8 million to $29 million respectively. However, the no-action alternative corresponding to the Amendment 7 DAS schedule reduce cumulative value of the net benefits by 18%, or by $194 million over the ten years from 2003 to 2012. Over the long term, these alternatives increase net benefits by about $33 - $34 million, that is, similar to levels achieved under the rotational alternatives Table 300).

- All options that allow access to the GB areas increase total benefits significantly. The increase in the cumulative value of the benefits ranges from $201 million to $867 million. Over the long-term, the net benefits increase by 11% to 50%, or by $89 to $402 million under the same options.

Table 300. Impacts on Net Economic Benefits (Net of status quo benefits)

STRATEGY			Net Economic Benefits (Cumulative PV, $ million)			
			Short-term		Long-Term	
			Difference from Status quo	% Difference Status quo	Difference from Status quo	% Difference Status quo
Rotational alternatives						
Adaptive rotational closures and re-openings, variable closure duration			-$17 to $17	-2% to 2%	$25 to $48	3% to 7%
Adaptive rotational closures with 3 year closure duration			-$7 to $19	-1% to 1%	$29 to $65	4% to 8%
Adaptive rotational startegy with 4 year closure			-$5	0.5%	$38	5%
Adaptive rotational closure with 50% to 100% max. biomass closed			-$2 to $5	-0.2 to 0.5%	$45 to $51	5.5% to 6.5%
Adaptive rotational 3 year closure with 3.5 inch rings			$14	1%	$36	4%
Adaptive rotational 3 year closure with 4 inch rings			$3	0.3%	$60	8%
Mechanical rotation with 3yr to 5 yr closure duration			-$24 to -$75	-2% to -7%	$32 to $35	4% to 5%
Non-rotational alternatives						
Status Quo			$0	0%	$0	0%
No rotation with 4 inch rings			-$8	-1%	$33	4%
No action			-$194	-18%	$12	2%
Area-based management with uniform fishing mortality (1-e)			-$29	-3%	$34	4%
Groundfish closed area options with F=0.1 to F=0.2						
F13 areas or all areas open		F=0.1 to 0.2	$504 to $867	47% to 80%	$271 to $402	32% to 50%
F11 area open (CL2-south)		F=0.1 to 0.2	$201 to $599	19% to 55%	$89 to $256	11% to 33%
Reservoir rotations						
R1, R2, R3	F11 (Cl2-S) areas	18000-19000 mt	$233 to $276	22% to 25%	$163 to $185	20% to 23%
R4, R5, R6	F13 areas	20000-21000 mt	$304 to $367	28% to 34%	$202 to $251	25% to 31%

- The variable closure options with more strict growth thresholds (20/10 closure/reopening, options ACR-4 and ACR-5), the fixed closure options with 4-inch rings and with 10% and 20% growth criteria (AFCD-12, AFCD-8) and the mechanical rotation options reduce the value of total benefits slightly during the first ten years by about 1% to 2%. This is mostly because of the high variability of landings under these options from year to year, which creates fluctuations in prices and revenues. Over the long-term from 2013 to 2030, these alternatives increase net benefits slightly more than other options (see Table 300 and also see Table 306 and Table 310 for detailed results by scenario).

- Increasing the closure duration and/or the maximum biomass closed results in little improvement in overall net benefits while at the same time increasing the variability of the landings and the benefits over the long-term. Increasing the ring size, however, from 3.5 inches to 4 inches, tends to have a greater positive impacts on net benefits compared to an option which increase closure duration or employs a stricter growth criteria for closures (see Table 300) and also Table 306 and Table 310 for detailed results by scenario).

- The quantitative bio-economic analyses provided in this section and in Table 297 through Table 310 do not take into account the costs of monitoring and enforcement of an area management system. At this point, these costs were not determined quantitatively, but enforcement costs will increase compared to overall days-at-sea management.

- In addition, an area-management system that does not provide flexibility to the fishermen in deciding where and how much to fish --such as through transferable quotas, or effort, or with DAS trade-offs combined with trip limits for accessing newly opened areas-- will make it unprofitable for some vessels to fish in certain parts of ocean. Consequently, the overall fishing activity under an area management system may fall short of the potential effort corresponding to a management system based on reducing fishing mortality in all areas with no areas closed to fishing. Therefore, the net economic benefits of the rotational area management options presented in this section will probably be overestimates of the actual net benefits. Allocation of transferable quotas or DAS could alleviate this problem to some extent, although it will also increase the transaction costs.

The detailed results for individual scenarios are shown in **Table 303** through **Table 310** and are discussed below following the section on economic model.

8.7.3.2 Methodology and assumptions

The detailed results from the economic analysis are presented in Table 303 to Table 310 for the first 10 years, from 2003 to 2012, and for the long-term period from 2013 to 2030. Ex-vessel prices and fleet revenue are estimated from the economic model. Status quo corresponds to the Amendment 7 fishing mortality schedule and based on the assumption that the vessels fish in the most productive scallop areas subject to traditional fishing location choices (i.e., assumes fleet dynamics).

Tables show the mean value for each variable, as well as the range of values that fall within the 25^{th} and 75^{th} percentiles. The lower (25^{th} percentile) and upper (75^{th} percentile) values included in the range show the variability of the average values from one option to another.[103] In other words, larger is the difference between the lower and the upper values, higher is the variability.

For an evaluation of the variability of the landings, and revenues for the first ten years of the management program, the percentage difference of the lower value from the mean value of the variable is also calculated (i.e., negative variability). For example, the mean (average) value of the landings for the status quo option (NR-1) is 32 million pounds per year during the first ten years from 2003 to 2012, and the range changes from 29 million to 35 million pounds. In terms of percentage variability, the 25^{th} percentile or the lower bound of the range shows that the annual landings could be 11% less than the mean landings (Table 303). On the positive side, the 75^{th} percentile or the upper bound of range indicates that landings could exceed the mean value by 8%. When the percentage values given in the column corresponding to negative variability for landings are compared across options, it could be seen that the adaptive rotation options with a 20/10 closure/reopening option, i.e., options ACR-4 and ACR-5, present the highest risk since the landings could fall short of the mean value by as much as 24% to 25%. These options also have the highest positive variability, by about 17% to 18%.

From the point of view of the economic variables, such as revenues, consumer and producer surpluses and total economic benefits, the risk on the negative side, that is, the risk of actual values falling short of the estimated average values is more important than a positive risk, i.e., actual values exceeding the estimated values. For this reason, only the negative variability is calculated for these variables although the range shows the variability on the positive side as well. For example, the percentage negative variability for revenues indicates that revenues could be less than the estimated average revenues by about

[103] Range shows the values between the 25^{th} and 75^{th} percentiles such that 25% of all the estimated values are less than the 25^{th} percentile, i.e., the lower value of the range, and 25% of the estimated values are higher than the 75^{th} percentile, i.e., the higher value of the range.

13% for the adaptive rotation alternatives (ACR-4 and ACR-5). Table 303 compares the landings, price and revenues for each option with the values estimated for the status quo alternative. First columns for each variable show values net of status quo, and the second columns show the percentage differences from the status quo levels. It is important to realize, however, the numbers shown in each columns are the averages for the first 10 years from 2003 to 2012, and actual values of landings, price and revenues fluctuate from year to year, especially for the rotational alternatives.

The cumulative present values of the producer and consumer surpluses, total economic benefits and employment are shown in **Table 304** along with their range corresponding to the 25th and 75th percentiles. Percentage negative variability from the mean values is also calculated for an assessment of risk involved for each alternative. Similarly, **Table 305** shows the producer and consumer surpluses, total economic benefits and employment net of the status quo as well as the percentage differences from the status quo values.

8.7.3.3 Impacts on landings, prices and fleet revenues during the first ten years (2003-2012)

The impacts on landings, price and revenue are shown in Table 303 to Table 305 and could be summarized as follows:

- Almost all rotation alternatives, with the exception of the mechanical rotation, result in an increase in landings compared to the status quo option over the first ten years of the management plan. This increase ranges from 1% to 4.7% per year as an average over the 10 years from 2003 to 2012. As a result, the ex-vessel price of scallops is estimated to decline slightly by about 0.2% to 1.5% from the status quo levels for most these scenarios (Table 303). The increase in average annual landings lead to a slight increase in average fleet revenues, by about 0.4% to 2% for rotational alternative, except mechanical rotation and the rotation options with result in large fluctuations from year to year.

Figure 146 – Impacts of Rotational and non-rotational options on ex-vessel prices: No Access to Georges Bank Closed Areas

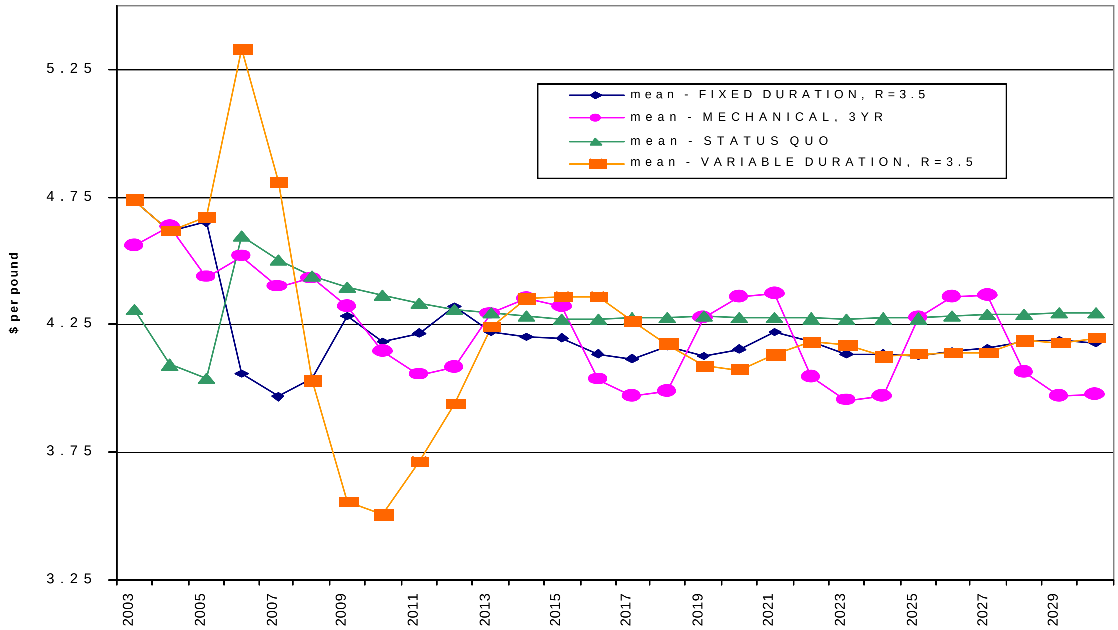
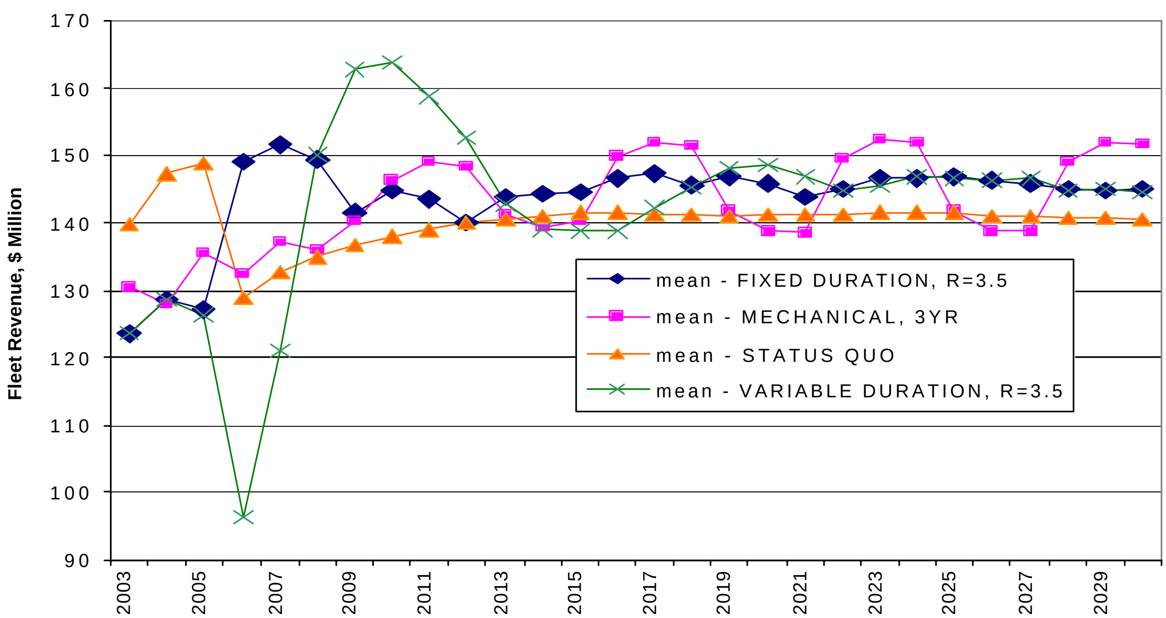


Figure 147. Impacts of Rotational and non-rotational options on fleet revenues: No Access to Georges Bank Closed Areas



- Variability in landings result in fluctuations in prices and revenues. Examples of how various management options affect the variability in prices and revenues are shown in Figure 146 and Figure 147.

- Figure 146 and Figure 147 show that rotational management with variable duration and mechanical rotation with 3-year closure duration exhibit higher variability in prices and revenues (annual mean values) compared a rotational area management with a 3-year closure and compared to status quo options.

- The estimated increase in landings ranges from 1% to 3% for the rotation alternatives with fixed closures (AFCD-1 to AFCD-12). Overall, these options exhibit less variability in landings as compared to options with variable closure durations (Table 303). The increase in landings under these options result in an increase in fleet revenues ranging from 0.3% to 1.6%.

- The exceptions to these results are options with a 4-year closure and with a 50% and 100% of the maximum biomass closed. In fact, these options result in no improvement in annual average fleet revenues (Table 303). These latter options reduce annual average fleet revenues slightly (at the most by 1.5%) because of the high variability in landings, and thus in prices from year to year (Table 303 and Table 304). In general, the rotational options that increase closure duration or maximum biomass closed result in higher variability in landings while they improve landings and revenues only slightly if at all.

- The mechanical rotation options are estimated to reduce average landings per year slightly, by about 0.5% to 1%. Although the decline in landings on the average leads to a slight increase in prices, this increase does not offset the decline in landings. As a result, fleet revenues decline, slightly (0.2%) for the option with 3-year closures, and by 3.5% for the 5-year closure option.

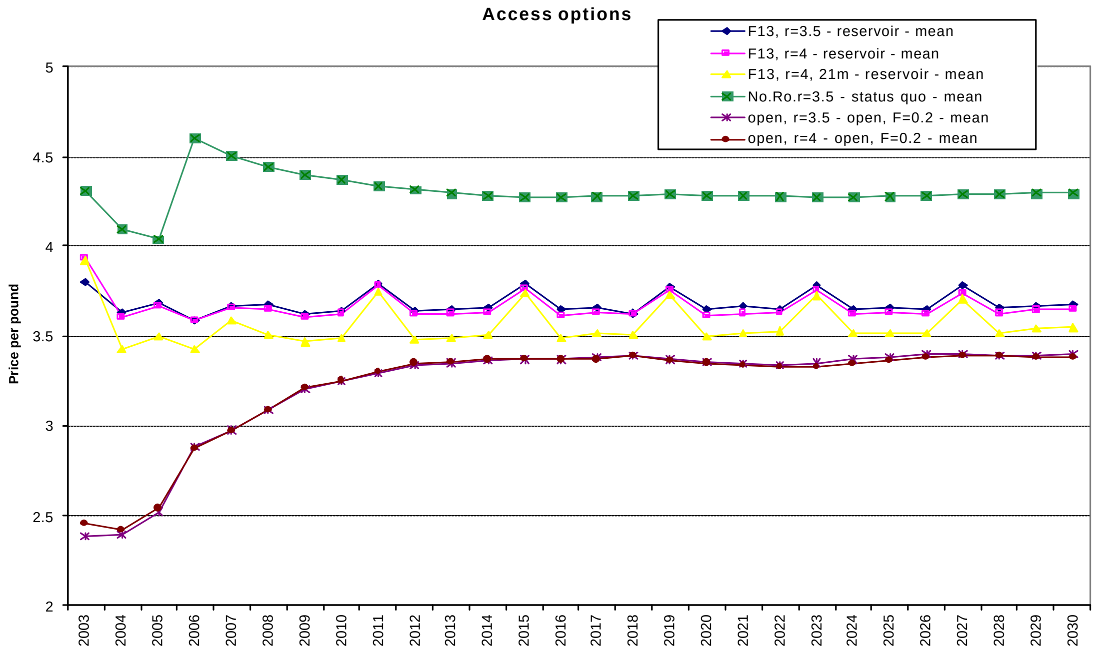
- The adaptive rotations with variable closure durations (Scenarios ACR-1 to ACR-5) improve landings slightly compared to other rotational options. However, the same alternatives also result in higher variability. For example, the largest increase in landings, about 4% to 5% on average, is achieved under the adaptive rotation options with a 20/10 closure/reopening option, i.e., options ACR-4 (3.5 inch rings) and ACR-5 (4 inch rings) But, these alternatives also present the highest variability, especially in terms of negative risk. As mentioned above, under these alternatives the landings could fall short of the mean value by as much as 24% to 25% a year (Table 297). The average annual fleet revenues fall short of the status quo levels by about 0.2% to 1% under these options because of the larger fluctuations from one year to the next year.

- Four-inch rings result in slightly lower landings, about a million pounds per year on the average, compared to the 3.5-inch ring options during the first 10 years from 2003 to 2013 under all scenarios. Variability is not affected by any significant degree under the 4-inch ring options compared to the 3.5-inch ring options. In terms of fleet revenues, these options also result in slightly lower revenues as compared to options with 3.5-inch rings in the first 10 years (2003 to 2012).

- The no-rotation alternatives with 4-inch rings and with uniform fishing mortality (Section 5.3.2.9) are expected to reduce average landings per year slightly by about 1% to 1.5% during the 10-year period from 2003 to 2012. On the other hand, the variability is expected to be less for these options since landings could only fall by about 11% below the mean value of landings. Following the reduction in landings, the fleet revenues also expected to decline slightly by about 0.5%.

- The options that allow access to the GB closed areas (options OPEN-1 to OPEN-16) are expected increase average annual landings from 32 million pounds (without access) to 40 million pounds if only Closed Area 2 South (such as under Framework 11) were given access and up to 78 million pounds if all areas were opened to scallop fishing. In terms of percentages, these represent 20% to over 100% increase over the status quo levels that allow no access to GB closed areas. The increase in landings result in lower prices in the range of around $3.00 to $4.00 per pound of scallops, compared to an average price per pound of $4.34 for the status quo option (Figure 148). Nevertheless, the large increase in landings offset the decline in prices resulting in higher revenues for the fleet by 10% (Framework 11 openings) to 25% (options with all areas open).

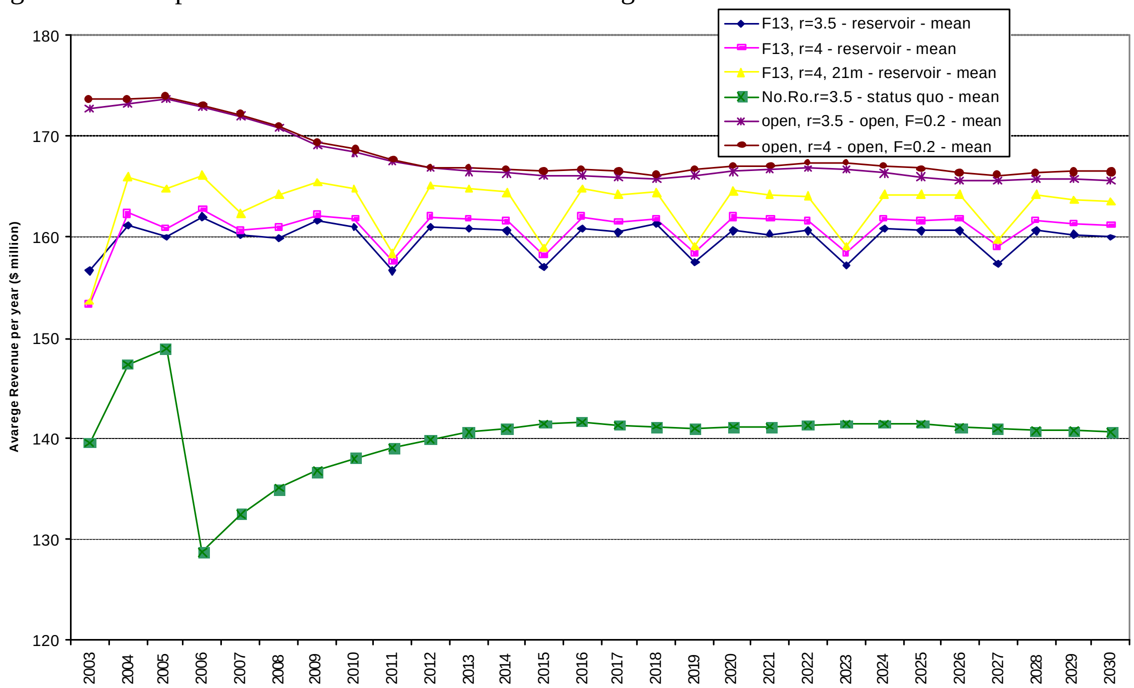
Figure 148. Impact on prices with access to Georges Bank closed areas



- The adaptive rotational closures with groundfish areas used as a stabilizing “reservoir” increase landings to 40 to 46 million pounds per year, or by about 25% to 44%, while at the same time reducing the variability. These options minimize negative risk since the estimated landings could fall short of mean values by only about 4 percent. This is because under this option the groundfish closed areas would be granted access if open area landings fall short of a specified target. The increase in landings under these options is estimated to reduce average annual prices by 10%, and to increase fleet revenues by 12% to 17% (see Figure 148 and Figure 149).

- The overall impacts on regional revenues and incomes, however, will be greater than the revenue estimates shown in Figure 147 and Figure 149 because of the indirect and induced multiplier impacts. Indirect impacts include the impacts on sales, income, employment and value-added of industries that supply commercial harvesters, such as the impacts on marine service stations that sell gasoline and oil to scallop vessels. The induced impacts represent the sales, income and employment resulting from expenditures by crew and employees of the indirect sectors. An input/output analysis conducted by NMFS (1998) estimated that sales, income and employment multipliers for the sea scallop fishery in the Northeast Region. The sales multiplier for the coastal counties in Northeast was estimated to be approximately 1.8 in 1996 for the scallop dredge and trawls. These sales and income multipliers were, however, estimated including only the backward linkages associated with the harvest of sea scallops.

Figure 149 – Impacts on revenues with access to Georges Bank closed areas



8.7.3.4 The impact on producer and consumer surpluses, total economic benefits and employment

The estimates of the producer and consumer surpluses and total economic benefits are shown in detail in **Table 305** and **Table 306**, and in summary form net of status quo in

Table 301. The total economic benefits equal the sum of the consumer and producer surpluses and their value net of status quo provide an overall measure of the impacts of the management alternatives on the national economy. A summary of the net economic benefits (net of status quo) by broad categories of rotational and non-rotational alternatives were shown in Table 300 above. The employment is measured by CREW*DAS corresponding to each option. The results could be summarized as follows:

- The adaptive rotational options with variable closures and more strict closure/opening criteria (ACR-4 and ACR-5), the fixed closure rotations with 4 year closure, and also with 50% to 100% biomass closed and the mechanical rotational options are expected to reduce the cumulative present value of the producer surplus (discounted at 7%) during the period from 2003 to 2012 by about 2% to 3%. The same conclusion is valid for the mechanical rotation options (a decrease by 1% to 9%) and for the no action option (a decrease of 13%).

- Table 301 summarizes the consumer and producer benefits net of status quo for both the short- and long-term. The cumulative present value of the consumer surplus (discounted at 7%) increase, however, under most options because of the increase in landings coupled with a decrease in prices, by about 1% to 7%. The exceptions are the mechanical rotation options, no action, the uniform fishing mortality (option1-e), and the adaptive rotation options with fixed closure but with strict opening criteria, which all result a decline in the consumer surplus.

Table 301 – Impacts on Consumer and Producer Benefits Net of Status Quo

STRATEGY			(Cumulative PV, $ million) Consumer Benefits first 10 years Net of SQ	Consumer Benefits Long-term Net of SQ	Producer Benefits first 10 years Net of SQ	Producer Benefits Long-term Net of SQ
Rotational alternatives						
Adaptive rotational closures and re-openings, variable closure duration			$9 to $17	$15 to $25	-$26 to $12	$10 to $22
Adaptive rotational closures with 3 year closure duration			-$4 to $19	$20 to $35	-$3 to $10	$16 to $30
Adaptive rotational startegy with 4 year closure			$14	$21	-$19	$17
Adaptive rotational closure with 50% to 100% max. biomass closed			$18 to $19	$25 to $29	-$13 to -$21	$20 to $22
Adaptive rotational 3 year closure with 3.5 inch rings			$9	$20	$5	$16
Adaptive rotational 3 year closure with 4 inch rings			$2	$31	$1	$29
Mechanical rotation with 3yr to 5 yr closure duration			-$13 to -$17	$22 to $31	-$12 to -$68	$1 to $13
Non-rotational alternatives						
Status Quo			$0	$0	$0	$0
No rotation with 4 inch rings			-$8	$16	$0	$17
No action			-$87	$3	-$108	$10
Area-based management with uniform fishing mortality (1-e)			-$16	$19	-$13	$15
Groundfish closed area options with F=0.1 to F=0.2						
F13 areas or all areas open		F=0.1 to 0.2	$347 to $731	$178 to $304	$129 to $150	$72 to $103
F11 area open (CL2-south)		F=0.1 to 0.2	$114 to $468	$53 to $196	$87 to $143	$36 to $85
Reservoir rotations						
R1, R2, R3	F11 (Cl2-S) areas	18000-19000 mt	$137 to $167	$98 to $115	$96 to $109	$64 to $71
R4, R5, R6	F13 areas	20000-21000 mt	$193 to $238	$131 to $165	$111 to $129	$71 to $86

- Most variable closure rotational options (with no access to the GB areas) increase the cumulative present value of total benefits (net of status quo) slightly by 1% to 2% over the ten years from 2003 to 2012 (Table 300). Likewise, most rotational options with fixed closure duration are expected to increase net benefits slightly, by 0.5% or 2%, or by $5 to $20 million as a total of the first ten years of the management program compared to the status quo levels. The variable closure options with a 20/10 closure/reopening option, (options ACR-4 and ACR-5), the fixed closure options with 4-inch rings and with 10% and 20% growth criteria (AFCD-12, AFCD-8) and the mechanical rotation options reduce the value of total benefits slightly during the same period by about 1% to 2% for most, and by 7% for the 5 year mechanical closure. This is primarily because of the high variability of landings under these options from year to year, which creates fluctuations in prices, and revenues as well.

- The non-rotation options (NR-2 to NR-5) also reduce the total economic benefits during the first 10 years, from 2003 to 2012. The decline under the uniform fishing mortality alternative (1-e) and 4-inch rings with no rotation is small, about 1% to 3%, respectively. However, the no-action alternative corresponding to the Amendment 7 DAS schedule reduce cumulative value of the net benefits by 18%, or by $194 million over the ten years from 2003 to 2012.

- All options that allow access to the Georges Bank areas increase total benefits significantly. The increase in the cumulative value of the benefits ranges from $201 million to $856 million, or by 20% to 80%, for the first set of access options (OPEN-1 to OPEN-16) and from $233 million to $367 million, or by 22% to 34%, for the adaptive rotational closures with groundfish areas used as a stabilizing "reservoir" (i.e., options R1 to R6).

- The impacts on employment are similar to the impacts on net benefits. Most rotational options (with no access to the GB areas) increase employment (compared to status quo) slightly, by 1% to 3%, during the first 10 years (2003 to 2012) of the management program. The variable closure rotation option with a 20/10 closure/reopening option, and 4-inch rings (ACR-5), the fixed closure options with 4-inch rings and with 10% (AFCD-8) and the mechanical rotation option reduce employment slightly during the same period by about 1% to 5%. The no-rotation options

(NR-2 to NR-5) also reduce employment during the first 10 years from 2003 to 2012. The decline under the uniform fishing mortality alternative (1-e) and 4-inch rings with no rotation is small, respectively 1% to 6%. However, the no-action alternative corresponding to the Amendment 7 DAS schedule is expected to reduce employment by 23%. All options that allow access to the GB areas will increase employment significantly. The increase in employment ranges from 7% to 95%, for the first set of access options (OPEN-1 to OPEN-16) and from 14% to 28%, for the adaptive rotational closures with groundfish areas used as a stabilizing "reservoir" (i.e., options R1 to R6).

8.7.3.5 Impacts on landings, prices and fleet revenues in the long-term (2013-2030)

The long-term impacts are evaluated for the last 18 years starting at 2013, because the positive impacts rotational closures, 4-inch rings and effort reduction options on the overall yield mostly seen after the first 10 years as the scallop stock is rebuilt to the target levels and the annual fluctuations start to diminish under most options (see Table 307 to Table 310.

- All rotation and no-rotation alternatives result in an increase in landings compared to the status quo option over the long-term. The average annual increase in landings range from 4% to 9% a year for the rotational alternatives without access to the GB closed areas.

- The options that provide access to groundfish areas result in a 14% to 68% (all areas open) increase in landings. The adaptive rotational options with groundfish areas used as a stabilizing reservoir increase landings by about 24% to 40% per year depending on the level of targeted landings. These later options exhibit less variability in annual landings (a 4% to 7% deviation form average on the negative side) whereas negative variability of the annual landings could reach 12% to 18% under the first set of traditional access options which either open Framework 11 or Framework 13 areas to scallop fishing.

- The largest increase in landings is achieved under options with a 4-inch ring and which apply stricter growth closure criteria. For example, the increase in landings for a fixed closure rotation option with 4 inch rings and with a 20% growth criteria is almost 9% per year whereas another fixed closure rotation option with a relatively lenient 40% growth closure criteria and with 3.5 inch rings results in only 4% increase in average landings per year. The increase in the duration of closures or the increase in the percentage of the maximum biomass closed do not seem to be as effective in increasing the level of annual landings as the options either use 4-inch rings or a stricter growth criteria for closure. In addition, the same options increase the variability in landings compared to alternatives that use a shorter closure duration or less of the biomass closed (Table 307 and Table 308).

- Among the no-rotation options, 4-inch rings and the uniform fishing mortality (Section 5.3.2.9) increase the average annual landings by 4% to 4.9% respectively. Both of these alternatives exhibit less variability in annual landings compared to the rotational options.

- As the landings are expected to increase under all options except no-action alternative (Amendment 7 DAS), the ex-vessel price of scallops are estimated to decline slightly by 2% to 4% compared to the status quo levels. Under all options, however, the increase in landings offset the decrease in prices and leads to an increase in fleet revenues by 2% to 5% for options that allow no access and by 7 to 21 for options that provide access to the groundfish areas.

8.7.3.6 The impact on producer and consumer surpluses, total economic benefits and employment in the long-term (2013-2030)

- The estimated values of the producer and consumer surpluses, total economic benefits and employment are shown in Table 309 and Table 310 for all the rotational and non-rotational options. The values and the differences from the status quo in those Tables show the cumulative present values of the relevant variables at the mean recruitment levels over the period 2013 to 2030. In other words, they represent sum of the discounted values for the 18 years as opposed to annual average values given in Table 307 and Table 308 for landings, prices and revenues.

- Table 301 summarizes the consumer and producer benefits net of status quo options for broad categories of rotational and non-rotational options both for the short- and the long-term. In the long-term, the increase in landings and revenues result in an increase in producer surplus (measured by total fleet revenue net of variable costs) under all rotational and no-rotation options compared to the status quo levels. This increase is small, however, for the options that provide no access to groundfish-closed areas, and represent and increase ranging from 2% to 5% compared to the status quo level over an 18-year period. The increase is small also because the later years are discounted more compared to the years in the near future. The options which provide access to the groundfish areas leads to a larger the producer surplus ranging from 6% to 17% over the long-term.

- The increase in the consumer benefits as measured by the consumer surplus is greater than the increase in the producer surplus because consumers benefit not only from larger volume of landings but also from lower prices for scallops. The percentage increase in the consumer surplus from the status quo levels range from 7% to 15% for all options except no-action that do not allow access to the groundfish areas. The access to these areas, however, is estimated to increase consumer surplus by 11% to 50% depending on the option and the area opened for fishing.

- The total economic benefits net of status quo, that is the sum of the producer and the consumer surpluses are expected to increase under all rotational and non-rotational options by 2% to 8% for options if the groundfish areas remained closed and by 11% to 50% if they were given access to scallop fishing over the long term from 2012 to 2030.

- Increasing the closure duration and/or the maximum biomass closed results in little improvement in overall net benefits while at the same time increasing the variability of the landings and the benefits. For example, a 3-year closure alternative with adaptive rotation, a 30% growth criteria and 3.5 inch rings increase economic benefits net of status quo by $36 million over the 18 years from 2012 to 2030. If the closure duration were increased to 4 years while other management rules were kept the same, the economic benefits reach $38 million, a mere $2 million increase compared to 3-year closure option, over the total of 18 years. Increasing the ring size, however, from 3.5 inch to 4 inch for the same option improves the net benefits from $36 million to $60 million. Although applying stricter growth criteria, for example 20% compared to 30%, increase net economic benefits to $41 million as compared to $36 million, applying a 4-inch ring is estimated to have a larger positive impact on the overall benefits.

- Employment as measured by crew*days-at-sea is also expected to increase over the long-term by about 1% to 4% over 18 years from 2013 to 2030 for most of the non-rotational alternatives without access, and by 10% to 60% for the alternatives which include access to the groundfish closed areas. The only exceptions are no-action alternative, which keep DAS at the Amendment

–7 levels, and no-rotation alternative with 4-inch rings, which reduce employment by 8% and 2% respectively.

8.7.3.7 Sources of uncertainty in the analysis

The economic impacts of the rotational area management and non-rotational options were analyzed based on the available information of yield streams from the biological simulations and data on vessel costs, crew shares, prices, and revenues of the scallop vessels. Therefore, the numerical results of this analysis should be interpreted with caution due to uncertainties about the likely changes in:

- Factors affecting scallop resource abundance and landings
- Fishing behavior
- Fixed costs
- Variable costs including the price of fuel
- Import prices
- Bycatch and revenues from other fisheries
- The share system
- The number of active vessels
- Structural changes in ownership
- The composition of fleet in terms of tonnage, horse power and crew size of the active vessels
- Disposable income and preferences of consumers for scallops
- Price differences and premium on small versus large scallops.
- Enforcement costs

For a further discussion of the uncertainties and sensitivity analyses of these results, see Appendix IV.

8.7.3.8 Detailed economic analysis tables and scenario descriptions

STRATEGY

For the adaptive rotational closures and re-openings with variable closure duration, that is for scenarios from ACR-1 to ACR-5, the first number shows the growth criteria for closure and the second indicates the growth closure criteria for re-opening. For scenarios for fixed closure duration, i.e., for scenarios AFCD-1 to AFCD-12, the first number shows the growth criteria for closure, and the second number shows the closure duration.

F11 indicates access to the CL2 south as in Framework 11. Similarly, F13 indicates access to the 3 areas, CL2, CL1 and Nantucket areas as in Framework 13.

DESCRIPTION OF SCENARIOS

Non-rotational scenarios (4 scenarios)

- Status quo: Amendment 7 fishing mortality schedule, i.e., F=0.2 and 3.5 inch rings (NR-1)
- No-rotation with 4 inch rings: F=0.2 (NR-2)
- No action: Amendment 7 DAS schedule and 3.5 inch rings (NR-3)
- Area based management with area specific F targets (1-e): Uniform F=0.2 and 3.5 inch rings

Mechanical rotation (2 scenarios)

- 3 year closed, 3 year opened (M-1)
- 5 year closed, 1 year opened (M-2)

Adaptive rotational closures with fixed closure duration

(12 scenarios, AFCD-1 to AFCD-12).

Includes scenarios with various growth closure criteria, 3.5 or 4-inch rings and with increased closure duration or maximum biomass closed (see Tables 1 to 8). In these scenarios, areas are closed for fixed duration (3 to 4 years) when growth rate exceeds a threshold. In most cases, the percent of biomass in a region that can be closed is also limited, and various between 25%, 50% or 100%.

Adaptive rotational closures and re-openings, i.e., variable closure duration

(5 scenarios, ACR-1 to ACR-5).

In these rotation scenarios, areas are closed when the growth rate exceeds a threshold and reopened when it reaches a specified threshold.

Reservoir rotations (6 scenarios, R1 to R6).

Open areas are managed by adaptive rotation assuming 20% growth rate threshold, 3-year closure duration, maximum 25% of biomass closed, and 3.5-inch rings. If open area landings fall below a specified target, groundfish closed area access will be granted to bring landings up to the target.

Groundfish closed area options (13 scenarios, OPEN-1 to OPEN-13).

Table 302 . Summary of Impacts: Landings, Variability and Net Economic Benefits

Options				**Landings** Million lb.		**Landings** Negative Variability First 10 yr.	**Net Economic Benefits (Cumulative Present Value, $ million)** Short-term		Long-Term	
Scenario	Strategy	Max.Bio Closed	Ring	First 10 yr. mean	Long-term mean		Difference from Status quo	% Difference Status quo	Difference from Status quo	% Difference Status quo
Adaptive rotational closures and re-openings, variable closure duration										
ACR-2 to ACR-5	20/10 to 30/15	25	3.5 to 4	33-34	34-36	21% to 25%	-$17 to $17	-2% to 2%	$25 to $48	3% to 7%
Adaptive rotational closures with 3 year closure duration										
AFCD-1 to AFCD-12		25	3.5 to 4	32-33	34-36	13% to 18%	-$7 to $19	-1% to 1%	$29 to $65	4% to 8%
Adaptive rotational closures with increased duration time or MAX. biomass closed										
AFCD-9	4 year closure, 30% cls.criteria	25	3.5	33	35	16%	-$5	0.5%	$38	5%
AFCD-2 to AFCD-3	50% to 100% MAX. biomass closed	50-100	3.5	33	35	18%	-$2 to $5	-0.2 to 0.5%	$45 to $51	5.5% to 6.5%
Comparison of adaptive rotational closures with 3.5 and 4 inch rings										
AFCD-1	30-3	25	3.5	33	35	16%	$14	1%	$36	4%
AFCD-11	30-3	25	4	33	36	16%	$3	0.3%	$60	8%
Mechnical rotation										
M-1 to M-2	3yr to 5yr closed		3.5	32	35-36	13% to 19%	-$24 to -$75	-2% to -7%	$32 to $35	4% to 5%
Non-rotational alternatives										
NR-1	status quo	F=0.2	3.5	32	33	11%	$0	0%	$0	0%
NR-2	No rotation with 4 inch rings	F=0.2	4	32	34	11%	-$8	-1%	$33	4%
NR-3	No action	13411 DAS	3.5	27	33	4%	-$194	-18%	$12	2%
NR-5	Uniform fishing mortality	F=0.2 (1-e)	3.5	32	35	11%	-$29	-3%	$34	4%
Groundfish closed area options with F=0.1 to F=0.2										
F13 areas or all areas open		F=0.1 to 0.2	3.5 - 4	52-68	47- 55	11% to 15%	$504 to $867	47% to 80%	$271 to $402	32% to 50%
F11 area open (CL2-south)		F=0.1 to 0.2	3.5 - 4	39-55	37- 47	13% to 22%	$201 to $599	19% to 55%	$89 to $256	11% to 33%
Reservoir rotations										
R1, R2, R3	F11 (Cl2-S) areas	18000-19000 r	3.5 - 4	40-42	41-42	3% to 4%	$233 to $276	22% to 25%	$163 to $185	20% to 23%
R4, R5, R6	F13 areas	20000-21000 r	3.5 - 4	44-46	43-46	3% to 4%	$304 to $367	28% to 34%	$202 to $251	25% to 31%

Table 303 . Biological variables, price and revenue

Options							Landings (Million lb.)				Price ($/lb)			Revenue (Million $)		
Scenario	Strategy	Max.Bio Closed	Ring	DAS	Meat Count	LPUE	Mean	Range	Variability Negative (%)	Variability Positive (%)	Mean	Range	Difference High-Low	Mean	Range	Variability Negative (%)
Adaptive rotational closures and re-openings, variable closure duration																
ACR-1	40/25	25	3.5	14,716	17	2236	33	27 - 37	17	12	4.28	4.03 - 4.65	0.62	141	127 - 149	10
ACR-2	30/15	25	3.5	14,948	16	2229	34	26 - 39	21	15	4.27	3.97 - 4.74	0.77	140	123 - 149	12
ACR-3	30/15	25	4	14,340	15	2309	33	26 - 38	21	16	4.30	3.99 - 4.75	0.76	140	123 - 149	12
ACR-4	20/10	25	3.5	14,932	16	2234	34	25 - 39	24	17	4.29	3.96 - 4.81	0.85	138	120 - 147	13
ACR-5	20/10	25	4	14,353	15	2310	33	25 - 39	25	18	4.32	3.99 - 4.84	0.86	137	119 - 146	13
Adaptive rotational closures with fixed closure duration																
AFCD-1	30-3	25	3.5	14,577	17	2254	33	28 - 37	16	13	4.29	4.04 - 4.64	0.60	140	128 - 148	9
AFCD-11	30-3	25	4	13,869	15	2339	33	27 - 37	16	13	4.33	4.08 - 4.67	0.59	139	127 - 147	9
AFCD-12	20-3	25	4	13,758	15	2341	32	28 - 36	14	11	4.35	4.12 - 4.65	0.53	139	128 - 146	8
AFCD-2	30-3	50	3.5	14,532	16	2268	33	27 - 38	18	14	4.32	4.04 - 4.70	0.66	138	124 - 146	10
AFCD-3	30-3	100	3.5	14,442	16	2270	33	27 - 37	18	14	4.34	4.07 - 4.71	0.65	137	123 - 145	10
AFCD-4	40-3	25	3.5	14,576	17	2248	33	28 - 37	16	13	4.29	4.02 - 4.64	0.62	141	128 - 149	9
AFCD-5	25-3	25	3.5	14,526	16	2259	33	28 - 37	15	12	4.30	4.05 - 4.63	0.57	140	128 - 148	8
AFCD-6	20-3	25	3.5	14,451	16	2260	33	28 - 37	14	12	4.31	4.07 - 4.62	0.55	140	129 - 147	8
AFCD-7	15-3	25	3.5	14,373	16	2261	33	28 - 36	13	11	4.32	4.10 - 4.61	0.51	140	129 - 147	7
AFCD-8	10-3	25	3.5	14,290	16	2260	32	28 - 36	13	10	4.33	4.12 - 4.61	0.48	139	129 - 146	7
AFCD-9	30-4	25	3.5	14,494	17	2249	33	28 - 37	16	13	4.33	4.09 - 4.68	0.59	137	125 - 144	9
Mechanical rotation																
M-1	3yr clsd	3yr open	3.5	14,620	16	2168	32	28 - 35	13	10	4.36	4.16 - 4.63	0.47	138	128 - 145	7
M-2	5yr clsd	1 yr open	3.5	16,697	17	1875	32	26 - 36	19	14	4.40	4.13 - 4.80	0.66	134	120 - 142	11
Non-rotational options																
NR-1	status quo	F=0.2	3.5	14,464	18	2211	32	29 - 35	11	8	4.34	4.17 - 4.57	0.40	139	130 - 144	6
NR-2	no rotation	F=0.2	4	13,632	16	2317	32	28 - 34	11	8	4.37	4.21 - 4.60	0.39	138	130 - 144	6
NR-3	No action	3411 DAS	3.5	11,084	17	2375	27	26 - 28	4	4	4.73	4.64 - 4.81	0.16	122	119 - 125	2
NR-5	Uniform	=0.2 (1-e)	3.5	14,267	16	2203	32	28 - 34	11	8	4.38	4.22 - 4.60	0.38	138	129 - 143	6
Groundfish Closed Area options																
OPEN-1	F11 (Cl2-S)*	F=0.1	4	19,931	14	2431	49	42 - 53	13	9	3.42	3.20 - 3.74	0.55	166	159 - 169	4
OPEN-10	All areas open*	F=0.1	4	26,922	14	2469	67	59 - 73	12	9	2.64	2.42 - 2.97	0.55	173	171 - 172	1
OPEN-11	All areas open*	F=0.1	3.5	24,227	15	2407	58	52 - 63	11	8	2.96	2.75 - 3.25	0.49	172	169 - 173	2
OPEN-12	All areas open*	F=0.2	3.5	28,176	15	2385	68	60 - 74	12	9	2.62	2.40 - 2.94	0.54	172	170 - 171	1
OPEN-13	Ro. and F11 areas**	F=0.2	3.5	15,455	16	2523	39	30 - 46	22	18	3.94	3.56 - 4.47	0.91	152	135 - 161	12
OPEN-14	Ro. and F13 areas**	F=0.2	3.5	20,924	15	2472	52	45 - 57	13	11	3.26	3.00 - 3.62	0.61	168	162 - 172	4
OPEN-15	Ro. and F13 areas**	F=0.2	3.5	23,637	15	2465	59	50 - 65	15	11	2.97	2.69 - 3.37	0.67	171	166 - 173	3
OPEN-16	Ro. and F13 areas**	F=0.2	4	23,303	15	2490	58	50 - 65	14	11	2.98	2.70 - 3.37	0.67	171	166 - 173	3
OPEN-2	F11 (Cl2-S)*	F=0.2	4	22,183	14	2445	55	47 - 60	14	10	3.15	2.90 - 3.53	0.63	169	163 - 171	4
OPEN-3	F11 (Cl2-S)*	F=0.1	3.5	20,912	15	2352	49	43 - 54	13	9	3.38	3.16 - 3.71	0.55	166	159 - 169	4
OPEN-4	F11 (Cl2-S)*	F=0.2	3.5	23,233	16	2361	55	47 - 61	14	11	3.12	2.88 - 3.50	0.63	168	163 - 171	4
OPEN-5	F13*	F=0.1	4	20,734	14	2451	51	45 - 56	12	9	3.30	3.09 - 3.61	0.52	168	162 - 171	4
OPEN-6	F13*	F=0.2	4	23,367	14	2459	58	50 - 64	13	10	3.01	2.77 - 3.36	0.59	171	166 - 172	3
OPEN-7	F13*	F=0.1	3.5	21,749	15	2372	52	46 - 56	12	9	3.26	3.05 - 3.58	0.53	168	162 - 171	3
OPEN-8	F13*	F=0.2	3.5	24,462	15	2375	58	51 - 64	13	10	2.99	2.75 - 3.33	0.59	170	165 - 171	3
OPEN-9	All areas open*	F=0.1	4	23,088	14	2486	58	51 - 62	11	8	3.00	2.79 - 3.29	0.49	172	168 - 174	2
Reservoir Rotations																
R1	F11 (Cl2-S)	18000 mt	3.5	16,473	14	2459	40	39 - 41	4	1	3.85	3.83 - 3.96	0.13	156	153 - 156	2
R2	F11 (Cl2-S)	18000 mt	4	16,473	14	2459	40	39 - 41	4	1	3.85	3.83 - 3.96	0.13	156	153 - 156	2
R3	F11 (Cl2-S)	19000 mt	4	17,024	14	2476	42	41 - 42	3	1	3.76	3.74 - 3.84	0.10	158	156 - 158	1
R4	F13***	20000 mt	3.5	18,231	15	2396	44	42 - 44	3	2	3.67	3.62 - 3.76	0.14	160	158 - 161	1
R5	F13***	20000 mt	4	17,670	14	2479	44	42 - 45	4	2	3.67	3.61 - 3.77	0.15	160	158 - 162	1
R6	F13***	21000 mt	4	18,441	14	2495	46	44 - 47	4	3	3.55	3.47 - 3.66	0.18	163	161 - 165	1

* Biomass is calculated under the assumption that the open areas are uniformly fished at F=0.2 (NR-5, alternative 1-e)

**Access to the GB areas is combined with the rotation option AFCD6 in the open areas

***Mechanical Rotation in closed areas: NLS+CL1 fished 1/4 year, with CL2-S fished 3/4 years

Table 304. Landings, Price and Revenue (2003-2012)

Options				Landings		Price		Revenue	
Scenario	Strategy	Max.Bio Closed	Ring	Difference from SQ (NR-1), mil.lb.	% Difference from SQ (NR-1)	Difference from SQ (NR-1), $/lb	% Difference from SQ (NR-1)	Difference from SQ (NR-1), Mil.$	% Difference from SQ (NR-1)
Adaptive rotational closures and re-openings, variable closure duration									
ACR-1	40/25	25	3.5	1	3.2	-0.06	-1.4	3	1.9
ACR-2	30/15	25	3.5	1	4.6	-0.07	-1.6	2	1.3
ACR-3	30/15	25	4	1	3.8	-0.04	-0.9	1	0.8
ACR-4	20/10	25	3.5	1	4.7	-0.05	-1.1	0	-0.2
ACR-5	20/10	25	4	1	3.9	-0.02	-0.4	-1	-0.9
Adaptive rotational closures with fixed closure duration									
AFCD-1	30-3	25	3.5	1	3.0	-0.05	-1.1	2	1.3
AFCD-11	30-3	25	4	1	1.7	-0.01	-0.2	1	0.6
AFCD-12	20-3	25	4	0	0.8	0.01	0.2	0	0.3
AFCD-2	30-3	50	3.5	1	3.1	-0.02	-0.5	-1	-0.5
AFCD-3	30-3	100	3.5	1	2.5	0.00	0.0	-2	-1.5
AFCD-4	40-3	25	3.5	1	2.8	-0.05	-1.2	2	1.6
AFCD-5	25-3	25	3.5	1	2.7	-0.04	-0.9	2	1.1
AFCD-6	20-3	25	3.5	1	2.1	-0.03	-0.7	1	1.0
AFCD-7	15-3	25	3.5	0	1.6	-0.02	-0.5	1	0.7
AFCD-8	10-3	25	3.5	0	0.9	-0.01	-0.2	1	0.4
AFCD-9	30-4	25	3.5	1	2.4	-0.01	-0.2	-2	-1.2
Mechnical rotation									
M-1	3yr clsd	3yr open	3.5	0	-0.5	0.02	0.5	0	-0.2
M-2	5yr clsd	1 yr open	3.5	0	-1.0	0.06	1.4	-5	-3.4
Non-rotational alternatives									
NR-1	status quo	F=0.2	3.5	0	0.0	0.00	0.0	0	0.0
NR-2	no rotation	F=0.2	4	0	-1.1	0.03	0.7	0	-0.3
NR-3	No action	13411 DAS	3.5	-5	-16.7	0.39	8.9	-16	-11.8
NR-5	Uniform	F=0.2 (1-e)	3.5	0	-1.5	0.04	0.9	-1	-0.6
Groundfish closed area options									
OPEN-1	F11 (Cl2-S)*	F=0.1	4	17	51.8	-0.92	-21.2	27	19.6
OPEN-10	All areas open*	F=0.1	4	35	108.7	-1.70	-39.1	34	24.6
OPEN-11	All areas open*	F=0.1	3.5	26	82.5	-1.38	-31.8	34	24.2
OPEN-12	All areas open*	F=0.2	3.5	36	111.2	-1.72	-39.6	33	23.8
OPEN-13	Ro. and F11 areas**	F=0.2	3.5	7	20.9	-0.40	-9.1	14	9.8
OPEN-14	Ro. and F13 areas**	F=0.2	3.5	20	61.6	-1.08	-24.8	30	21.4
OPEN-15	Ro. and F13 areas**	F=0.2	3.5	26	82.6	-1.37	-31.6	33	23.5
OPEN-16	Ro. and F13 areas**	F=0.2	4	26	81.9	-1.36	-31.4	33	23.6
OPEN-2	F11 (Cl2-S)*	F=0.2	4	23	70.3	-1.19	-27.4	31	22.0
OPEN-3	F11 (Cl2-S)*	F=0.1	3.5	17	54.1	-0.96	-22.1	27	19.7
OPEN-4	F11 (Cl2-S)*	F=0.2	3.5	23	72.3	-1.21	-28.0	30	21.6
OPEN-5	F13*	F=0.1	4	19	59.2	-1.04	-23.9	29	21.2
OPEN-6	F13*	F=0.2	4	26	80.4	-1.33	-30.6	32	23.1
OPEN-7	F13*	F=0.1	3.5	20	61.5	-1.08	-24.8	29	21.2
OPEN-8	F13*	F=0.2	3.5	26	82.5	-1.35	-31.2	31	22.6
OPEN-9	All areas open*	F=0.1	4	26	79.6	-1.34	-30.8	34	24.3
Reservoir rotations									
R1	F11 (Cl2-S)	18000 mt	3.5	8	26.2	-0.49	-11.2	17	12.3
R2	F11 (Cl2-S)	18000 mt	4	8	26.2	-0.49	-11.2	17	12.3
R3	F11 (Cl2-S)	19000 mt	4	10	31.3	-0.58	-13.3	20	14.1
R4	F13***	20000 mt	3.5	12	36.1	-0.67	-15.4	21	15.4
R5	F13***	20000 mt	4	12	36.6	-0.67	-15.4	22	15.7
R6	F13***	21000 mt	4	14	43.5	-0.78	-18.1	24	17.6

* Biomass is calculated under the assumption that the open areas are uniformly fished at F=0.2 (NR-5, alternative 1-e)

**Access to the GB areas is combined with the rotation option AFCD6 in the open areas

***Mechanical Rotation in closed areas: NLS+CL1 fished 1/4 year, with CL2-S fished 3/4 years

Table 305. Economic Benefits and Employment (2003-2012)

Options				Producer Surplus (Mill.$, cum.PV)			Consumer Surplus (Mill.$, cum.PV)			Total Benefits (Million $, cum.PV)			Employment (cum.PV) (annual, 1000)		
Scenario	Strategy	Max.Bio Closed	Ring	Mean	Range	Variability Negative (%)	Mean	Range	Variability Negative (%)	Mean	Range	Variability Negative (%)	Mean	Range	Variability Negative (%)
Adaptive rotational closures and re-openings, variable closure duration															
ACR-1	40/25	25	3.5	817	746 - 856	9	289	209 - 354	28	1,106	956 - 1210	14	989	989 - 1095	15
ACR-2	30/15	25	3.5	805	720 - 845	11	295	196 - 377	34	1,099	915 - 1223	17	1,004	1004 - 1150	19
ACR-3	30/15	25	4	801	718 - 844	10	290	193 - 375	33	1,092	911 - 1219	17	964	964 - 1103	19
ACR-4	20/10	25	3.5	784	695 - 822	11	290	182 - 382	37	1,074	877 - 1204	18	1,003	1003 - 1166	22
ACR-5	20/10	25	4	779	689 - 818	12	286	177 - 380	38	1,065	865 - 1197	19	965	965 - 1132	22
Adaptive rotational closures with fixed closure duration															
AFCD-1	30-3	25	3.5	810	746 - 848	8	287	214 - 352	26	1,097	960 - 1199	12	980	980 - 1091	14
AFCD-11	30-3	25	4	806	742 - 845	8	280	208 - 343	26	1,086	950 - 1188	13	932	932 - 1035	14
AFCD-12	20-3	25	4	802	743 - 838	7	273	208 - 330	24	1,075	952 - 1168	11	925	925 - 1014	12
AFCD-2	30-3	50	3.5	792	723 - 832	9	295	213 - 372	28	1,087	935 - 1203	14	977	977 - 1105	16
AFCD-3	30-3	100	3.5	784	715 - 822	9	297	214 - 371	28	1,081	929 - 1193	14	971	971 - 1099	15
AFCD-4	40-3	25	3.5	815	748 - 855	8	286	211 - 353	26	1,101	958 - 1208	13	980	980 - 1090	14
AFCD-5	25-3	25	3.5	808	747 - 845	7	285	215 - 346	25	1,092	962 - 1191	12	976	976 - 1085	13
AFCD-6	20-3	25	3.5	806	748 - 842	7	281	214 - 339	24	1,087	963 - 1182	11	971	971 - 1069	12
AFCD-7	15-3	25	3.5	804	751 - 839	7	277	216 - 331	22	1,081	967 - 1170	11	966	966 - 1057	11
AFCD-8	10-3	25	3.5	802	751 - 836	6	274	216 - 324	21	1,076	966 - 1161	10	960	960 - 1043	11
AFCD-9	30-4	25	3.5	785	726 - 819	8	292	217 - 358	26	1,077	943 - 1177	12	974	974 - 1080	14
Mechnical rotation															
M-1	3yr clsd	3yr open	3.5	793	740 - 827	7	265	209 - 311	21	1,058	949 - 1138	10	982	982 - 1060	10
M-2	5yr clsd	1 yr open	3.5	736	659 - 779	10	271	190 - 341	30	1,007	850 - 1120	16	1,122	1122 - 1222	12
Non-rotational alternatives															
NR-1	status quo	F=0.2	3.5	805	761 - 832	5	278	228 - 317	18	1,082	989 - 1150	9	972	972 - 1037	9
NR-2	no rotation	F=0.2	4	805	760 - 834	6	269	221 - 308	18	1,074	981 - 1143	9	916	916 - 976	9
NR-3	No action	13411 DAS	3.5	697	681 - 714	2	191	178 - 206	7	888	859 - 920	3	745	745 - 762	2
NR-5	Uniform	F=0.2 (1-e)	3.5	792	748 - 820	6	261	214 - 298	18	1,053	962 - 1117	9	959	959 - 1020	9
Groundfish closed area options															
OPEN-1	F11 (Cl2-S)	F=0.1	4	942	912 - 954	3	576	459 - 668	20	1,518	1371 - 1622	10	1,339	1339 - 1441	11
OPEN-10	All areas open	F=0.1	4	930	945 - 906	-2	1,008	825 - 1160	18	1,939	1770 - 2066	9	1,809	1809 - 1951	10
OPEN-11	All areas open	F=0.1	3.5	951	946 - 945	1	788	655 - 897	17	1,739	1601 - 1842	8	1,628	1628 - 1743	9
OPEN-12	All areas open	F=0.2	3.5	912	931 - 886	-2	1,037	850 - 1189	18	1,949	1781 - 2074	9	1,893	1893 - 2040	11
OPEN-13	Ro. and F11 areas	F=0.2	3.5	891	782 - 942	12	392	248 - 532	37	1,283	1029 - 1474	20	1,039	1039 - 1147	12
OPEN-14	Ro. and F13 areas	F=0.1	3.5	951	926 - 958	3	635	501 - 750	21	1,586	1427 - 1709	10	1,406	1406 - 1539	12
OPEN-15	Ro. and F13 areas	F=0.2	3.5	951	942 - 941	1	806	626 - 956	22	1,757	1568 - 1897	11	1,588	1588 - 1748	13
OPEN-16	Ro. and F13 areas	F=0.2	4	954	944 - 945	1	798	620 - 947	22	1,753	1564 - 1892	11	1,566	1566 - 1725	13
OPEN-2	F11 (Cl2-S)	F=0.2	4	948	930 - 946	2	723	560 - 851	23	1,671	1491 - 1797	11	1,491	1491 - 1619	12
OPEN-3	F11 (Cl2-S)	F=0.1	3.5	937	909 - 947	3	596	475 - 692	20	1,533	1385 - 1639	10	1,405	1405 - 1512	11
OPEN-4	F11 (Cl2-S)	F=0.2	3.5	936	922 - 931	1	746	578 - 878	22	1,682	1500 - 1809	11	1,561	1561 - 1699	12
OPEN-5	F13	F=0.1	4	950	927 - 958	2	625	506 - 719	19	1,575	1433 - 1678	9	1,393	1393 - 1494	10
OPEN-6	F13	F=0.2	4	948	940 - 940	1	798	634 - 930	21	1,746	1575 - 1870	10	1,570	1570 - 1699	11
OPEN-7	F13	F=0.1	3.5	944	924 - 949	2	646	523 - 743	19	1,590	1447 - 1692	9	1,462	1462 - 1569	10
OPEN-8	F13	F=0.2	3.5	934	931 - 922	0	822	657 - 959	20	1,756	1588 - 1882	10	1,644	1644 - 1782	12
OPEN-9	All areas open	F=0.1	4	960	952 - 957	1	762	633 - 869	17	1,722	1585 - 1826	8	1,551	1551 - 1660	9
Reservoir rotations															
R1	F11 (Cl2-S)	18000 mt	3.5	901	891 - 900	1	414	386 - 421	7	1,315	1277 - 1322	3	1,107	1107 - 1140	5
R2	F11 (Cl2-S)	18000 mt	4	901	891 - 900	1	414	386 - 421	7	1,315	1277 - 1322	3	1,107	1107 - 1140	5
R3	F11 (Cl2-S)	19000 mt	4	913	907 - 912	1	445	422 - 451	5	1,358	1329 - 1363	2	1,144	1144 - 1175	5
R4	F13	20000 mt	3.5	916	910 - 918	1	471	444 - 487	6	1,387	1354 - 1406	2	1,225	1225 - 1269	5
R5	F13	20000 mt	4	922	912 - 927	1	473	443 - 493	6	1,395	1356 - 1420	3	1,187	1187 - 1229	5
R6	F13	21000 mt	4	934	924 - 940	1	516	484 - 544	6	1,449	1408 - 1484	3	1,239	1239 - 1287	5

*Biomass is calculated under the assumption that the open areas are uniformly fished at F=0.2 (NR-5, alternative 1-e)

**Access to the GB areas is combined with the rotation option AFCD6 in the open areas

***Mechanical Rotation in closed areas: NLS+CL1 fished 1/4 year, with CL2-S fished 3/4 years

Table 306. Economic Benefits Net of Status Quo (2003-2012)

Options				Producer Surplus		Consumer Surplus		Net Economic Benefits		Employment	
Scenario	Strategy	Max.Bio Closed	Ring	Difference from SQ (NR-1), mil.lb.	% Difference from SQ (NR-1)	Difference from SQ (NR-1), mil.lb.	% Difference from SQ (NR-1)	Difference from SQ (NR-1), mil.lb.	% Difference from SQ (NR-1)	Difference from SQ (NR-1), mil.lb	% Difference from SQ (NR-1)
Adaptive rotational closures and re-openings, variable closure duration											
ACR-1	40/25	25	3.5	12	2	12	4	24	2	17	2
ACR-2	30/15	25	3.5	0	0	17	6	17	2	33	3
ACR-3	30/15	25	4	-3	0	13	5	9	1	-8	-1
ACR-4	20/10	25	3.5	-21	-3	12	4	-9	-1	31	3
ACR-5	20/10	25	4	-26	-3	9	3	-17	-2	-7	-1
Adaptive rotational closures with fixed closure duration											
AFCD-1	30-3	25	3.5	5	1	9	3	14	1	8	1
AFCD-11	30-3	25	4	1	0	2	1	3	0	-40	-4
AFCD-12	20-3	25	4	-3	0	-4	-1	-7	-1	-47	-5
AFCD-2	30-3	50	3.5	-13	-2	18	6	5	0	5	0
AFCD-3	30-3	100	3.5	-21	-3	19	7	-2	0	-1	0
AFCD-4	40-3	25	3.5	10	1	9	3	19	2	8	1
AFCD-5	25-3	25	3.5	3	0	7	3	10	1	4	0
AFCD-6	20-3	25	3.5	1	0	3	1	5	0	-1	0
AFCD-7	15-3	25	3.5	-1	0	0	0	-1	0	-6	-1
AFCD-8	10-3	25	3.5	-3	0	-4	-1	-7	-1	-12	-1
AFCD-9	30-4	25	3.5	-19	-2	14	5	-5	0	2	0
Mechnical rotation											
M-1	3yr clsd	3yr open	3.5	-12	-1	-13	-5	-24	-2	11	1
M-2	5yr clsd	1 yr open	3.5	-68	-9	-7	-2	-75	-7	150	15
Non-rotational alternatives											
NR-1	status quo	F=0.2	3.5	0	0	0	0	0	0	0	0
NR-2	no rotation	F=0.2	4	0	0	-8	-3	-8	-1	-56	-6
NR-3	No action	13411 DAS	3.5	-108	-13	-87	-31	-194	-18	-227	-23
NR-5	Uniform	F=0.2 (1-e)	3.5	-13	-2	-16	-6	-29	-3	-13	-1
Groundfish closed area options											
OPEN-1	F11 (Cl2-S)	F=0.1	4	137	17	298	108	436	40	367	38
OPEN-10	All areas open	F=0.1	4	125	16	731	263	856	79	837	86
OPEN-11	All areas open	F=0.1	3.5	146	18	510	184	657	61	656	68
OPEN-12	All areas open	F=0.2	3.5	107	13	760	274	867	80	922	95
OPEN-13	Ro. and F11 areas	F=0.2	3.5	87	11	114	41	201	19	67	7
OPEN-14	Ro. and F13 areas	F=0.1	3.5	146	18	357	129	504	47	434	45
OPEN-15	Ro. and F13 areas	F=0.2	3.5	146	18	528	190	674	62	616	63
OPEN-16	Ro. and F13 areas	F=0.2	4	150	19	521	188	670	62	594	61
OPEN-2	F11 (Cl2-S)	F=0.2	4	143	18	445	160	589	54	519	53
OPEN-3	F11 (Cl2-S)	F=0.1	3.5	132	16	318	115	451	42	433	45
OPEN-4	F11 (Cl2-S)	F=0.2	3.5	131	16	468	169	599	55	589	61
OPEN-5	F13	F=0.1	4	145	18	347	125	492	45	421	43
OPEN-6	F13	F=0.2	4	143	18	520	187	663	61	598	62
OPEN-7	F13	F=0.1	3.5	139	17	369	133	508	47	490	50
OPEN-8	F13	F=0.2	3.5	129	16	545	196	674	62	672	69
OPEN-9	All areas open	F=0.1	4	155	19	484	174	640	59	580	60
Reservoir rotations											
R1	F11 (Cl2-S)	18000 mt	3.5	96	12	137	49	233	22	135	14
R2	F11 (Cl2-S)	18000 mt	4	96	12	137	49	233	22	135	14
R3	F11 (Cl2-S)	19000 mt	4	109	13	167	60	276	25	172	18
R4	F13	20000 mt	3.5	111	14	193	70	304	28	253	26
R5	F13	20000 mt	4	117	15	196	70	313	29	215	22
R6	F13	21000 mt	4	129	16	238	86	367	34	267	28

*Biomass is calculated under the assumption that the open areas are uniformly fished at F=0.2 (NR-5, alternative 1-e)

**Access to the GB areas is combined with the rotation option AFCD6 in the open areas

***Mechanical Rotation in closed areas: NLS+CL1 fished 1/4 year, with CL2-S fished 3/4 years

Table 307. Biological Results, Price and Revenue in the Long-term (2013-2030)

Options				Landings (Million lb.)				Price ($/lb)			Revenue (Million $)		
Scenario	Strategy	Max.Bio Closed	Ring	Mean	Range	Variability Negative (%)	Variability Positive (%)	Mean	Range	Difference High-Low	Mean	Range	Variability Negative (%)
Adaptive rotational closures and re-openings, variable closure duration													
ACR-1	40/25	25	3.5	34	28 - 38	18	12	4.21	3.96 - 4.61	0.65	144	129 - 152	10
ACR-2	30/15	25	3.5	35	26 - 41	25	18	4.18	3.82 - 4.75	0.93	145	124 - 156	14
ACR-3	30/15	25	4	36	27 - 41	24	16	4.14	3.81 - 4.68	0.87	147	127 - 156	13
ACR-4	20/10	25	3.5	34	24 - 41	30	20	4.19	3.79 - 4.88	1.10	144	118 - 156	18
ACR-5	20/10	25	4	35	25 - 42	29	19	4.15	3.75 - 4.84	1.09	147	121 - 158	18
Adaptive rotational closures with fixed closure duration													
AFCD-1	30-3	25	3.5	35	28 - 40	19	15	4.18	3.88 - 4.62	0.74	145	129 - 154	11
AFCD-11	30-3	25	4	36	29 - 41	19	14	4.13	3.83 - 4.57	0.75	147	132 - 156	11
AFCD-12	20-3	25	4	36	30 - 41	18	14	4.12	3.82 - 4.52	0.70	148	134 - 156	9
AFCD-2	30-3	50	3.5	35	27 - 41	23	17	4.16	3.81 - 4.68	0.87	146	127 - 156	13
AFCD-3	30-3	100	3.5	35	27 - 42	24	18	4.15	3.78 - 4.70	0.92	146	126 - 157	14
AFCD-4	40-3	25	3.5	34	28 - 39	18	13	4.20	3.93 - 4.61	0.68	144	129 - 152	10
AFCD-5	25-3	25	3.5	35	28 - 40	19	15	4.17	3.86 - 4.60	0.74	145	130 - 155	10
AFCD-6	20-3	25	3.5	35	29 - 40	17	13	4.17	3.89 - 4.55	0.67	146	132 - 154	9
AFCD-7	15-3	25	3.5	35	29 - 39	15	12	4.17	3.91 - 4.52	0.61	145	133 - 153	8
AFCD-8	10-3	25	3.5	35	30 - 39	14	11	4.17	3.93 - 4.50	0.56	145	134 - 153	8
AFCD-9	30-4	25	3.5	35	27 - 41	23	17	4.17	3.82 - 4.70	0.88	145	126 - 156	13
Mechnical rotation													
M-1	3yr clsd	3yr open	3.5	35	30 - 38	13	10	4.16	3.96 - 4.46	0.50	145	135 - 152	7
M-2	5yr clsd	1 yr open	3.5	36	29 - 40	18	12	4.13	3.88 - 4.53	0.66	146	133 - 153	9
Non-rotational alternatives													
NR-1	status quo	F=0.2	3.5	33	29 - 36	11	9	4.28	4.09 - 4.52	0.43	141	133 - 147	6
NR-2	no rotation	F=0.2	4	34	31 - 37	11	9	4.21	4.02 - 4.45	0.43	144	136 - 150	6
NR-3	No action	3411 DAS	3.5	33	31 - 35	6	6	4.28	4.15 - 4.42	0.27	142	137 - 146	3
NR-5	Uniform	=0.2 (1-e)	3.5	35	31 - 38	11	9	4.19	4.00 - 4.44	0.44	145	136 - 151	6
Groundfish closed area options													
OPEN-1	F11 (Cl2-S)*	F=0.1	4	46	40 - 50	14	8	3.54	3.34 - 3.88	0.54	164	155 - 167	5
OPEN-10	All areas open*	F=0.1	4	55	48 - 60	13	8	3.09	2.91 - 3.44	0.54	171	166 - 173	3
OPEN-11	All areas open*	F=0.1	3.5	53	47 - 57	12	7	3.20	3.02 - 3.52	0.50	169	164 - 172	3
OPEN-12	All areas open*	F=0.2	3.5	54	47 - 58	13	8	3.16	2.97 - 3.51	0.54	170	164 - 172	4
OPEN-13	Ro. and F11 areas**	F=0.2	3.5	37	31 - 43	18	13	4.01	3.72 - 4.44	0.72	150	136 - 158	9
OPEN-14	Ro. and F13 areas**	F=0.2	3.5	47	39 - 53	17	11	3.48	3.21 - 3.91	0.70	164	154 - 169	6
OPEN-15	Ro. and F13 areas**	F=0.2	3.5	48	39 - 53	18	11	3.46	3.19 - 3.92	0.73	165	154 - 169	7
OPEN-16	Ro. and F13 areas**	F=0.2	4	48	39 - 53	18	11	3.44	3.17 - 3.91	0.73	165	154 - 170	7
OPEN-2	F11 (Cl2-S)*	F=0.2	4	47	40 - 51	15	9	3.50	3.30 - 3.89	0.59	164	155 - 168	6
OPEN-3	F11 (Cl2-S)*	F=0.1	3.5	45	39 - 49	14	8	3.59	3.39 - 3.94	0.54	162	153 - 166	5
OPEN-4	F11 (Cl2-S)*	F=0.2	3.5	45	38 - 49	15	9	3.57	3.37 - 3.96	0.59	162	152 - 166	6
OPEN-5	F13*	F=0.1	4	48	42 - 52	13	8	3.45	3.26 - 3.79	0.53	165	158 - 169	5
OPEN-6	F13*	F=0.2	4	49	42 - 53	15	8	3.41	3.22 - 3.79	0.58	166	157 - 169	5
OPEN-7	F13*	F=0.1	3.5	47	41 - 51	13	8	3.50	3.31 - 3.84	0.54	164	156 - 167	5
OPEN-8	F13*	F=0.2	3.5	47	40 - 51	15	8	3.48	3.28 - 3.86	0.58	164	155 - 168	5
OPEN-9	All areas open*	F=0.1	4	54	48 - 58	12	7	3.15	2.97 - 3.46	0.49	171	165 - 173	3
Reservoir rotations													
R1	F11 (Cl2-S)	18000 mt	3.5	41	38 - 41	7	1	3.83	3.80 - 3.98	0.18	157	152 - 157	3
R2	F11 (Cl2-S)	18000 mt	4	41	38 - 41	7	1	3.83	3.80 - 3.98	0.18	157	152 - 157	3
R3	F11 (Cl2-S)	19000 mt	4	42	40 - 42	5	0	3.76	3.75 - 3.87	0.12	158	156 - 158	2
R4	F13***	20000 mt	3.5	43	42 - 44	4	2	3.68	3.63 - 3.79	0.16	160	157 - 161	2
R5	F13***	20000 mt	4	44	42 - 45	4	2	3.66	3.61 - 3.77	0.16	161	158 - 162	2
R6	F13***	21000 mt	4	46	44 - 48	4	4	3.56	3.46 - 3.66	0.20	163	161 - 165	1

*Biomass is calculated under the assumption that the open areas are uniformly fished at F=0.2 (NR-5, alternative 1-e)
**Access to the GB areas is combined with the rotation option AFCD6 in the open areas
***Mechanical Rotation in closed areas: NLS+CL1 fished 1/4 year, with CL2-S fished 3/4 years

Table 308. Landing, price and revenue in the long-term (2013-2030)

Options				Landings		Price		Revenue	
Scenario	Strategy	Max.Bio Closed	Ring	Difference from SQ (NR-1), mil.lb.	% Difference from SQ (NR-1)	Difference from SQ (NR-1), $/lb	% Difference from SQ (NR-1)	Difference from SQ (NR-1), Mil.$	% Difference from SQ (NR-1)
Adaptive rotational closures and re-openings, variable closure duration									
ACR-1	40/25	25	3.5	1	3.9	-0.08	-1.8	3	2.1
ACR-2	30/15	25	3.5	2	5.1	-0.10	-2.3	4	2.7
ACR-3	30/15	25	4	3	7.8	-0.14	-3.3	6	4.1
ACR-4	20/10	25	3.5	2	4.6	-0.09	-2.0	3	2.4
ACR-5	20/10	25	4	2	7.4	-0.13	-3.1	6	4.0
Adaptive rotational closures with fixed closure duration									
AFCD-1	30-3	25	3.5	2	5.2	-0.10	-2.3	4	2.7
AFCD-11	30-3	25	4	3	8.2	-0.15	-3.5	6	4.3
AFCD-12	20-3	25	4	3	8.9	-0.16	-3.8	7	4.7
AFCD-2	30-3	50	3.5	2	6.3	-0.12	-2.8	5	3.3
AFCD-3	30-3	100	3.5	2	7.0	-0.14	-3.2	5	3.6
AFCD-4	40-3	25	3.5	1	4.0	-0.08	-1.8	3	2.1
AFCD-5	25-3	25	3.5	2	5.8	-0.11	-2.6	4	3.0
AFCD-6	20-3	25	3.5	2	6.0	-0.12	-2.7	4	3.2
AFCD-7	15-3	25	3.5	2	5.8	-0.11	-2.6	4	3.1
AFCD-8	10-3	25	3.5	2	5.9	-0.11	-2.6	4	3.1
AFCD-9	30-4	25	3.5	2	5.7	-0.11	-2.5	4	2.9
Mechnical rotation									
M-1	3yr clsd	3yr open	3.5	2	6.3	-0.12	-2.7	4	3.1
M-2	5yr clsd	1 yr open	3.5	3	8.4	-0.15	-3.5	5	3.3
Non-rotational alternatives									
NR-1	status quo	F=0.2	3.5	0	0.0	0.00	0.0	0	0.0
NR-2	no rotation	F=0.2	4	1	4.0	-0.07	-1.7	3	2.3
NR-3	No action	3411 DAS	3.5	0	0.4	0.00	0.0	1	0.4
NR-5	Uniform	=0.2 (1-e)	3.5	2	4.9	-0.09	-2.2	4	2.7
Groundfish closed area options									
OPEN-1	F11 (Cl2-S)*	F=0.1	4	13	40.4	-0.75	-17.4	23	16.0
OPEN-10	All areas open*	F=0.1	4	22	67.9	-1.19	-27.8	30	21.3
OPEN-11	All areas open*	F=0.1	3.5	20	60.5	-1.08	-25.2	28	20.1
OPEN-12	All areas open*	F=0.2	3.5	21	63.0	-1.12	-26.2	29	20.3
OPEN-13	Ro. and F11 areas**	F=0.2	3.5	5	13.7	-0.27	-6.3	9	6.6
OPEN-14	Ro. and F13 areas**	F=0.2	3.5	14	43.4	-0.80	-18.7	23	16.5
OPEN-15	Ro. and F13 areas**	F=0.2	3.5	15	44.7	-0.83	-19.3	24	16.7
OPEN-16	Ro. and F13 areas**	F=0.2	4	15	45.6	-0.84	-19.6	24	17.0
OPEN-2	F11 (Cl2-S)*	F=0.2	4	14	42.2	-0.78	-18.2	23	16.3
OPEN-3	F11 (Cl2-S)*	F=0.1	3.5	12	36.8	-0.69	-16.1	21	14.7
OPEN-4	F11 (Cl2-S)*	F=0.2	3.5	12	37.8	-0.71	-16.6	21	14.9
OPEN-5	F13*	F=0.1	4	15	45.5	-0.83	-19.4	24	17.3
OPEN-6	F13*	F=0.2	4	16	47.6	-0.87	-20.3	25	17.7
OPEN-7	F13*	F=0.1	3.5	14	41.9	-0.78	-18.1	23	16.1
OPEN-8	F13*	F=0.2	3.5	14	43.1	-0.80	-18.7	23	16.3
OPEN-9	All areas open*	F=0.1	4	21	64.3	-1.13	-26.4	30	20.9
Reservoir rotations									
R1	F11 (Cl2-S)	18000 mt	3.5	8	24.2	-0.46	-10.6	15	11.0
R2	F11 (Cl2-S)	18000 mt	4	8	24.2	-0.46	-10.6	15	11.0
R3	F11 (Cl2-S)	19000 mt	4	9	27.9	-0.52	-12.2	17	12.3
R4	F13***	20000 mt	3.5	10	31.8	-0.60	-14.0	19	13.3
R5	F13***	20000 mt	4	11	33.6	-0.63	-14.6	20	14.1
R6	F13***	21000 mt	4	13	39.1	-0.72	-16.8	22	15.6

Table 309. Economic Benefits and Employment (2013-2030)

Options				Producer Surplus (Mill.$, cum.PV)			Consumer Surplus (Mill.$, cum.PV)			Total Benefits (Million $, cum.PV)			Employment (cum.PV) (annual, 1000)		
Scenario	Strategy	Max.Bio Closed	Ring	Mean	Range	Variability Negative (%)	Mean	Range	Variability Negative (%)	Mean	Range	Variability Negative (%)	Mean	Range	Variability Negative (%)
Adaptive rotational closures and re-openings, variable closure duration															
ACR-1	40/25	25	3.5	609	551 - 637	9	225	158 - 274	30	834	709 - 911	15	1,790	1514 - 1977	15
ACR-2	30/15	25	3.5	611	528 - 649	14	229	138 - 304	40	840	915 - 1223	17	1,810	1418 - 2104	19
ACR-3	30/15	25	4	623	544 - 657	13	239	147 - 308	38	862	911 - 1219	17	1,767	1400 - 2019	19
ACR-4	20/10	25	3.5	607	502 - 650	17	224	119 - 309	47	831	877 - 1204	18	1,830	1338 - 2169	22
ACR-5	20/10	25	4	619	515 - 660	17	235	125 - 321	47	854	865 - 1197	19	1,795	1308 - 2123	22
Adaptive rotational closures with fixed closure duration															
AFCD-1	30-3	25	3.5	613	551 - 646	10	230	156 - 292	32	842	960 - 1199	12	1,801	1495 - 2033	14
AFCD-11	30-3	25	4	625	564 - 657	10	242	165 - 305	32	867	950 - 1188	13	1,763	1462 - 1987	14
AFCD-12	20-3	25	4	627	571 - 658	9	244	173 - 307	29	871	952 - 1168	11	1,779	1511 - 1998	12
AFCD-2	30-3	50	3.5	616	540 - 654	12	235	147 - 310	38	852	935 - 1203	14	1,814	1445 - 2089	16
AFCD-3	30-3	100	3.5	619	538 - 657	13	239	145 - 319	39	858	929 - 1193	14	1,824	1428 - 2110	15
AFCD-4	40-3	25	3.5	610	551 - 640	10	226	157 - 279	30	835	958 - 1208	13	1,787	1504 - 1995	14
AFCD-5	25-3	25	3.5	614	554 - 647	10	232	160 - 295	31	846	962 - 1191	12	1,811	1512 - 2052	13
AFCD-6	20-3	25	3.5	615	561 - 645	9	233	167 - 290	28	848	963 - 1182	11	1,817	1552 - 2028	12
AFCD-7	15-3	25	3.5	614	566 - 642	8	232	172 - 284	26	846	967 - 1170	11	1,822	1582 - 2011	11
AFCD-8	10-3	25	3.5	614	569 - 641	7	233	176 - 281	24	847	966 - 1161	10	1,831	1617 - 2000	11
AFCD-9	30-4	25	3.5	613	537 - 651	12	231	145 - 305	37	844	943 - 1177	12	1,811	1446 - 2091	14
Mechnical rotation															
M-1	3yr clsd	3yr open	3.5	609	570 - 632	6	232	181 - 273	22	842	949 - 1138	10	1,893	1700 - 2033	10
M-2	5yr clsd	1 yr open	3.5	597	545 - 624	9	242	171 - 294	29	839	850 - 1120	16	2,193	1947 - 2360	12
Non-rotational alternatives															
NR-1	status quo	F=0.2	3.5	596	563 - 620	6	210	171 - 246	19	807	989 - 1150	9	1,761	1597 - 1892	9
NR-2	no rotation	F=0.2	4	613	580 - 636	5	226	184 - 263	19	839	981 - 1143	9	1,725	1570 - 1850	9
NR-3	No action	13411 DAS	3.5	606	587 - 624	3	213	192 - 237	10	819	859 - 920	3	1,623	1599 - 1659	2
NR-5	Uniform	F=0.2 (1-e)	3.5	611	578 - 633	6	229	186 - 267	19	841	962 - 1117	9	1,833	1666 - 1961	9
Groundfish closed area options															
OPEN-1	F11 (Cl2-S)	F=0.1	4	681	653 - 692	4	382	299 - 438	22	1,063	1371 - 1622	10	2,287	2031 - 2444	11
OPEN-10	All areas open	F=0.1	4	694	682 - 696	2	514	410 - 581	20	1,208	1770 - 2066	9	2,797	2491 - 2967	10
OPEN-11	All areas open	F=0.1	3.5	691	677 - 694	2	478	388 - 539	19	1,169	1601 - 1842	8	2,689	2416 - 2855	9
OPEN-12	All areas open	F=0.2	3.5	685	671 - 687	2	488	387 - 552	21	1,174	1781 - 2074	9	2,854	2533 - 3031	11
OPEN-13	Ro. and F11 areas	F=0.2	3.5	632	578 - 660	9	263	185 - 327	30	896	1029 - 1474	20	1,939	1657 - 2171	12
OPEN-14	Ro. and F13 areas	F=0.1	3.5	683	649 - 694	5	395	291 - 474	26	1,078	1427 - 1709	10	2,343	1996 - 2588	12
OPEN-15	Ro. and F13 areas	F=0.2	3.5	680	645 - 691	5	400	288 - 479	28	1,079	1568 - 1897	11	2,431	2047 - 2670	13
OPEN-16	Ro. and F13 areas	F=0.2	4	682	647 - 693	5	404	291 - 484	28	1,086	1564 - 1892	11	2,414	2036 - 2659	13
OPEN-2	F11 (Cl2-S)	F=0.2	4	680	650 - 691	5	388	295 - 447	24	1,069	1491 - 1797	11	2,356	2053 - 2519	12
OPEN-3	F11 (Cl2-S)	F=0.1	3.5	671	642 - 682	4	365	285 - 419	22	1,036	1385 - 1639	10	2,334	2066 - 2502	11
OPEN-4	F11 (Cl2-S)	F=0.2	3.5	669	637 - 680	5	368	279 - 423	24	1,037	1500 - 1809	11	2,403	2089 - 2573	12
OPEN-5	F13	F=0.1	4	687	662 - 696	4	406	321 - 463	21	1,093	1433 - 1678	9	2,360	2100 - 2516	10
OPEN-6	F13	F=0.2	4	685	658 - 694	4	414	318 - 474	23	1,099	1575 - 1870	10	2,447	2145 - 2612	11
OPEN-7	F13	F=0.1	3.5	677	651 - 687	4	389	307 - 445	21	1,065	1447 - 1692	9	2,409	2139 - 2575	10
OPEN-8	F13	F=0.2	3.5	674	646 - 683	4	393	301 - 450	23	1,067	1588 - 1882	10	2,497	2181 - 2669	12
OPEN-9	All areas open	F=0.1	4	699	686 - 702	2	497	405 - 560	19	1,197	1585 - 1826	8	2,631	2370 - 2790	9
Reservoir rotations															
R1	F11 (Cl2-S)	18000 mt	3.5	661	647 - 660	2	308	275 - 313	11	969	1277 - 1322	3	1,977	1837 - 2031	5
R2	F11 (Cl2-S)	18000 mt	4	661	647 - 660	2	308	275 - 313	11	969	1277 - 1322	3	1,977	1837 - 2031	5
R3	F11 (Cl2-S)	19000 mt	4	667	659 - 665	1	325	299 - 326	8	992	1329 - 1363	2	2,028	1907 - 2081	5
R4	F13	20000 mt	3.5	668	660 - 669	1	341	316 - 352	7	1,009	1354 - 1406	2	2,178	2062 - 2254	5
R5	F13	20000 mt	4	675	667 - 677	1	350	323 - 360	8	1,025	1356 - 1420	3	2,116	2007 - 2182	5
R6	F13	21000 mt	4	682	675 - 687	1	375	351 - 401	6	1,057	1408 - 1484	3	2,199	2087 - 2296	5

Table 310. Economic Benefits and Employment net of Status Quo in the Long-term (2013-2030)

Options				Producer Surplus		Consumer Surplus		Net Economic Benefits		Employment (1000 crew*das)	
Scenario	Strategy	Max.Bio Closed	Ring	Difference from SQ (NR-1), mil.lb.	% Difference from SQ (NR-1)	Difference from SQ (NR-1), mil.lb	% Difference from SQ (NR-1)	Difference from SQ (NR-1), mil.lb.	% Difference from SQ (NR-1)	Difference from SQ (NR-1), mil.lb	% Difference from SQ (NR-1)
Adaptive rotational closures and re-openings, variable closure duration											
ACR-1	40/25	25	3.5	13	2	15	7	28	3	29	2
ACR-2	30/15	25	3.5	15	2	19	9	33	4	49	3
ACR-3	30/15	25	4	26	4	29	14	55	7	6	0
ACR-4	20/10	25	3.5	10	2	14	7	25	3	69	4
ACR-5	20/10	25	4	22	4	25	12	48	6	34	2
Adaptive rotational closures with fixed closure duration											
AFCD-1	30-3	25	3.5	16	3	20	9	36	4	40	2
AFCD-11	30-3	25	4	29	5	31	15	60	7	2	0
AFCD-12	20-3	25	4	30	5	34	16	65	8	18	1
AFCD-2	30-3	50	3.5	20	3	25	12	45	6	53	3
AFCD-3	30-3	100	3.5	22	4	29	14	51	6	63	3
AFCD-4	40-3	25	3.5	13	2	15	7	29	4	27	1
AFCD-5	25-3	25	3.5	18	3	22	10	39	5	50	3
AFCD-6	20-3	25	3.5	18	3	23	11	41	5	56	3
AFCD-7	15-3	25	3.5	18	3	22	11	40	5	61	3
AFCD-8	10-3	25	3.5	17	3	23	11	40	5	70	4
AFCD-9	30-4	25	3.5	17	3	21	10	38	5	50	3
Mechnical rotation											
M-1	3yr clsd	3yr open	3.5	13	2	22	11	35	4	132	7
M-2	5yr clsd	1 yr open	3.5	1	0	31	15	32	4	432	24
Non-rotational alternatives											
NR-1	status quo	F=0.2	3.5	0	0	0	0	0	0	0	0
NR-2	no rotation	F=0.2	4	17	3	16	7	33	4	-36	-2
NR-3	No action	13411 DA$	3.5	10	2	3	1	12	2	-138	-8
NR-5	Uniform	F=0.2 (1-e	3.5	15	2	19	9	34	4	72	4
Groundfish closed area options											
OPEN-1	F11 (Cl2-S)	F=0.1	4	85	14	172	82	256	32	526	29
OPEN-10	All areas open	F=0.1	4	98	16	304	145	402	50	1036	57
OPEN-11	All areas open	F=0.1	3.5	95	16	268	128	363	45	928	51
OPEN-12	All areas open	F=0.2	3.5	89	15	278	133	367	46	1093	60
OPEN-13	Ro. and F11 area	F=0.2	3.5	36	6	53	25	89	11	179	10
OPEN-14	Ro. and F13 area	F=0.1	3.5	86	14	185	88	271	34	582	32
OPEN-15	Ro. and F13 area	F=0.2	3.5	83	14	190	90	273	34	670	37
OPEN-16	Ro. and F13 area	F=0.2	4	86	14	194	92	280	35	653	36
OPEN-2	F11 (Cl2-S)	F=0.2	4	84	14	178	85	262	33	595	33
OPEN-3	F11 (Cl2-S)	F=0.1	3.5	74	12	155	74	229	28	573	31
OPEN-4	F11 (Cl2-S)	F=0.2	3.5	72	12	158	75	230	29	642	35
OPEN-5	F13	F=0.1	4	90	15	196	93	286	35	599	33
OPEN-6	F13	F=0.2	4	89	15	204	97	293	36	687	38
OPEN-7	F13	F=0.1	3.5	80	13	178	85	259	32	648	35
OPEN-8	F13	F=0.2	3.5	78	13	183	87	260	32	736	40
OPEN-9	All areas open	F=0.1	4	103	17	287	137	390	48	870	48
Reservoir rotations											
R1	F11 (Cl2-S)	18000 mt	3.5	64	11	98	47	163	20	216	12
R2	F11 (Cl2-S)	18000 mt	4	64	11	98	47	163	20	216	12
R3	F11 (Cl2-S)	19000 mt	4	71	12	115	55	185	23	267	15
R4	F13	20000 mt	3.5	71	12	131	62	202	25	417	23
R5	F13	20000 mt	4	79	13	140	67	219	27	355	19
R6	F13	21000 mt	4	86	14	165	79	251	31	438	24

8.7.4 Economic Impacts: Short-term economic effects of area rotation, Georges Bank closed area access, and habitat closed area alternatives

8.7.4.1 Introduction

This section evaluates the short-term economic impacts of the area rotation measures including area access, and habitat closure options considered by the Council during the development of Amendment 10.

The analysis includes the following scenarios and the likely combinations of measures described in Section **5.3** and described in Section **8.2.1.2**:

Scenarios with no access to Groundfish Areas and no additional habitat closures

30/25/3 rotation policy

MA default rotation

No Action: Amendment 7 DAS Schedule

Status Quo: F=0.2 and no rotation.

Groundfish Area Access Options

Alternative 1 : Mechanical Rotation

Alternative 2: Framework 11 Areas

Alternative 3: Framework 13 Areas

Alternative 4: All areas not otherwise included in a level 1-4 habitat closure

Habitat alternatives

Alternative 1: GFMort2 and STATUS QUO (alternative 9 has similar results)

Alternative 3a (3b and 4 have similar results)

Alternatives 5a and 5b (5c, 5d have similar results to 5a)

Alternative 6

Alternative 7

Alternative 8b (8a have similar results)

Groundfish mortality closed area alternative 1

The economic impacts of these options on net national benefits and scallop vessels were analyzed using the biological projections reported in Sections **8.2.1**. and the economic model presented in Appendix IV The results of this analysis are useful in showing the direction of change from the no action levels and the comparative net benefits of the proposed action, rather than in predicting the absolute values of the landings, revenues and economic benefits in future years.

8.7.4.2 Overview of short-term economic impacts of measures

The projected landings, revenues, economic benefits (including the producer and the consumer benefits) of the measures addressed in this section differ from the no action levels because of the following factors and policy options included in Amendment 10:

Modification of the overall fishing effort and catch levels specified in Amendment 7 in order to make them consistent with the current condition of the sea scallop resource at the given fishing mortality targets (F=0.2).

Rotational management

Area Access options combined with rotation (MA default rotation).

Habitat Closures.

In order to evaluate the distinct impacts of these factors and policy options, the economic benefits are evaluated from three separate perspectives:

- The following Relative to the **'no action'**: The regulatory guidelines require that the economic impacts of the proposed options be compared relative to the impacts likely to occur if 'no action' is taken. No action here refers to continuation of the Amendment 7 days-at-sea schedule (with 35 DAS for full-time vessels), which will remain in effect until these measures are amended. No action, as defined, includes no access to the Groundfish Areas and no new habitat closures. The economic benefits estimated as net of no action values show the benefits of modification using this regulatory perspective and definition of no action.

- Relative to the **'status quo'**: The following analysis defines 'status quo' as no rotation with DAS allocations set at F=0.2. Status quo includes no access to the Groundfish Areas and also includes no new habitat closures. Although the effort reduction measures of Amendment 7 will be implemented without a new Amendment, the recent assessments of the scallop resource abundance may necessitate a change in the DAS allocations by Framework process in order to meet the target fishing mortality level of 0.2 even in the absence of Amendment 10.

- Relative to **'no habitat closures'**: In order to assess the impacts on the habitat alternatives on the economic benefits derived from the scallop fishery, the economic impacts of the proposed rotation and area access alternatives were estimated for each habitat alternative. These economic benefits were then compared relative to the levels estimated with no habitat closures.

The following section provides an overview of impacts in terms of these three perspectives, although numerical results will be discussed primarily in relation to the levels for no action and no habitat closures. Following a discussion of impacts of modification of the Amendment 7 fishing effort (Section 8.7.4.3), impacts of the area access alternatives (Section 8.7.4.4), impacts of the habitat alternatives (Section 8.7.4.5), the combined impacts of the measures in conjunction with the habitat alternatives is summarized in Section 8.7.4.6. The economic impacts of the alternatives are shown for the preferred area access alternative 1 only in the summary Table 311 through Table 316. The impacts on landings, prices, revenues, costs, producer and consumer surpluses, employment, total net benefits, DAS-used per vessel, revenues, costs and gross profits per vessel of each area access, rotation and habitat alternative are presented in more detail, however, in

Table 329 to Table 345. Although the impacts of the alternatives were discussed in terms of their impacts on landings and total benefits below, the Tables following this discussion include price, revenue, producer and consumer surplus estimates as well. The relative impacts of the alternatives are similar, whether they are compared in terms of landings, revenues, or net economic benefits.

8.7.4.3 Modification of fishing effort and catch levels and the economic impacts relative to 'no action':

The discussion of impacts relative to the no action scenario is aimed at providing an answer to the following question:

> ***How does the modification of the Amendment 7 fishing effort and catch levels in accordance with the current condition of the sea scallop resource (at F=0.2) affect the landings, revenue, and net economic benefits?***

As Table 311 shows, the annual average scallop landings for the no action alternative (Amendment 7 DAS schedule) are projected to remain at 22 million during the period 2004-2007, which corresponds to the total fleet DAS-used (not DAS allocation) of 9,473 days-at-sea. Modification of these levels, corresponding to F=0.2 at the current scallop biomass levels, is estimated to increase annual average landings by 8 million lbs for the period 2004-2007 for the status quo (30 million pounds annual average), and by about 4 million pounds each year for the rotational management options with no access to groundfish areas and with no habitat closures. This increase in landings translates into an increase in net benefits of $76 million for the MA default rotation option and to an increase of $131 million for the status quo.

Landings are expected to increase even further with area access options, even when they are combined with habitat closures (Table 312). For example, the landings for the preferred area access option, i.e., alternative 1 (mechanical rotation) is estimated to be 33-34 million pounds for habitat alternative 7, about 39-40 million pounds for habitat alternatives 5b and 6, and about 41 to 42 million pounds for habitat alternatives 3a, 3b, 4, 5a, 5c, 5d and 8a and 8b. These increases are consistent with an increase in total fleet DAS-used by 28% with no access to groundfish areas and MA default rotation and by 85% with the preferred area access alternative 1, habitat alternative 5a and MA default rotations.

As a result of the increase in total fishing effort and landings from the Amendment 7, i.e., no action levels, total benefits relative to no action levels would be positive for all alternatives both with and without area access and habitat closures. Modification of the Amendment 7 fishing effort and catch levels alone, however, is expected to increase economic benefits as follows:

- The economic benefits of rotation options (either for 30/25/3 rotation or MA default rotation) net of no action and with no access to the groundfish areas will be positive, about $72 to $76 million for the period from 2004 to 2007 (inclusive). This is equivalent to the results obtained for habitat alternatives 1 (GFMort2) and 9.

- Status quo, with no rotation, and with no access would result in a $131 million increase in economic benefits net of no action over the same period.

8.7.4.4 The economic impacts of the area access alternatives relative to 'status quo' with no access to the groundfish areas and no habitat closures:

The discussion of impacts relative to the status quo is aimed at providing an answer to the following question:

How does area access alone affect the landings, revenues, and net economic benefits after adjustments are made to the Amendment 7 fishing effort and catch levels?

In order to separate the impacts of the area access alternatives on the economic benefits from the impacts of the adjustments to the Amendment 7 fishing effort and catch levels, the landings, revenues and economic benefits were evaluated relative to the status quo, i.e., no rotation, F=0.2 and no access. As Table 311 shows, the annual average scallop landings for status quo are projected be around 30 million during the period 2004-2007 with no access to the groundfish closed areas. If, however, access to groundfish areas is provided for scallop fishing, without rotation and habitat closures, the landings are projected to increase to 46 million pounds for area access alternative 1, and to 58 million for alternative 4 over the period 2007-2008. Since alternative 3 provides access to the Framework 13 areas (including closed areas 1, 2 and Nantucket lightship area) and alternative 2 provides access only to Framework 11 areas (Closed Area 2), the landings will be higher with alternative 3 compared to alternatives 1 and 2.

The rotational management (MA default rotation), combined with area access, would increase average landings to 43 million pounds for area access alternative 1 and to 55 million pounds per year for area access alternative 4 in the absence of habitat closures (Table 312). As a result, the economic benefits of the area access are expected to be considerably higher relative to the status quo with no access to the groundfish areas:

- If no habitat closures were implemented, the cumulative economic benefits would increase by $190 million (net of status quo) for area access alternative 1 and to as much as $352 million for area access alternative 4 under a MA default rotation option over the period 2003-2007 (Table 315).

- Under the same circumstances, the no rotation (and F=02) alternative is estimated to increase the cumulative economic benefits by $237 million for area access alternative 1 and to as much as $392 million for area access alternative 4 over the period 2003-2007 (Table 315).

8.7.4.5 The economic impacts of the habitat alternatives relative to 'no habitat closures':

The discussion of impacts relative to the no habitat closures is aimed at providing an answer to the following question:

How do the habitat closures affect the landings, revenues, and net economic benefits after adjustments are made to the Amendment 7 fishing effort and catch levels and if access is provided to groundfish areas?

The bottom two rows of Table 312 show the average annual landings with MA default rotation and also with no rotation for area access alternatives 1 to 4. For the preferred area access alternative 1, combined with MA default rotation, the average landings would increase to 43 million lbs over the period 2004-2007 and to 46 million lbs with no rotation at F=0.2 in the absence of habitat closures. The habitat alternative 1, however, would result in a reduction in average annual landings to 26 million pounds because this alternative does not provide any access to the groundfish areas. The reduction would be less for habitat alternative 7, with annual landings of 34 million lbs as an average of the four years from 2004 to 2007. There would also be a decline in annual average landings for the remaining habitat alternatives, although to a lesser extent, ranging from 39 million lbs for habitat alternative 5b to 42 million lbs for the habitat alternative 5a.

The reduction in landings due to the habitat closures will have negative impacts on economic benefits as Table 316 shows.

- Habitat alternatives1 and 9 will have the largest economic impacts and will reduce the estimated cumulative value of the total economic benefits by $245 million over the period 2004 to 2007.

- Habitat alternative 7 will reduce total benefits by $131 million.

- Habitat alternative 5b is estimated to reduce the total benefits by $49 million, and alternatives 3a, 3b, 4, and 6 by $32 million

- Habitat alternatives 5a, 5c, 5d, 8a will have the fewest impacts and will reduce the cumulative value of the economic benefits by $5 million, followed by habitat alternative 8b, which is estimated to reduce the economic benefits by $9 million over the period 2004-2007.

8.7.4.6 Combined economic impacts of the area access, rotation and habitat closures net of no action:

This section summarizes the economic impacts of the measures, rotation and area access alternatives after the impacts of the additional habitat closures on landing, revenues and benefits are taken into account. Although the habitat closures will have negative impacts on scallop revenues and net national benefits to the nation (as measured by the total economic benefits comprising consumer and producer surpluses), the positive impacts of rotation and area access alternatives will offset these negative impacts. As a result, the total economic benefits relative to the no action and status quo (except in conjunction with habitat alternative 1) levels will be positive even when additional areas are closed under the various habitat alternatives:

- The total benefits net of no action are estimated to increase by $322 for the rotation (MA default rotation) option and by $368 for no rotation and the F=0.2 scenario if access to groundfish areas is allowed under the preferred alternative 1 (mechanical rotation) over the period 2004-2007 and no habitat closures are implemented (Table 314). The increase in net benefits would be larger for area access alternatives 2 to 4.

- Similarly, the proposed groundfish area access alternatives (alternatives 1 to 4), combined with habitat closures, except when it is combined with habitat alternative 1, are estimated to increase total economic benefits net of status quo (Table 315). Habitat alternative 1 (GFMort2), however, is estimated to reduce the total economic benefits by $55 million relative to status quo for the period 2003-2007 because it does not provide access to groundfish areas.

- Preferred area access alternative (alternative 1) with MA default rotation is estimated to provide the largest economic benefits net of no action when it is combined with habitat alternatives 5a, 5c, 5d, 8a, and 8b (Table 314). The cumulative economic benefits are expected to increase by $312-$316 million over the period 2004-2007 for these habitat alternatives with area access alternative 1. Total benefits from area access alternatives 2 to 4 will exceed these levels, ranging from $332 million (area access alternative 2) to $479 million (area access alternative 4) when combined with the same group of habitat alternatives.

- The economic benefits net of no action will be the least for habitat alternative 1 because no access is provided to groundfish areas and, therefore, area access alternatives do not apply. The net economic benefits will increase by $76 million net of no action because of the modification of fishing effort and catch levels from the levels set in Amendment 7 (Table 314).

- Preferred area access alternative 1 with MA default rotation will increase economic benefits by $190 million net of no action over the period 2004-2007, whereas the benefits from area access alternatives 2 to 4 will exceed these levels (Table 314).

- The cumulative value of the total economic benefits will range from $273 million to $290 million for the preferred area access alternative 1 when combined with habitat alternatives 5b, 3a, 3b, 4 and 6 (Table 314). Again, more access to groundfish areas as depicted with area access alternatives 2 to 4 will increase net benefits beyond these values.

- The overall impacts on regional revenues and incomes, however, will be greater than the revenue estimates shown in Table 311 through Table 316 because of the indirect and induced multiplier impacts. Indirect impacts include the impacts on sales, income, employment and value-added of industries that supply commercial harvesters, such as the impacts on marine service stations that sell gasoline and oil to scallop vessels. The induced impacts represent the sales, income and employment resulting from expenditures by crew and employees of the indirect sectors. An input/output analysis conducted by NMFS (1998) estimated that sales, income and employment multipliers for the sea scallop fishery in the Northeast Region. The sales multiplier for the coastal counties in Northeast was estimated to be approximately 1.8 in 1996 for the scallop dredge and trawls. These sales and income multipliers were, however, estimated including only the backward linkages associated with the harvest of sea scallops.

- The revenues, costs and economic benefits were estimated assuming that the number of vessels will stay the same, and that there would be no reduction in total effort even if there were some business failures because DAS would be redistributed among the remaining vessels either with regulation and/or consolidation. If some vessels exit the fishery, and there is no redistribution of DAS among the remaining vessels, the absolute level of benefits of all options will be lower, but the relative benefits of the proposed options net no action will be probably higher than predicted in this analysis.

For a discussion of the uncertainties and sensitivity analyses of these results see Appendix IV.

Table 311. Landings, prices, revenues and economic benefits with no access to groundfish areas and no habitat closures

No Access and no habitat closures	Average of 2004-2007			Cumulative values for 2004-2007		
	Landings Million lb.	Ex-vessel price (in 96 prices) $/lb	Fleet Revenues (in 96 prices) Million $	Producer Surplus (in 96 prices) Million $	Consumer Surplus (in 96 prices) Million $	Total Benefits (in 96 prices) Million $
30/25/3 rotation policy	26	4.73	124	404	113	518
MA default rotation	26	4.71	125	407	115	522
No Action	22	5.05	110	365	81	446
Status quo	30	4.49	133	432	145	577

Table 312. Impacts of area access alternative 1 with and without habitat closures

	Average of 2004-2007			Cumulative values for 2004-2007		
	Landings Million lb.	Ex-vessel price (in 96 prices) $/lb	Fleet Revenues (in 96 prices) Million $	Producer Surplus (in 96 prices) Million $	Consumer Surplus (in 96 prices) Million $	Total Benefits (in 96 prices) Million $
Closure Alternatives and MA default rotation						
Alternative 1 (GFMort2 and SQ)	26	4.71	125	407	115	522
Habitat alternative 3a	41	3.85	154	494	242	735
Habitat alternative 5a	42	3.75	158	504	258	763
Habitat alternative 5b	39	3.94	153	493	226	719
Habitat alternative 6	40	3.87	155	497	239	736
Habitat alternative 7	34	4.27	142	463	174	637
Habitat alternative 8b	42	3.76	157	503	255	758
Groundfish GF Mortality closed area alt.1	33	4.29	141	457	169	626
No habitat closures						
MA default rotation	43	3.72	158	505	262	768
No Rotation, F=0.2	46	3.55	162	513	300	814

Table 313. Economic impacts relative to *no action* with no access to groundfish areas and no habitat closures

	Average of 2004-2007		Cumulative values for 2004-2007		
	Landings Million lb.	Fleet Revenues (in 96 prices) Million $	Producer Surplus (in 96 prices) Million $	Consumer Surplus (in 96 prices) Million $	Total Benefits (in 96 prices) Million $
No Access and no habitat closures					
30/25/3 rotation policy	4	13	40	32	72
MA default rotation	4	14	42	34	76
No Action	-	-	-	-	-
Status quo	8	23	67	64	131

Table 314. Impacts of area access alternative 1 (preferred option) relative to *no action* with and without habitat closures

	Average of 2004-2007		Cumulative values for 2004-2007		
	Landings Million lb.	Fleet Revenues (in 96 prices) Million $	Producer Surplus (in 96 prices) Million $	Consumer Surplus (in 96 prices) Million $	Total Benefits (in 96 prices) Million $
Closure Alternatives and MA default rotation					
Alternative 1 (GFMort2 and SQ)	4	14	42	34	76
Habitat alternative 3a	19	44	129	160	289
Habitat alternative 5a	20	48	140	177	316
Habitat alternative 5b	17	43	128	145	273
Habitat alternative 6	18	45	133	157	290
Habitat alternative 7	12	32	98	92	190
Habitat alternative 8b	20	47	139	173	312
Groundfish GF Mortality closed area alt.1	11	31	92	87	179
No habitat closures					
MA default rotation	21	48	141	181	322
No Rotation, F=0.2	24	52	149	219	368

Table 315. Economic impacts of area access alternative 1 with ma default rotation relative to *status quo*

	Average of 2004-2007		Cumulative values for 2004-2007		
	Landings Million lb.	Fleet Revenues (in 96 prices) Million $	Producer Surplus (in 96 prices) Million $	Consumer Surplus (in 96 prices) Million $	Total Benefits (in 96 prices) Million $
Closure Alternatives and MA default rotation					
Alternative 1 (GFMort2 and SQ)	-4	-8	-25	-30	-55
Habitat alternative 3a	11	22	62	96	158
Habitat alternative 5a	12	25	72	113	185
Habitat alternative 5b	9	20	60	81	141
Habitat alternative 6	10	22	65	93	159
Habitat alternative 7	4	9	31	29	59
Habitat alternative 8b	12	25	71	110	181
Groundfish GF Mortality closed area alt.1	3	8	25	24	48
No habitat closures					
MA default rotation	13	26	73	117	190
No Rotation, F=0.2	16	29	81	155	237

Table 316. Economic impacts of the habitat alternatives relative to the no habitat closures with ma default rotation and area access alternative 1

	Average of 2004-2007		Cumulative values for 2004-2007		
	Landings Million lb.	Fleet Revenues (in 96 prices) Million $	Producer Surplus (in 96 prices) Million $	Consumer Surplus (in 96 prices) Million $	Total Benefits (in 96 prices) Million $
Closure Alternatives and MA default rotation					
Alternative 1 (GFMort2 and SQ)	-16	-34	-98	-147	-245
Habitat alternative 3a	-2	-4	-12	-21	-32
Habitat alternative 5a	0	-1	-1	-4	-5
Habitat alternative 5b	-4	-6	-13	-36	-49
Habitat alternative 6	-3	-4	-8	-24	-32
Habitat alternative 7	-9	-16	-43	-88	-131
Habitat alternative 8b	-1	-1	-2	-7	-9
Groundfish GF Mortality closed area alt.1	-10	-17	-49	-94	-142
No habitat closures					
MA default rotation	-	-	-	-	-
No Rotation, F=0.2	3	4	8	38	46

8.7.4.7 Overfishing definition alternatives

This section provides a comparative economic analysis of the proposed overfishing definition (which the Council did not approve) with the status quo overfishing definition (OF) with and without area rotation and access to the Georges Bank groundfish areas. Because the status quo OF would allow a higher fishing mortality in the open areas over the near term, it would result in larger landings of scallops compared to the proposed overfishing (OF) definition. Therefore, the economic impacts of these alternative definitions would differ considerably from each other. Over the long term, the higher fishing mortality allowed in open fishing areas with the status quo overfishing definition would result in lower LPUE, lower biomass, and hence lower landings and revenue.

As Table 317 through Table 319 show, if the management options were determined in accordance with the status quo overfishing definition (SQOFD) combined with a 38,000 maximum DAS-used and coupled with 3.5 inch rings, the estimated annual average landings for the period 2004-2008 would exceed estimated landings with the proposed overfishing definition (POFD) for all scenarios with and without area rotation and access to the Georges Bank groundfish areas. Over the long-term, however, the landings will be lower with the SQOFD compared to POFD. The corresponding economic impacts could be summarized as follows:

- Fleet revenues, consumer surplus and total economic benefits would be larger with the SQOFD compared to levels with POFD during 2004-2008. Consumer surplus, is estimated to increase as prices decline and landings increase. Producer surplus is larger with the SQOFD compared to POFD scenario during 2004-2007 for most scenarios. Since total benefits comprise both consumer and producer surplus, the increase in these components would lead to an increase in total benefits during the same period under SQOFD.

- The operating expenses vary with the fishing effort and include trip costs such as food, fuel, oil, water and ice and half of the repairs as semi-variable costs. Because DAS-used with the SQOFD will be higher compared to the POFD scenario, the operating costs will be correspondingly high if the SQOFD is applied in the determination of the management measures compared to the POFD. This difference in costs will be magnified over time.

- Producer surplus measures total fleet revenues minus the total operating costs, and it includes both profits and the crew shares. Producer surplus is expected to decline continuously due to the rising operating costs and to start falling below, as early as 2008, the level of producer surplus that could be achieved with the POFD scenario with the exception of no rotation combined with access.

Over the longer term, the increase in landings, revenues and total benefits are expected to slow down as increased fishing mortality reduces LPUE. As
Table 320 shows, LPUEs in the open areas decline considerably with the status quo overfishing definition alternative, to 1,248 pounds per day-at-sea in 2004, from 1,479 pounds per day-at-sea (new overfishing definition). For the same reasons, overall average LPUEs are lower with SQOFD alternative compared to the POFD (Table 321). As a result, landings will be lower with SQOFD despite a larger fishing effort, resulting in less catch and revenue per day-at-sea, and greater operating costs per pound of scallops. For these reasons, over the longer term, total benefits are expected to be significantly smaller if SQOFD instead of POFD is used for the scallop management (Table 317 to Table 319). Revenues, crew shares and profits per vessel with the POFD will larger as well than the respective values with the SQOFD scenario over the long-

term. The final alternative selected by the Council, which requires 4-inch rings and applies a higher DAS-tradeoff for controlled access with area-specific DAS allocations will improve the results for SQOFD by reducing the fishing mortality and increasing the selectivity of gear towards larger scallops. It will also minimize the short-term economic impacts on the vessels. For example, POFD would result in a decline in fleet revenues from its estimated levels of 168 million (in 96 prices) in 2003 to 151 million in 2004, and to 162 million over 2005-2007. whereas with SQOFD, the fleet revenues would stay almost constant (ranging from $167 to $169) during the same period.

Table 317. Economic impacts of overfishing definition alternatives with no rotation and no area access

Overfishing definition	Data	2003	2004	2005-2007	2008	Long-term average
Proposed Overfishing definition	Landings, million lb.	52.6	29.1	27.1	32.9	36.2
	Price	3.2	4.5	4.7	4.3	4.1
	Revenue, million $	168.4	132.0	125.6	141.2	148.1
	Operating Costs. $	34.0	13.7	12.5	14.9	16.4
	Producer surplus, mill.$	134.4	118.3	113.1	126.3	131.7
	Consumer Surplus, mill.$	103.0	37.4	33.6	46.3	54.5
	Total Benefits, mill.$	237.4	155.7	146.7	172.6	186.2
Status quo Overfishing definition 38,000 DAS	Landings, million lb.	52.6	42.4	41.4	37.1	19.3
	Price	3.2	3.7	3.8	4.0	5.1
	Revenue, million $	168.4	157.9	155.9	148.4	98.9
	Operating Costs, $	34.0	24.2	28.6	33.7	43.4
	Producer surplus, mill.$	134.4	133.7	127.3	114.7	55.5
	Consumer Surplus, mill.$	103.0	71.9	69.2	57.8	19.1
	Total Benefits, mill.$	237.4	205.6	196.5	172.4	74.6

Table 318. Economic impacts of overfishing definition alternatives with no rotation and with access to Georges Bank groundfish areas

Overfishing definition	Data	2003	2004	2005-2007	2008	Long-term average
Proposed Overfishing definition	Landings, million lb.	52.6	40.1	47.5	37.4	47.5
	Price	3.2	3.9	3.5	4.0	3.5
	Revenue, million $	168.4	155.0	164.1	150.4	164.4
	Operating Costs. $	34.0	17.7	20.3	16.2	20.5
	Producer surplus, mill.$	134.4	137.3	143.8	134.1	143.8
	Consumer Surplus, mill.$	103.0	65.0	86.9	57.8	86.8
	Total Benefits, mill.$	237.4	202.3	230.7	191.9	230.6
Status quo Overfishing definition 38,000 DAS	Landings, million lb.	52.6	47.7	51.6	46.5	43.4
	Price	3.2	3.5	3.3	3.5	3.7
	Revenue, million $	168.4	164.7	168.3	163.1	159.0
	Operating Costs, $	34.0	23.9	24.4	25.1	27.1
	Producer surplus, mill.$	134.4	140.8	143.9	138.0	132.0
	Consumer Surplus, mill.$	103.0	87.4	99.3	83.6	74.9
	Total Benefits, mill.$	237.4	228.3	243.2	221.7	206.9

Table 319. Economic impacts of overfishing definition alternatives with area rotation and with access to Georges Bank groundfish areas

Overfishing definition	Data	2003	2004	2005-2007	2008	Long-term average
Proposed	Landings, million lb.	52.6	37.9	45.9	40.4	48.9
Overfishing	Price	3.2	4.0	3.6	3.9	3.4
Definition	Revenue, million $	168.4	151.4	162.4	155.5	166.0
3.5 inch rings	Operating Costs. $	34.0	16.8	19.5	17.6	21.3
	Producer surplus, mill.$	134.4	134.6	142.8	138.0	144.7
	Consumer Surplus, mill.$	103.0	59.0	82.2	65.9	91.0
	Total Benefits, mill.$	237.4	193.6	225.0	203.9	235.7
Status quo	Landings, million lb.	52.6	49.8	55.7	46.3	46.1
Overfishing	Price	3.2	3.3	3.1	3.5	3.5
definition	Revenue, million $	168.4	166.6	171.0	162.4	162.1
38,000 DAS	Operating Costs, $	34.0	31.2	33.9	61.9	34.9
3.5 inch rings	Producer surplus, mill.$	134.4	135.5	137.1	100.5	127.1
	Consumer Surplus, mill.$	103.0	93.7	112.6	83.3	83.0
	Total Benefits, mill.$	237.4	229.1	249.7	183.8	210.1
Status quo	Landings, million lb.	52.6	50.0	52.5	47.4	46.6
Overfishing	Price	3.2	3.3	3.2	3.5	3.5
Definition	Revenue, million $	168.4	167.0	168.8	164.4	162.5
4 inch rings	Operating Costs. $	34.0	25.0	28.8	43.6	42.5
	Producer surplus, mill.$	134.4	142.1	140.0	120.8	119.9
	Consumer Surplus, mill.$	103.0	94.4	102.3	86.4	84.5
	Total Benefits, mill.$	237.4	236.5	242.3	207.2	204.4

Table 320. MA default rotation scenario with area option 1

Fishing year	Area	LA Catch (mt)	LA DAS	Ave. LPUE (lbs/d)	Ave. MC
2004	**NLSA/CA1**	3,113	2,360	2,908	11.9
2004	**HC**	10,958	10,014	2,412	16.3
2004	**Open areas**	1,799	2,682	1,479	20.2
2004 SQOFD	**Open areas**	4,962	8,764	1,248	
2005	**CA2**	9,678	7,292	2,926	12.4
2005	**HC**	8,918	8,386	2,344	16.6
2005	**Open areas**	2,137	2,984	1,578	19.0
2005 SQOFD	**Open areas**	5,651	9,026	1,380	

Table 321. Catch per day-at-sea used and total DAS-used with status quo and proposed overfishing definitions.

Overfishing definition	Area Rotation	Groundfish area access	Data	2004-2008 average	Long-term average
Proposed Overfishing definition	No	No	Catch per DAS-used	2,191	2,258
			Total DAS-used	13,467	15,864
		Yes	Catch per DAS-used	2,400	2,429
			Total DAS-used	17,259	19,398
	Yes		Catch per DAS-used	2,396	2,417
			Total DAS-used	17,188	20,035
Status quo Overfishing definition 38,000 DAS	No	No	Catch per DAS-used	1,579	510
			Total DAS-used	26,285	38,018
		Yes	Catch per DAS-used	2,146	1,749
			Total DAS-used	22,701	24,874
	Yes		Catch per DAS-used	1,500	1,496
			Total DAS-used	36,949	31,260

8.7.4.8 Short-term impacts of measures on vessels and small businesses

The proposed measures, including groundfish area access options, combined with various habitat alternatives, are estimated to have positive impacts on the business activities of sea scallop fishermen relative to the no action alternative. The Small Business Administration defines a small business entity as an enterprise that grosses less than $3.5 million a year, including its affiliates. The majority of the vessels in the scallop fishery are small business entities according to this definition.

The estimated DAS-used, revenues, fixed and variable costs, crew shares, and revenues net of costs are shown in Table 322 for each option without area access and habitat closures and in Table 348 and Table 349 for each option with area access, with and without habitat closures.

In calculating values per vessel, total fleet DAS, landings and revenues were divided among an estimated 264 full-time or full-time equivalent vessels. The number of full-time vessels that will participate in the fishery was estimated to be 242, assuming that it will be equal to the number of full-time permits issued during the 2001 fishing year. For the purposes of this analysis, DAS allocations associated with the part-time and occasional permits were converted to full-time equivalent permits. For example, allocations of 48 DAS for 34 part-time vessels would be equivalent to allocations of 120 DAS for 13.6 full-time vessels. Similarly, DAS allocated to occasional vessels and DAS-used by general category vessels were converted to full-time DAS equivalencies, bringing the number of estimated full-time equivalent vessels to 264.

The total fleet days-at-sea (Table 336 and Table 337) was then divided by this number to obtain DAS-used per full-time vessel shown in Table 346 and Table 347. It should be emphasized, however, that DAS allocations would be higher than the estimated DAS-used levels depending on the rate of participation in the fishery.

The annual average scallop revenues per full-time vessel were estimated by multiplying three variables: (1) the estimated DAS-used, (2) the ex-vessel price projected by the economic model, and (3) the landings per day-at-sea (LPUE) projected by the biological model for each scenario. The annual revenue estimates do not include revenues from monkfish and other fisheries.

The operating expenses and fixed costs were estimated with the methods explained in Appendix IV. Operational costs consist of trip costs, such as food, fuel, oil and ice, which vary with DAS, as well as half of repairs, assuming that more vessel activity will increase repair costs. The fixed costs include insurance, license, half of repairs, office expenses, professional fees (for accounting etc.,), dues, utilities, interest, dock expenses, rent, employee benefits and bank, store, auto, travel expenses.

Other than these costs, the vessels will incur dockside expenses and overhead no matter how many days they fish. These expenses were included in the fixed costs for all options. If staying at the dock more increases some dockside expenses for options with lower fishing effort and DAS allocations, the decline in the operational costs will be less than reported in Table 322 to Table 325 [104]. Even then, it is unlikely for the operational costs of the lower DAS allocations to exceed the costs of the higher DAS allocations because a major portion of the operational costs consists of trip expenses, which decline with fishing effort and DAS. In fact, operational cost function (equation 2) reported in the economic model section showed that the coefficient for the DAS is statistically significant and the operational costs increase as DAS increases. Additionally, fixed costs seems to be higher for vessels with a higher DAS-use, showing no evidence that that the average fixed costs per vessel increase as a vessel stay longer at the dock (Appendix IV).

The gross profit estimates given in Table 322 through Table 325 show the difference of gross revenue over variable and fixed expenses. The results show that the impact on the revenues and gross profits of the vessels will be positive relative to no action for all area access alternatives when combined with rotation and habitat closures (Table 324 and Table 325). This is the expected result since under the no action scenario the DAS allocations would be reduced drastically to about 36 days-at-sea in accordance with the effort-reduction schedule set by Amendment 7. Although, estimated prices and LPUE will be higher for no action compared to the other alternatives, the reduction revenues due to the decline in DAS-used would far outweigh the positive impacts of the increase in prices and the reductions in variable costs.

On average, the gross profits and crew incomes are estimated to be positive during 2004-2007 for all the options included in this Amendment. The estimated gross revenues with no action alternative are very negligible, however. Furthermore, positive gross revenues do not necessarily indicate that the fleet would be financially sound at this level of operation or that the profits per vessel would be positive. Gross profits include fixed and operating costs, including repairs, and but not vessel replacement or depreciation costs. In addition, at the estimated levels of gross revenues, there may be very little return on the owner's investment, let alone a rate of return that reflects the level of risk for scallop fishing. In other words, gross profits will be imperfect indicators of the financial viability of the vessels until more current and comprehensive data are obtained not only on vessel costs, but also on vessel owners' short-term and long-term liabilities (such as mortgage on vessels), and other fishery related income and assets generated from the fishing profits of previous years. For these reasons, the numerical values of these estimates (Table 322 to Table 325) should be interpreted with caution and should be used mainly to compare one alternative to another. There is no doubt that including other items, such as opportunity costs of capital, would reduce the gross profit estimates for all options. But since this reduction would be in an equal amount for each alternative, the profitability of each option relative to the others would not change.

[104] Some industry members reported that some repairs that are done by crew when they are on board catching scallops will not be finished if the DAS allocations are reduced and the vessel owners will need to pay for these repairs when the boat is at the dock.

It is also useful to compare the economic impacts on vessels of the proposed alternatives, including the habitat closures, relative to the status quo. This alternative, like no action, allows no access to groundfish areas and includes no habitat closures. It, however, implies a different fishing effort level than the no action alternative. Although without Amendment 10 the effort reduction measures of Amendment 7 will be implemented, the DAS allocations may be adjusted by a Framework process in order to achieve status quo fishing mortality targets at F=0.2 consistent with the recent assessments of the scallop resource abundance. The level of DAS-used for the status quo alternative is, however, estimated to be lower than the DAS-used in recent years in order to keep the fishing mortality at the target levels.

The annual average vessel revenues for the rotational area option would exceed the levels that could be achieved with status quo levels, if access (alternative 1 - preferred option) is provided to the groundfish areas even with additional habitat closures. Even though habitat closures will reduce the average fleet revenues, access to the groundfish areas is expected to offset this reduction, resulting in a small increase in gross and gross profits with the preferred access option (alternative 1). The annual average revenues and gross profits per average vessel for area access alternatives 2 to 4 are also estimated to exceed the status quo revenues and gross profits as shown in Table 348 and Table 349 . The average revenues per vessel would be lower than status quo levels only for habitat alternative 1, which does not provide any access to the groundfish areas.

Table 324 and Table 325 show the percentage change in gross profits and revenues, variable costs and crew shares relative to the no action levels. If area access is provided (preferred access alternative 1), the gross profits for the proposed options would significantly exceed the gross profits for the no action alternative. Obviously, the percentage increase in revenues (44% for the MA default rotation option and 47% for the no rotation option with F=0.2) would be the largest if there were no habitat closures. If some areas were closed to protect habitat, however, the largest increase in revenues (about 43%) would be observed with habitat alternatives 5a and 8b, and the least increase (about 13%) would be with habitat alternative 1. The results for the gross profits are similar except that the percentage increase in gross profits compared to no action exceeds 500% for most options because gross profits are negligible with the later alternative.

<u>Uncertainties</u>

Gross profits and revenue estimates are useful only in comparing the economic impacts of alternatives relative to each other. The absolute values of the estimates should be interpreted with caution since they represent average revenues for the period 2004 to 2007 corresponding to the average LPUE estimates of the biological model. In other words, these estimates should not be used to forecast the absolute values of the future vessel revenues:

- The revenues and gross profits, costs, and crew shares were estimated for an average full-time vessel in the scallop fleet. Some vessels in the fleet will have a higher fishing power, higher LPUE's, and larger revenues, however, than the others as discussed in Section 8.7.2.4 Estimates for revenues, costs and profits will vary according to the vessel size in terms of gross tons, horsepower, and vessel age (older vessels will have more repair costs). They will also vary because of the differences in the skills of the captains and the crew. For these reasons, the actual revenues of the individual vessels will diverge from the fleet averages shown in Table 322, Table 348 and Table 349.

- These results were based on the assumption that the vessels will use all the trips allocated to them in the controlled access areas. If, however, some vessels were unable or choose not to fish in these areas at the selected days-at-sea trade-offs and trip limits, their revenues, costs, and profits will be different than estimated in Table 322 and Table 325. Also, some vessels may not benefit from fishing in the access areas to the same degree if their capacity to catch and land scallops is too limited to take full advantage of the high abundance and LPUEs in the controlled access areas.

- The costs and gross profits will change with the future fuel costs, and prices of other items, such as food, that comprise the variable and fixed costs.

- The revenues and costs were estimated assuming that the average vessel will use less than its full allocation. For example, under the 2002 DAS use scenario it is assumed that an average full-time vessel will only use 112 DAS, i.e., not 120 DAS.

- The number of active vessels are assumed to stay constant under all alternatives.

- Change in import prices, meat count, change in the disposable income and preferences of consumers will affect prices and therefore the revenues.

Table 322. Impacts on full-time vessels with no access to groundfish areas and no habitat closures

	Average of four years from 2004 to 2007 and for an average full-time vessel					
	DAS-used per vessel (in 96 prices)	Revenue per vessel (in 96 prices)	Operating costs per vessel (in 96 prices)	Fixed Costs per vessel (in 96 prices)	Crew Shares (in 96 prices)	Gross profits (in 96 prices)
2002 DAS use	112	588,012	124,221	163,397	254,896	45,498
30/25/3 rotation policy	44	467,336	44,401	163,397	236,623	22,915
MA default rotation	46	471,031	46,109	163,397	237,135	24,390
No Action	36	416,609	34,992	163,397	214,973	3,247
Status quo	52	502,287	53,354	163,397	250,482	35,054

Table 323. Economic impacts of area access alternative 1 on full-time vessels with ma default rotation

	Average of four years from 2004 to 2007, and for an average full-time vessel					
	DAS-used per vessel (in 96 prices)	Revenue per vessel (in 96 prices)	Operating costs per vessel (in 96 prices)	Fixed Costs per vessel (in 96 prices)	Crew Shares (in 96 prices)	Gross profits (in 96 prices)
Closure Alternatives and MA default rotation						
Alternative 1 (GFMort2 and SQ)	46	471,031	46,109	163,397	237,135	24,390
Groundfish mortality closed area 1	54	533,887	55,264	163,397	267,992	47,234
Habitat alternative 3a	64	583,959	66,433	163,397	290,112	64,017
Habitat alternative 5a	66	597,016	69,351	163,397	295,848	68,420
Habitat alternative 5b	60	577,585	62,703	163,397	288,881	62,604
Habitat alternative 6	63	585,227	65,485	163,397	291,499	64,846
Habitat alternative 7	53	537,497	53,715	163,397	271,329	49,056
Habitat alternative 8b	66	595,346	68,700	163,397	295,296	67,953
No habitat closures						
MA default rotation	67	599,075	70,245	163,397	296,460	68,973
No Rotation, F=0.2	73	613,855	77,765	163,397	300,197	72,496
MA default rotation, Status quo Overfishing Definition	116	657,516	129,108	163,397	293,718	71,292

Table 324. Economic impacts on vessels, percentage change relative to '*no action' values* with no additional habitat closures and no access to groundfish areas.

	Average of four years from 2004 to 2007, and for an average full-time vessel			
	Revenue per vessel (in 96 prices)	Operating costs per vessel (in 96 prices)	Crew Shares (in 96 prices)	Gross Profits (in 96 prices)
2002 DAS use	41%	255%	19%	384%
30/25/3 rotation policy	12%	27%	10%	180%
MA default rotation	13%	32%	10%	193%
No Action	0%	0%	0%	0%
Status quo	21%	52%	17%	291%

Table 325. Economic impacts on vessels, percentage change relative to '*no action' values with area access alternatives.*

	Average of four years from 2004 to 2007, and for an average full-time vessel			
	Revenue per vessel (in 96 prices)	Operating costs per vessel (in 96 prices)	Crew Shares (in 96 prices)	Gross Profits (in 96 prices)
Closure Alternatives and MA default rotation				
Alternative 1 (GFMort2 and SQ)	13%	32%	10%	193%
Habitat alternative 3a	40%	90%	35%	556%
Habitat alternative 5a	43%	98%	38%	596%
Habitat alternative 5b	39%	79%	34%	543%
Habitat alternative 6	40%	87%	36%	563%
Habitat alternative 7	29%	54%	26%	419%
Habitat alternative 8b	43%	96%	37%	592%
Groundfish mortality closed area 1	28%	58%	25%	402%
No habitat closures				
MA default rotation	44%	101%	38%	601%
No Rotation, F=0.2	47%	122%	40%	633%

8.7.4.9 Trip Limit Analysis

Amendment 10 proposed alternative includes area-specific DAS allocations combined with possession limits for the controlled access areas. Because the DAS allocations are area-specific, the vessels will loose revenues if they are unable or choose not to access these areas. The proposed one-to-one exchange provision for the controlled area trips is expected to provide flexibility to vessels regarding which areas to fish, thereby reducing the possibility for revenue loss to those vessels that are unable to access some off-shore areas due to their capacity constraints. The economic impacts of this alternative were examined in Section 8.7.2.4.

This section provides an analysis of the trip limit alternative with days-at-sea trade-offs, which was considered but not approved by Council (Section 5.3.3.2). Since with this alternative, vessels could choose to use their DAS-allocations only in the open areas, the trips limits should be sufficiently high to attract effort to controlled access areas for which they are required to trade-off part of their DAS allocations. The results of the analysis could be summarized as follows:

- With the rotational management, the trip limits in the controlled access areas should be higher than 13,650 pounds for Hudson Canyon and higher than 13,300 pounds for the Georges Bank controlled access areas in 2004 in order to attract effort from the open areas to the Georges Bank closed areas (under area access option 1 with no habitat closures).105

- The trip limits should be set at higher in 2005, higher than 14,425 pounds for Hudson Canyon and higher than 14,119 pounds for the Georges Bank controlled areas. This is because in LPUE in the

[105] The trip limits could be set even lower if the status quo overfishing definition alternative was selected for sea scallop management. Table 318 shows, the LPUE in the open areas would be much lower with the status quo OF alternative, about 1,248 pounds per day-at-sea in 2004, as compared to 1,479 with new OF definition.

open areas are estimated to increase in 2005, and a higher trip limit is necessary to attract effort to the controlled access areas (Table 326).

- The extent of the fishing effort that would be directed to the controlled access areas at different trip limits could not be quantified, however. Because of the decline in the catch rates after an area is opened, the fluctuations in the LPUEs in the open and in the restricted access areas, as well as the changes in the price premium for larger scallops during the course of the fishing year, it is not possible to predict with certainty the times when fishing in the controlled access areas will be more profitable compared to fishing in the open areas.

The following sections describe the calculation of equivalent trip limits, and discuss the impacts of 21,000 lb. possession limit, and the trip limits on vessels with different fishing powers and productivity, and points out the uncertainties that could impact the results of this analysis.

Calculation of the equivalent trip limits

The trip limit analysis was conducted for the rotational area management combined with the preferred area access alternative 1 and no habitat closures. The comparative results would be similar, however, if the analysis were conducted including habitat closures, with the exception of a few caveats. Since the options with no habitat closures result in a larger level of landings compared to options that include habitat closures, the price of scallop for the later options would be higher compared to the former. Therefore, gross and gross profits per trip would be higher. Since the controlled access areas will generally have a larger LPUE compared to the LPUE in the open areas, the comparative analysis of the trip limits, gross and gross profits are not expected to change significantly with habitat closures.

Table 326 provides estimated LPUEs, meat count (MC), and landings for each area and the gross and gross profits per day-at-sea in the open versus the controlled access areas of Georges Bank and Hudson Canyon. The revenues per day-at-sea in these areas are obtained by multiplying the estimated prices with the landings per day-at-sea (LPUE). The LPUEs in each area are estimated from the biological model and takes into account the steaming time and the shucking capacity at various meat size for scallops. The results of this analysis indicate that the LPUE point estimate for the mid-2004 fishing year 1479 pounds in the open areas, 2,412 pounds in Hudson Canyon and about 2,900 pounds per DAS in the Georges Bank closed areas. LPUE in the open areas and in the Georges Bank controlled access areas will be slightly higher in 2005, and LPUEs in the Hudson Canyon area will be slightly lower. Since these are averages corresponding to the middle of the fishing year, the actual LPUEs will differ from these values at any given point in time depending on the intensity of effort and the level and growth of exploitable biomass in each area (Table 326).

The gross profits per days-at-sea is equal to gross revenues minus the operating costs per DAS. For analytical purposes only, Table 326 shows the gross and revenues per DAS in each area for a 10 days-at-sea trip assuming that there will be no trip limits. The results how that an average vessel would earn $50,942 in gross profits, but close to double by fishing in the Hudson Canyon, and more than double of this amount by fishing in the NLSA/Closed area 1 from a 10 days-at-sea trip. However, without a possession limit or area-specific DAS allocations, the fishing effort in the controlled access areas will exceed the target fishing mortality levels. There would be also a derby style fishing increasing the costs for most vessels. For these reasons, the gross profits computed in Table 326 are mainly used to estimate the equivalent trip limits. Equivalent trip limits are defined here as the amount of pounds that could be landed from the controlled access areas that will provide approximately the same level of gross profits that could be derived by fishing 10 days-at-sea in the open areas.

Table 326. Comparative revenues and costs from fishing in the open versus controlled access area from a 10-day trip and with no possession limits – MA default rotational management combined with area access alternative 1 and no habitat closures.

	2004			2005		
	Open Areas	**Hudson Canyon**	**NLSA/ Closed Area 1**	**Open Areas**	**Hudson Canyon**	**Closed Area II**
Landings, million pounds	3.97	24.16	6.86	4.71	19.66	21.34
Ex-vessel price per pound	4.14	4.16	4.19	3.54	3.55	3.57
Average meat count	20.20	16.30	11.90	19.00	16.60	12.4
LPUE (pounds per DAS)	1,479.00	2,412.00	2,908.00	1,578.00	2,344.00	2,926
Catch in 10 days-fished	14,790.00	24,120.00	29,080.00	15,780.00	23,440.00	29,260.00
Gross revenues per DAS	6,123.06	10,033.92	12,184.52	5,586.12	8,321.20	10,445.82
Total gross trip revenues in 10 DAS	61,230.60	100,339.20	121,845.20	55,861.20	83,212.00	104,458.20
Operational Costs per DAS	1,028.85	1,028.85	1,028.85	1,054.21	1,054.21	1,054.21
Gross profits per DAS	5,094.21	9,005.07	11,155.67	4,531.91	7,266.99	9,391.61
Total net trip revenues in 10 DAS	50,942.12	90,050.72	111,556.72	45,319.12	72,669.90	93,916.12

The trip limits for the controlled access areas should be set at levels that would provide incentives for the vessels to fish in these areas. This level should be no less than the value that will generate the same level of gross profits from trips taken to the open areas. These equivalent trip limits are calculated by assuming that the mid-year LPUE estimates will prevail throughout the year in the open and the closed areas. It is also assumed that 10 days will be deducted from the DAS allocations of vessels (from days that could be used to fish elsewhere) for each trip they take to the controlled access areas.

According to the results of the analysis, with the rotational management, the trip limits in the controlled access areas should be set higher than 13,650 pounds for Hudson Canyon and higher than 13,300 pounds for the Georges Bank controlled access areas in 2004 in order to attract effort from the open areas to the Georges Bank closed areas (under area access option 1 with no habitat closures). At these trip limits, the gross profits that could be earned from the controlled access will be approximately equal to the gross profits per trip ($50492 in 2004 and $45,319 in 2005) from the open areas for a 10-DAS trip. The fishermen may benefit from fishing in the controlled access areas even at the equivalent trip limits. Although the vessels are required to trade-off 10 DAS from their allocations for the trips they take to the controlled access areas, most vessels will earn the same level of revenues in a shorter time period (at less than 10 DAS) in the controlled access areas because of the higher LPUEs in these areas. The trip limits should be set at little higher in 2005, that is, higher than 14,617 pounds for Hudson Canyon and higher than 14,119 pounds for the Georges Bank controlled areas in order to provide some economic incentive to vessels to fish in the controlled access areas.

Table 327. Equivalent trip limits and gross and gross profits per day-at-sea for a 21,000 lb. trip limit.

	2004			2005		
	Open Areas	**Hudson Canyon**	**NLSA/ Closed Area 1**	**Open Areas**	**Hudson Canyon**	**Closed Area II**
DAS-fished required to land pounds equivalent to what is landed in open areas in 10 days-at-sea, ie.,14,790 lbs	10.00	6.13	5.09	10.00	6.73	5.39
Equivalent possession limit	14,790.00	13,644.80	13,279.32	15,780.00	14,617.88	14,119.38
Calculation of gross profits per DAS with a 21,000 lb trip limit						
Gross per DAS-allocation if trip limit is set at 21,000 lbs	6,123.06	8,736.00	8,799.00	7,434.00	7,497.00	7,497.00
DAS-fished required to land 21,000 lbs	14.20	8.71	7.22	13.31	8.96	7.18
Operational Costs per DAS-allocation if trip limit is set at 21,000	1028.85	895.76	742.98	1054.21	944.47	756.61
Gross profits per DAS-allocation if trip limit is set at 21,000 lbs	5094.21	7840.24	8056.02	6379.79	6552.53	6740.39

Impacts of 21,000 lb trip limit

Table 327 also calculates the gross and gross profits per day-at-sea from the open and the controlled access areas if the trip limits were kept at 21,000 pounds and a 10 days-at-sea allocation trade-off was applied for trips taken to the later areas. The gross revenues per day-at-sea for an average vessel fishing in the controlled areas are expected to exceed the gross revenues per day-at-sea from the open areas in 2004 and 2005. This is due to the lower LPUEs in the open areas compared to the levels in controlled access areas. Also the trip expenses per pound of scallops landed will be lower in the controlled access areas because of higher LPUEs in these areas. This is because an average vessel can land the same amount of scallops that it could land in the open areas in less days-at-sea by fishing in the closed areas. For example, it is estimated that it would take 8.7 days-at-sea for an average vessel to land 21,000 pounds in the Hudson Canyon, and 7.2 days-at-sea in the Georges Bank areas, whereas it would take 14.2 days-at-sea to land the same pounds in the open areas. As a result, trip expenses will be lower and the revenues net of trip expenses will be higher for these areas.

The results indicate that, at this trip limit (i.e., at 21,000 lb), the gross profits per DAS from a trip taken to the Hudson Canyon will generate $7,840 in revenues in 2004 net of operational expenses such as food, fuel, ice, water and some repair expenses. At the same trip limit, gross profits per DAS from a trip taken to the Georges Bank controlled access areas would be $8,056, exceeding greatly the gross profits per DAS in the open areas, which is estimated to be $5,094 per day-at-sea in 2004. As a result, the vessels would increase their profits significantly if they fished in the controlled access areas of Hudson Canyon and the Georges Bank at the given possession limits and 10 DAS trade-off.

Impacts of trip limits on vessels with different productivity

The trip limits may also have a differential impact on vessels with different productivity indicated by their LPUEs. Higher productivity vessels will be constrained more by the trip limits compared to the vessels that have a lower LPUE rate, and the10-DAS trade-off for trips taken to the controlled access areas will impact the vessels with a larger capacity to fish per day more than the vessels with a lower capacity to fish. This is because they will be able land the possession limit in less than 10 DAS as discussed before. On the other hand, because the actual trip length will be less than 10 days for the high productivity vessels, their trip costs will be less compared to some smaller vessels that must fish 10 days or more to land the trip limit. In other words, higher productivity vessels may loose some allocated DAS from the trips they take to the regulated areas if the possession limits were set too low, but they would still gain if the reduction in their operating costs and the increase in their gross revenues from the closed area trips exceeds the lost revenues from the open area trips. Another alternative used by some vessels is to take fewer crew to the controlled access areas and use the full 10 DAS to catch the trip limit, which would increase the fuel costs but reduce the food costs, resulting in higher income per crew employed on that trip.

An example of these differential impacts is shown in Table 328. For example, if vessel A could land 3500 pounds per day-at-sea in the access areas, it would take only 6 days for that vessel to land a 21,000 pounds of possession limit. As a result, vessel A would loose 4 days of fishing opportunity in the open areas due to the 10-days-at-sea trade-off. It would still be economically beneficial for vessel A to access the controlled access areas, however, because its gross profits per DAS-allocated will be $15,054 from fishing in the controlled access areas, but will only be $4,840 in the open areas. As Table 328 shows, the annual gain in gross profits for vessel A will be over $156,500 if it fished in the controlled access areas at a 10 DAS-trade off, or a 26.9% increase compared to the gross profits by fishing in the open areas alone.

Table 328. Differential impacts of trip limits on high- and low-productivity vessels: An example. The scallop possession limit is assumed to be 21,000 lbs. and the number of allocated trips will be 4. Also, the analysis assumes a 120 annual day-at-sea allocation, in which the vessels uses all days to target sea scallops.

	High-productivity vessel (vessel A)		**Low-productivity vessel (vessel B)**	
	Open areas	**Controlled Access areas**	**Open areas**	**Controlled Access areas**
Ex-vessel price	$4.00	$4.50	$4.00	$4.50
Trip costs per day-used	$1160	$1160	$900	$900
Landings (lb.) per day-at-sea used	1500	3500	1250	1700
Days to land trip limit		6		12
Trip costs per allocated DAS	1160	696	900	900
Gross revenue per DAS	$6,000	$15,750	$5,000	$7,650
Net revenue per allocated DAS	$4,840	$15,054	$4,100	$6,750
Annual DAS used from allocation	80	40	71	49
Annual net revenue	$387,200	$350,160	$289,412	$333,529
Total net revenue from all areas	$737,360		$622,941	
Annual net revenue if only fished in open areas	$580,800		$492,000	
Net gain in annual gross profits from fishing in closed areas	$156,560		$130,941	
% increase in annual net revenue due to fishing closed areas	27.0%		26.6%	

For a vessel that has a LPUE lower than 2100 pounds per day-at-sea, it will take more than 10 days to land the trip limit of 21,000 pounds in the controlled access areas. For example, if vessel B could land at most 1,700 pounds per day, it will take more than 12 days-at-sea to land a possession limit of 21,000 pounds. Vessel B will still benefit economically, however, if it fished in the controlled access areas if its LPUE is higher in these areas compared to the open areas. As the example in Table 328 shows, the low-productivity vessel B would gain $4,100 per DAS in gross profits from trips taken to the open areas, but $6,750 from trips taken to the controlled access areas. The increase in its annual revenues would be $130,941, or a 26.6% increase compared to the level revenues if it fished only in the open areas. This increase is almost equal to the percentage increase for vessel A. Therefore, as this example shows, it is not clear if the imposed trip limits will have less advantageous impacts on higher productivity vessels compared to the smaller, less productive vessels, or vice versa.

There is an aspect of the trip limits however that will mainly affect the higher-productivity vessels. Although higher productivity vessels will gain from access to the controlled access areas at levels equal or higher than the equivalent trip limits, it is also true that the trip limit requires the more productive vessels to take more trips than their ability necessitates. Their trip costs are lower than their unconstrained counterparts but higher than necessary to harvest their effective allocation. This cost also increases with vessel productivity. An allocation of individual vessel quotas for the closed and the open areas would prevent unnecessary trip costs, but it would also increase enforcement costs significantly. At a result, Amendment 10 does not include a proposed option for individual vessel quotas, or a system of enforcement to determine, administer and enforce individual vessel landings.

The constraints on landings per trip and days-at-sea trade-offs are necessary, however, to allow access to the closed areas without reducing the overall days-at-sea allocations and/or number of closed area trips for all vessels. If the trip limits were set too high, for example, the overall landings from closed areas would increase, resulting in higher overall fishing mortality for the scallop resource. If there were no DAS-trade-offs, high productivity vessels (such as vessel A in the example given above) would not forego any days to fish in the open areas. Consequently, effort available to fish in the open areas would increase, again resulting in higher overall fishing mortality for the scallop resource. As explained in Section 8.2.1 increases in the overall fishing mortality would, in turn, necessitate further reductions in the allocation levels and/or number of trips for all vessels. For these reasons, it is important to establish a trip limit and days-at-sea trade-off combination in a way to ensure that the fishing mortality remains below target levels and overfishing of the resource is prevented.

Uncertainties

The results of this analysis should be interpreted by caution for the following reasons:

- The gross and net revenue estimates are sensitive to the various biological and economic factors, including LPUEs, the relative price of large versus small scallops, and the fuel prices that affect trip costs. Although the biological model estimates that LPUE in the Georges Bank closed areas will reach over 2900 pounds per day, some vessels may be unable to land this amount due to the constraints on their shucking capacity.

- The gross and net revenue estimates are sensitive to the various factors, including the price of large versus small scallops, and fuel prices. An increase in the relative price of large scallops and/or fuel prices will make restricted access areas economically more attractive relative to fishing in the open areas.

- Similarly, the fluctuations in the LPUEs in the open and the restricted areas during the course of the fishing year will affect the relative profitability of fishing in these areas. The analysis in

Section 8.2.1, was derived from the average LPUE in the middle of the fishing year, just one point in time. The LPUE in any given area is unlikely to stay constant, however, but will probably change over time according to the intensity of effort directed to that area and also according to the growth rate of the exploitable biomass in that area. Opportunities to fish elsewhere may also be restricted due to potential seasonal and/or long-term closures, affecting the LPUE in open areas. Therefore, at certain times of the year, fishing in the controlled access areas may become economically less profitable for some vessels depending on the changes in relative LPUEs, scallop and fuel prices at that point in time.

8.7.4.10 Qualitative discussion of the economic impacts of measures other than rotational management, habitat closures and area access and trip limits

Increasing the minimum ring size

Increasing the minimum ring size to 4-inches are expected to have positive economic impacts. Larger rings allow more small scallops to escape capture, reducing discard mortality and improving yield. Improved yield in the future years will increase the scallop revenues. In addition, gear efficiency for large scallops would increase reducing tow time to catch a possession limit or an amount that the crew can shuck. This in turn could result in lower operational expenses. Because the implementation of this measure would be delayed by up to a year, it will allow suppliers to draw down existing gear inventory and will allow fishermen time to use gear purchased before Amendment 10 is implemented. More discussion on the rationale and impacts of this measure is provided in Section 5.3.2.9.

Alternatives for Allocating Effort:

The proposed measures for allocating area-specific effort and catch controls include area-specific day-at-sea allocations or trip allocations with possession limits and day-at-sea tradeoffs. Limited access vessels would receive equal area-specific allocations, consistent with the effort limits for their full-time, part-time, or occasional permit. General category vessels are not allocated fishing effort, but would fish under a restrictive possession limit and an area specific TAC for recently re-opened rotation areas.

Amendment 10 also includes one-to-one trading as a mechanism to allow fishermen more flexibility and opportunity to better utilize their area-specific allocations. A procedure would allow vessels with limited access scallop permits to trade area-specific allocations with another limited access vessel. A vessel from Gloucester, MA, for example, might trade days or trips in the Mid-Atlantic for days or trips in a Georges Bank area that were originally allocated to a vessel from Hampton. These pros and cons of these measures are discussed in detail in Section 5.3.3, and the qualitative economic impacts are summarized below.

Individual day-at-sea allocations by management area

Instead of allocating total days-at-sea to limited access vessels to fish throughout all stock areas, some areas in a recently re-opened status would have day-at-sea designated for that use only. The vessels would also receive annual days-at-sea to fish in open scallop fishing areas.

Without a mechanism for trading the area-specific days-at-sea, however, the day-at-sea allocations by management area will reduce vessels' ability to decide where and how much to fish. For example, a vessel could be compelled to fish in areas other than the ones that it normally fishes, such as areas close to its homeport in order to make full use of it annual DAS allocation. Fishing in sub-optimal areas would, however, increase a vessel's operational costs, and reduce its profits. Some smaller vessels may even not be able to fish in some areas if the limits on their capacity prevents them taking the trip to these areas (such as distant offshore areas, for example).

On the other hand, for vessels that have no such capacity constraints and normally fish in the controlled access areas, the area-specific day-at-sea allocations would allow greater flexibility to determine how and when they will fish in that specific area. A trip limit allocation with days-at-sea trade-offs, however, would limit this flexibility because the vessels will not be able to fish in a controlled access area after the amount of the catch reaches the trip limit. A low trip limit will increase the operational costs of some vessels if it forces them to take more trips than necessary to land a specific amount of scallops. Because of these reasons, the operational costs of the vessels that regularly fish the controlled access areas may be lower with area-specific DAS allocations compared to a trip limit allocation. In addition, unlike the trip limit alternative, vessels that return to port early do not risk loosing extra days, despite their inability to land a possession limit on a trip.

Area-specific day-at-sea allocations are also easier to administer. They do not require managers to estimate a viable choice of possession limits and day-at-sea tradeoffs. If a possession limit were too low for the day-at-sea tradeoff, then fewer vessels would fish in a re-opened area. Conversely, if a possession limit is too high for the day-at-sea tradeoff, the area would be fished using fewer days off the clock and fishing mortality in the other open areas would be too high. On the other hand, in the absence of a mechanism for trading, the area-specific DAS allocations may result in lower overall landings and revenues if some vessels were not able to fully use their annual DAS allocations because of the limits on their capacity to fish in some specific areas.

Area-specific days-at-sea could also be monitored with existing VMS equipment, without tracking trips taken and monitoring compliance with a possession limit.

Area-specific trip allocations with possession limits and day-at-sea tradeoffs

According to this proposal, the trips into re-opened rotation management areas would have a possession limit and an automatic day-at-sea charge or 'tradeoff' for any declared trip to a re-opened area. Trip limit allocations combined with DAS-trade-off will allow greater flexibility to vessels about where to fish because they could choose to fish in the open areas only and not incur any DAS trade-offs. The economic impacts of the trip limits are discussed in more detail in Section 8.7.4.9 and in Section 5.3.3.2.

One-to-one exchanges of area-specific allocations

One-to-one exchanges would enable vessels with a limited access scallop permit and area-specific allocations to trade them with another limited access scallop vessel for allocations in preferred areas, thus allowing the vessel greater flexibility to choose where to fish. Trading of allocations could apply to area specific day-at-sea allocations or to area-specific trip allocations. Such flexibility would allow the fishermen to lower their operational costs and therefore increase their profits by fishing in areas that are closer to their homeport, that they are familiar with and have more fishing experience. In addition, this mechanism would help to prevent a reduction in landings, revenues and total economic benefits due to some vessels not being able to fish their total allocations because some areas they have allocations for are impracticable to fish either because of the capacity constraints or because of the economic reasons (such as high steaming costs). On the other hand, exchanges of area-specific allocations may have some transactions costs for vessel-owners and the crew. Further discussion of pros and cons of the trading is provided in Section 5.3.3.3.

General category permit for targeting scallops

The rationale, and pro and cons of these measures are discussed in Section 5.3.6. A new general category permit would be issued to vessels that intend to target sea scallops, with enhanced monitoring and reporting requirements. This permit would also enable the Council to allow vessels to access re-opened areas giving them the opportunity to increase their revenues. Vessels with a general category permit may not land more than the incidental permit scallop possession limit, however, unless the vessel operator participated in the general category call-in program to report his intent to fish for scallops.

One option that is not selected by the Council required all general category permits to carry VMS all the time. Another option required that only the vessels whose scallop fishing trips reported in the call-in program exceeded 45 days and vessels that fish in re-opened rotation management areas to continuously operate VMS equipment with the same polling frequency that applies to limited access vessels with VMS equipment. Although this requirement of operating VMS equipment will increase the costs for vessels that do not presently carry such equipment, under the second option, the revenues that are generated from 45 days of fishing will probably exceed these costs. **106** According to the recent estimates, a VMS unit sells approximately for $6,000, and monthly messaging costs average $125-$150.107 If the equipment cost were amortized over 4 years, the average costs per year including the monthly charges would be approximately $3,500. NMFS enforcement division in New Bedford is also in the process of testing a new VMS unit which may have reduced equipment costs.108

The proposed option would also prohibit vessels with limited access scallop permits from getting this new general category permit, because the narrower focus of this permit would allow higher days-at-sea allocations for limited access vessels than if the limited access vessels could fish in both permit categories. Such a measure may reduce the revenues of the scallop limited access vessels that were already landing scallops under a general category permit, but would increase the revenues of the other vessels that were landing scallops only when they are on a day-at-sea. These later group of vessels would gain if they receive an extra DAS allocation from a readjustment of total DAS for the limited access vessels. The economic impacts of this measure is examined in detail in Section 8.7.2.5.

Alternatives for Reducing Bycatch and Bycatch Mortality:

The proposed alternatives included area rotation and larger rings, both of which significantly contribute to reducing bycatch by increasing dredge efficiency. As discussed in Sections 5.3.5.1 and 5.3.5.2, by focusing fishing effort where catch rates are high and by improving the efficiency of catching large scallops, the area rotation and larger rings reduce the total area swept by commercial dredges and reduce the catch of small fish for some species, and also the catches invertebrates. The economic impacts of the area rotation and larger rings on the sea scallop fishery were analyzed in Sections 8.7.2.5 and 8.7.4. The pros and cons of the other measures proposed by the Council are discussed in detail in Sections 5.3.5.3 to 5.1.7. The proposed measures include prohibiting scallop vessels from landing finfish, and also area-specific possession limit for species that are vulnerable to capture by scallop gear, such as Southern New England yellowtail flounder, monkfish, and possibly winter flounder. Although these measures will

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106 In 45 days, a vessel landings 400 pounds of possession limit would make about $24,000 at a price of $4 per pound if the trip took 3 days, and more than this amount if the trip took less time. According to the preliminary estimates, annual cost of VMS was about 3,500 per year if these costs were amortized (or distributed over) 4 years.

107 Information is provided by Todd Dubois and Linda Galvin from NMFS Enforcement division in New Bedford.

108 Information is provided by Todd Dubois and Jim St.Cyr from NMFS Enforcement division in New Bedford.

reduce the revenues from bycatch for the scallop vessels, they will prevent the implementation of more stringent measures, such as closures of a rotation management area when the total catch (retained and discarded) meets the TAC for any such bycatch species.

8.7.4.11 Enforcement costs

The cost-benefit analysis does not include quantitative estimates for costs to administer, monitor and enforce DAS. The basis for this assumption is that the costs associated with setting up a monitoring and enforcement system for DAS have already been covered under the mandates of Amendment 4 and Amendment 7 to the sea scallop plan.

A qualitative analysis of the enforcement concerns, cost and benefits of the proposed options is provided in Section 8.9. These include a comprehensive discussion of the pros and cons of the area rotation alternatives, alternatives for allocating effort, reducing bycatch and bycatch mortality, and alternatives for general category and incidental catch permits from an enforcement perspective. Appendix IV and 8.9.5 also provide a description of the alternatives for improving data collection and monitoring, and discuss the implications of these in terms of the enforcement costs and benefits. These alternatives include observer coverage, bag tags and standard bags requirements, and requirement of all limited access vessels to operate a vessel monitoring system (VMS).

Despite the fact that rotational management, proposed area access programs and closures of other areas may increase the enforcement requirements and administrative burden, the monetary costs for the government may not appreciably change as long as the budgetary allocations for enforcement do not allow such an increase. Allocation of the existing resources to improve enforcement of new scallop regulations, however, would result in reduced enforcement of other management actions. In other words, the enforcement of the rotational management, area access and closures may reduce the overall efficiency of enforcement for fishery regulations in general if it requires a re-allocation of these resources. On the other hand, the proposed alternatives for improving data collection and monitoring, such as observer coverage, bag tags and standard bags requirements, and a requirement of limited access and general category vessels to operate a vessel monitoring system are expected to increase the enforcement efficiency, offsetting these costs.

8.7.4.12 Detailed Tables – Impacts of the Area Access, Rotation and Habitat Alternatives

Table 329. Projected annual average landings (million lbs.; average of 2004-2007).

Alternatives	Area Access Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Habitat closures with MA default rotation				
Alternative 1: SQ, No Access (9 similar)	26	26	26	26
GF Mortality closed area alt.1	33	34	34	34
Alternative 3a (3b and 4 similar)	41	43	44	47
Alternative 5a (5c, 5d and 8a similar)	42	43	46	54
Alternative 5b	39	40	43	51
Alternative 6	40	41	44	44
Alternative 7	34	34	36	41
Alternative 8b	42	43	46	52
No Habitat Closures				
MA default rotation	43	44	47	55
No Rotation, F=0.2	46	47	50	58

Table 330. Total cumulative discounted value of producer surplus with no additional habitat closures and no access to groundfish areas ($ million in 1996 constant prices).

Scenarios	Total of 2004-2007
2002 DAS use	446
30/25/3 rotation policy	404
MA default rotation	407
No Action	365
Status quo: No Rotation, F=0.2	432

Table 331. Total cumulative discounted value of producer surplus (total of 2004 to 2007; $ million in 1996 constant prices)

Alternatives	Area Access Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Habitat closures with MA default rotation				
Alternative 1: SQ, No Access (9 similar)	407	407	407	407
GF Mortality closed area alt.1	457	467	467	467
Alternative 3a (3b and 4 similar)	494	508	512	520
Alternative 5a (5c, 5d and 8a similar)	504	510	520	532
Alternative 5b	493	498	510	528
Alternative 6	497	502	513	513
Alternative 7	463	471	481	502
Alternative 8b	503	509	519	530
No Habitat Closures				
MA default rotation	505	511	520	532
No Rotation, F=0.2	513	516	522	528

Table 332. Total cumulative discounted value of consumer surplus with no additional habitat closures and no access to groundfish areas ($ million in 1996 constant prices).

Scenarios	Total of 2004-2007	% Increase from no action
2002 DAS use	264	224%
30/25/3 rotation policy	113	39%
MA default rotation	115	42%
No Action	81	0%
Status quo: No Rotation, F=0.2	145	78%

Table 333. Total cumulative discounted value of consumer surplus (total of 2004 to 2007, ($ million in 1996 constant prices).

Alternatives	Area Access Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Habitat closures with MA default rotation				
Alternative 1: SQ, No Access (9 similar)	115	115	115	115
GF Mortality closed area alt.1	169	181	181	181
Alternative 3a (3b and 4 similar)	242	262	273	306
Alternative 5a (5c, 5d and 8a similar)	258	268	301	393
Alternative 5b	226	237	267	356
Alternative 6	239	249	282	282
Alternative 7	174	185	201	245
Alternative 8b	255	265	298	366
No Habitat Closures				
MA default rotation	262	272	306	398
No Rotation, F=0.2	300	312	347	442

Table 334. Cumulative discounted value of the total benefits with no additional habitat closures and no access to groundfish areas. ($ million in 1996 constant prices).

Scenarios	Total of 2004-2007
2002 DAS use	710
30/25/3 rotation policy	518
MA default rotation	522
No Action	446
Status quo: No Rotation, F=0.2	577

Table 335. Cumulative discounted value of the total benefits ($ million in 1996 constant prices).

Alternatives	Area Access Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Habitat closures with MA default rotation				
Alternative 1: SQ, No Access (9 similar)	522	522	522	522
GF Mortality closed area alt.1	626	649	649	649
Alternative 3a (3b and 4 similar)	735	771	785	826
Alternative 5a (5c, 5d and 8a similar)	763	778	821	925
Alternative 5b	719	735	777	884
Alternative 6	736	751	794	794
Alternative 7	637	657	683	747
Alternative 8b	758	774	817	896
No Habitat Closures				
MA default rotation	768	783	826	929
No Rotation, F=0.2	814	828	869	969

Table 336. Total fleet DAS-used with no additional habitat closures and no access to groundfish area.

Scenarios	Total of 2004-2007	% Increase relative to no action
2002 DAS use	29564	212%
30/25/3 rotation policy	11726	24%
MA default rotation	12138	28%
No Action	9473	0%
Status quo: No Rotation, F=0.2	13829	46%

Table 337. Total fleet DAS-used with area access Alternatives

Alternatives	Area Access Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Habitat closures with MA default rotation				
Alternative 1: SQ, No Access (9 similar)	12138	12138	12138	12138
GF Mortality closed area alt.1	14278	14746	14746	14746
Alternative 3a (3b and 4 similar)	16835	17576	17932	19108
Alternative 5a (5c, 5d and 8a similar)	17507	17852	18932	22018
Alternative 5b	15989	16367	17385	20471
Alternative 6	16624	16970	18050	18050
Alternative 7	13914	14341	14927	16667
Alternative 8b	17359	17705	18785	21003
No Habitat Closures				
MA default rotation	17710	18055	19135	22221
No Rotation, F=0.2	19401	19747	20827	23913

Table 338. Estimated ex-vessel prices with no additional habitat closures and no access to groundfish areas

Scenarios	Average of 2004-2007
2002 DAS use	3.75
30/25/3 rotation policy	4.73
MA default rotation	4.71
No Action	5.05
Status quo: No Rotation, F=0.2	4.49

Table 339. Annual average ex-vessel prices for period 2004-2007 with area access alternatives

Alternatives	Area Access Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Habitat closures with MA default rotation				
Alternative 1: SQ, No Access (9 similar)	4.71	4.71	4.71	4.71
GF Mortality closed area alt.1	4.29	4.21	4.21	4.21
Alternative 3a (3b and 4 similar)	3.85	3.73	3.68	3.52
Alternative 5a (5c, 5d and 8a similar)	3.75	3.70	3.54	3.14
Alternative 5b	3.94	3.89	3.73	3.31
Alternative 6	3.87	3.83	3.66	3.66
Alternative 7	4.27	4.21	4.10	3.85
Alternative 8b	3.76	3.72	3.55	3.25
No Habitat Closures				
MA default rotation	3.72	3.68	3.52	3.13
No Rotation, F=0.2	3.55	3.51	3.36	2.99

Table 340. Average annual fleet revenue with no additional habitat closures and no access to groundfish areas

Scenarios	Average of 2004-2007 $ million, 96 prices	% Increase from no action
2002 DAS use	155	41%
30/25/3 rotation policy	124	12%
MA default rotation	125	13%
No Action	110	0%
Status quo: No Rotation, F=0.2	133	21%

Table 341. Annual average fleet revenue for period 2004-2007 with area access alternatives ($ million, in 1996 constant prices)

Alternatives	Area Access Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Habitat closures with MA default rotation				
Alternative 1: SQ, No Access (9 similar)	125	125	125	125
GF Mortality closed area alt.1	141	144	144	144
Alternative 3a (3b and 4 similar)	154	159	160	164
Alternative 5a (5c, 5d and 8a similar)	158	159	163	170
Alternative 5b	153	154	158	167
Alternative 6	155	156	160	160
Alternative 7	142	144	148	155
Alternative 8b	157	159	163	169
No Habitat Closures				
MA default rotation	158	160	164	171
No Rotation, F=0.2	162	163	166	172

Table 342. Average LPUE for 2004-2007 with no additional habitat closures and no access to groundfish Areas

Scenarios	Average of 2004-2007
2002 DAS use	1419
30/25/3 rotation policy	2236
MA default rotation	2178
No Action	2306
Status quo: No Rotation, F=0.2	2149

Table 343. Annual average LPUE for period 2004-2007 with area access alternatives

Alternatives	Area Access Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Habitat closures with MA default rotation				
Alternative 1: SQ, No Access (9 similar)	2178	2178	2178	2178
GF Mortality closed area alt.1	2312	2323	2323	2323
Alternative 3a (3b and 4 similar)	2409	2421	2430	2441
Alternative 5a (5c, 5d and 8a similar)	2421	2416	2442	2466
Alternative 5b	2442	2436	2462	2484
Alternative 6	2424	2417	2445	2445
Alternative 7	2408	2408	2426	2439
Alternative 8b	2422	2417	2443	2474
No Habitat Closures				
MA default rotation	2414	2410	2436	2460
No Rotation, F=0.2	2374	2370	2396	2423

Table 344. Impacts on employment as measured by Crew*DAS with no additional habitat closures and no access to groundfish Areas

Scenarios	Total of 2004-2007	% Increase from no action
2002 DAS use	794679	212%
30/25/3 rotation policy	315205	24%
MA default rotation	326260	28%
No Action	254647	0%
Status quo: No Rotation, F=0.2	371727	46%

Table 345. Impacts on employment as measured by Crew*DAS, percentage increase relative to no action values for period 2004-2007 with area access alternatives

Alternatives	Area Access Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Habitat closures with MA default rotation				
Alternative 1: SQ, No Access (9 similar)	28%	28%	28%	28%
GF Mortality closed area alt.1	51%	56%	56%	56%
Alternative 3a (3b and 4 similar)	78%	86%	89%	102%
Alternative 5a (5c, 5d and 8a similar)	85%	88%	100%	132%
Alternative 5b	69%	73%	84%	116%
Alternative 6	75%	79%	91%	91%
Alternative 7	47%	51%	58%	76%
Alternative 8b	83%	87%	98%	122%
No Habitat Closures				
MA default rotation	87%	91%	102%	135%
No Rotation, F=0.2	105%	108%	120%	152%

Table 346. Average DAS-used per vessel for period 2004 - 2007 with no area access and no habitat closures

Scenarios	Average of 2004-2007
2002 DAS use	112
30/25/3 rotation policy	44
MA default rotation	46
No Action	36
Status quo: No Rotation, F=0.2	52

Table 347. Average DAS-used per vessel for period 2004 - 2007 with area access and habitat alternatives

Alternatives	Area Access Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Habitat closures with MA default rotation				
Alternative 1: SQ, No Access (9 similar)	46	46	46	46
GF Mortality closed area alt.1	54	56	56	56
Alternative 3a (3b and 4 similar)	64	66	68	72
Alternative 5a (5c, 5d and 8a similar)	66	68	72	83
Alternative 5b	60	62	66	77
Alternative 6	63	64	68	68
Alternative 7	53	54	56	63
Alternative 8b	66	67	71	79
No Habitat Closures				
MA default rotation	67	68	72	84
No Rotation, F=0.2	73	75	79	90

Table 348. Annual average revenues per vessel for period 2004-2007 with area access and habitat alternatives

Alternatives	Area Access Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Habitat closures with MA default rotation				
Alternative 1: SQ, No Access (9 similar)	471,031	471,031	471,031	471,031
GF Mortality closed area alt.1	533,887	544,999	544,999	544,999
Alternative 3a (3b and 4 similar)	583,959	599,843	605,163	619,287
Alternative 5a (5c, 5d and 8a similar)	597,016	602,953	617,688	644,474
Alternative 5b	577,585	583,099	599,618	633,220
Alternative 6	585,227	589,268	605,652	605,652
Alternative 7	537,497	546,118	558,855	587,963
Alternative 8b	595,346	601,116	616,129	638,155
No Habitat Closures				
MA default rotation	599,075	604,862	619,274	645,347
No Rotation, F=0.2	613,855	616,991	628,641	649,062

Table 349. Annual average gross profits per vessel for period 2004-2007 with area access and habitat alternatives109

Alternatives	Area Access Alternatives			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Habitat closures with MA default rotation				
Alternative 1: SQ, No Access (9 similar)	32,003	32,003	32,003	32,003
GF Mortality closed area alt.1	54,807	58,724	58,724	58,724
Alternative 3a (3b and 4 similar)	71,542	77,017	78,654	82,640
Alternative 5a (5c, 5d and 8a similar)	75,932	77,886	82,257	88,319
Alternative 5b	70,144	71,869	77,120	86,137
Alternative 6	72,374	73,523	78,600	78,600
Alternative 7	56,635	59,595	63,986	73,427
Alternative 8b	75,468	77,351	81,842	87,365
No Habitat Closures				
MA default rotation	76,480	78,368	82,599	88,347
No Rotation, F=0.2	79,972	80,709	83,745	87,010

109 Gross profits=Gross revenues – Operational expenses – Crew income – Fixed Costs

8.8 Social Impact Assessment (J. Olsen)

8.8.1 Introduction

The mandate to consider the social impacts from proposed federal fishery regulations stems from the National Environmental Policy Act (NEPA) and the Sustainable Fisheries Act (SFA). NEPA requires that any regulation that will have impacts on the environment must also consider the economic and social impacts of such actions. National Standard 8 of the SFA requires that "Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities" (16 U.S.C.§ 1851(2)(8)). The act further defines a fishing community as one that is "substantially dependent or substantially engaged in the harvesting or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew and United States fish processors that are based in such community" (16 U.S.C.§ 1802 (16)). The following analyses (as well as the section addressing National Standard 8) attempt to gauge the possible social impacts from the proposed measures, and their implications for fishermen, fishing families, businesses, and fishing communities.

Impacts of some alternatives are difficult to assess or occur through the application of other management measures. Alternatives of this type include the choice of overfishing definition (Section 3.4), data collection alternatives (Section 5.3.7), alternatives to promote scallop-related research (Section 5.3.8), and methods to adjust management measures (Section 5.3.9). Discussion of the social implications of these alternatives is therefore not discussed separately below.

8.8.2 Alternatives For Improving Yield (Section 5.3.2)

The various alternatives for area management and rotational closures (Sections 5.1.3.1 to 5.3.2.7) promise improved yields that could contribute to the sustainability of fishermen and fishing families, fishing operations, and fishing communities. The question for the social impact analysis is to what extent the costs and benefits associated with the regulations may be borne disproportionately, and what precisely those social costs and benefits may be. The impacts from the proposed area regulations, however, will depend on which areas are closed, because scalloping takes place in different places by different fishermen, for a variety of reasons other than simply the area's biological productivity (Section 7.1.1.4).

The use of spatially based measures has been noted in the anthropological literature as a means of effort control that is widespread in many communities around the world, and often the most acceptable form of management to fishermen (McGoodwin 1990, Acheson and Wilson 1996). However, the acceptability of closed areas depends not only on how effective they are in achieving biological goals, but also in terms of the allocation effects of closures: such as whether those who bear the costs of management are the same as those who reap the benefits. In terms of the alternatives in Sections 5.1.3.1 to 5.3.2.7, the benefits from any expected increase in productivity would accrue mainly to fishermen who practice a mobile fishing strategy. The costs, however, may be borne more heavily by smaller vessels or others who cannot switch areas as easily, and general category vessels (often the small vessels) who may be closed out of areas but not allowed back in, depending on the allocation schemes. And whether or not vessels are capable of intensifying or switching to mobile fishing, the issue is that institutionally favoring such practices can have significant social costs: including disruptions to family and community life with related social problems, as well as increased risk to safety at sea. The following tables (Table 350 to Table 352) show how fishing activity in the rotational areas with fixed boundaries (Sections 5.3.2.2 to

5.3.2.4) varies by port of landing, homeport, and vessel size over the five-year period 1997-2001. This should be considered the minimum activity in these areas, since only logbook data with valid locations were included. Coupled with the biological short-term projections for biomass, growth, and closure likelihood (Table 353)—and the more basic sociocultural premise that the scallop fleet is not homogeneous—closures from the rotational areas may affect particular ports and segments of the fleet more than they affect others. For example, MA4 has a 97% chance of closure in the first year of rotational management (Table 353). Such a closure would affect over 10% of the landings from Wildwood, Cape May, Chincoteague, Seaford, Hampton, Newport News and Wanchese as landing ports (Table 350); for most of these ports, scallops constituted a significant proportion of their total landed value in 2000 and/or 2001 (see Section 7.1.1). A closure of MA4 would also affect over 10% of the landings from Wildwood, Richmond, Poquoson, Newport News, Norfolk, Swanquarter, Lowland, Aurora, Bayboro, New Bern, Oriental, and Atlantic as homeports (Table 351); for most of these ports, scallops constituted a significant proportion of their total landed value in 2000 and/or 2001 (see Section 7.1.1). Additionally, there are a number of areas—some occurring in state waters—of importance to small-scale fishermen, primarily around Downeast Maine and Cape Cod Bay (**Figure 150**), which are not covered by the research vessel survey and thus not included in the rotational areas that depend on the survey instrument (Sections 5.3.2.2 to 5.3.2.4). Indeed as Table 352 shows, only 13 percent of the fishing activity of small scallop vessel is included in the rotational areas. In a management system in which some but not all fishing areas are subject to closure and regulated fishing, the open areas could be subject to over exploitation from new effort, with negative consequences for the fishermen who customarily fish there.

Table 350. **Fishing activity in the draft rotational areas by port of landing for calendar years 1997-2001.**

Port Landed	Five yr port total, all areas	No. vessels, all areas	MA1 %	MA2 %	MA3 %	MA4 %	MA5 %	MA6 %	MA7 %	MA8 %	MA9 %	GB1 %	GB2 %	GB3 %	GB4 %	GB5 %	GB6 %	GB7 %	GB8 %	Other %	Total %
Provincetown MA	709,793	58	0	0	0	*	0	0	0	0	0	17	3	*	*	0	*	2	0	76	100
Barnstable MA	768,836	21	0	0	0	0	0	0	0	0	*	5	21	0	0	0	0	*	0	73	100
New Bedford MA	59,451,593	327	0	*	0	0	1	1	6	6	2	1	6	4	5	4	1	3	2	59	100
Fairhaven MA	1,588,212	21	0	0	0	0	*	5	9	11	6	0	1	0	4	7	*	*	*	53	100
Newport RI	426,537	33	0	0	*	*	*	*	6	24	1	0	0	0	0	3	*	*	0	60	100
Point Judith RI	372,185	35	0	0	0	0	*	0	10	14	10	0	0	0	*	0	0	0	0	58	100
Stonington CT	3,272,870	23	*	0	0	*	2	3	12	28	10	0	0	0	1	2	*	*	*	37	100
New London CT	490,379	4	0	0	0	0	0	0	*	**	**	0	0	0	0	*	0	0	0	66	100
Shinnecock NY	205,218	30	0	0	0	0	0	0	*	12	50	0	0	0	0	0	0	0	0	38	100
Point Pleasant NJ	2,602,749	66	0	0	0	1	5	9	34	11	1	0	0	0	0	*	0	0	0	39	100
Barnegat NJ	497,783	19	0	0	0	0	0	12	19	2	0	0	0	0	0	0	0	0	0	67	100
Long Beach NJ	3,859,842	25	0	*	*	*	3	16	20	12	2	0	0	0	*	0	*	0	0	45	100
Wildwood NJ	214,499	4	0	0	0	**	30	0	0	0	0	0	0	0	0	0	0	0	0	55	100
Cape May NJ	12,044,832	161	0	0	1	12	17	11	6	3	0	0	0	0	*	0	0	0	0	48	100
Chincoteague VA	286,525	17	0	*	3	16	***	0	0	0	0	0	0	0	0	0	0	0	0	41	100
Seaford VA	7,852,843	21	1	3	10	14	7	3	5	4	0	0	0	0	0	0	0	0	0	53	100
Hampton VA	6,881,010	55	2	6	9	11	4	4	6	2	0	0	0	0	*	*	*	*	0	55	100
Newport News VA	18,878,029	78	4	7	13	17	11	4	3	1	0	0	0	0	*	*	0	0	0	40	100
Wanchese NC	452,363	24	*	*	3	17	28	10	0	0	*	0	0	0	0	0	0	0	0	36	100

Note: only includes those with at least 200,000 lbs scallops landed in the five year period, and with greater than 20% of these landings coming from the total set of rotational areas. Cannot report full information when less than 3 entities involved: * refers to less than or equal to 10% of landings; ** refers to less than or equal to 20%; and *** refers to less than or equal to 40%. Source: logbooks.

Table 351. **Fishing activity in the draft rotational areas by homeport for calendar years 1997-2001.**

Home Port	Five yr port total, all areas	No. vessels, all areas	MA1 %	MA2 %	MA3 %	MA4 %	MA5 %	MA6 %	MA7 %	MA8 %	MA9 %	GB1 %	GB2 %	GB3 %	GB4 %	GB5 %	GB6 %	GB7 %	GB8 %	Other %	Total %
Rockland ME	205,338	3	0	0	0	0	0	0	0	0	*	0	****	**	***	0	0	*	*	5	100
Owls Head ME	234,787	6	0	0	0	*	*	0	*	0	0	*	**	0	0	0	0	0	0	80	100
Bedford MA	^^	cr	0	0	0	0	0	0	*	0	0	*	**	**	*	0	0	*	0	51	100
Boston MA	456,651	11	0	0	0	0	0	0	10	*	*	0	9	0	0	*	0	0	*	68	100

Home Port	Five yr port total, all areas	No. vessels, all areas	MA1 %	MA2 %	MA3 %	MA4 %	MA5 %	MA6 %	MA7 %	MA8 %	MA9 %	GB1 %	GB2 %	GB3 %	GB4 %	GB5 %	GB6 %	GB7 %	GB8 %	Other %	Total %
Truro/N.Truro MA	^	cr	0	0	0	0	0	0	0	0	0	*	*	*	*	0	0	*	0	73	100
Wellfleet MA	565,128	5	0	0	*	0	*	0	0	0	0	3	**	0	0	0	0	0	0	73	100
Hyannis MA	507,603	5	0	0	0	0	0	0	*	0	*	2	18	0	0	0	0	*	0	77	100
Mattapoisett MA	^	cr	0	0	0	0	0	0	0	0	0	0	0	***	***	*	0	**	*	14	100
Fairhaven MA	6,425,944	31	*	0	*	*	*	1	3	4	1	1	3	1	4	4	1	3	2	71	100
New Bedford MA	44,923,223	175	*	*	0	1	1	1	7	6	3	1	6	4	5	4	1	3	2	56	100
N. Dartmouth MA	^	cr	0	0	0	0	0	0	0	0	0	0	0	0	*	*	0	**	*	75	100
Davisville RI	868,991	3	0	0	0	0	*	0	8	*	6	0	*	*	*	*	0	*	21	51	100
Point Judith RI	677,330	27	0	0	0	0	*	*	10	19	7	0	*	0	3	*	0	0	*	48	100
Stonington CT	3,123,080	13	*	0	*	*	2	2	13	28	10	0	0	0	1	2	*	*	2	37	100
New London CT	^^	cr	0	0	0	0	0	0	*	**	*	0	0	0	0	*	0	0	*	67	100
Point Pleasant NJ[n]	1,896,436	10	0	0	0	*	6	9	36	11	*	0	0	0	0	0	0	*	*	35	100
Barnegat Light NJ	4,541,013	22	0	*	*	0	3	16	19	11	2	0	0	0	*	0	*	0	0	48	100
Wildwood NJ	537,105	6	0	0	0	26	17	*	*	*	0	0	0	0	0	0	0	0	*	52	100
Cape May NJ	12,750,373	49	1	1	3	7	13	10	7	4	1	*	*	*	0	1	*	*	1	51	100
Richmond VA	^	cr	0	*	***	***	*	*	*	*	0	0	0	0	0	0	0	0	0	34	100
Poquoson VA	^	cr	0	*	***	**	**	0	*	0	0	0	0	0	0	0	0	0	0	37	100
Hampton VA	4,001,512	11	1	4	2	7	1	5	10	6	1	0	4	0	1	1	1	0	0	57	100
Newport News VA	8,879,183	23	2	5	7	15	8	4	5	1	1	*	*	0	*	*	*	0	0	52	100
Carrollton VA	^^	cr	*	*	**	*	**	*	0	0	0	0	0	0	*	*	0	0	0	47	100
Virginia Beach VA	^	cr	0	0	****	*	*	*	0	0	0	0	0	0	0	0	0	0	0	45	100
Norfolk VA	14,618,134	49	2	4	11	14	7	4	5	4	1	*	1	*	*	0	*	0	*	48	100
Wanchese NC	1,131,942	12	*	0	*	*	*	*	*	0	0	0	0	*	*	0	0	*	*	80	100
Swanquarter NC	655,045	4	0	*	8	**	***	*	0	*	0	0	0	0	0	0	0	0	0	42	100
Lowland NC	1,034,899	6	*	*	13	20	12	2	*	*	0	0	0	0	0	0	0	0	0	44	100
Aurora NC	641,395	3	*	*	*	***	*	**	**	*	0	0	0	0	0	0	0	0	0	28	100
Bayboro NC	364,161	7	0	*	*	47	**	*	*	0	0	0	0	0	0	0	0	0	0	32	100
New Bern NC	2,148,310	8	2	5	7	21	11	8	2	2	*	0	0	0	0	0	0	0	0	42	100
Oriental NC	1,223,060	6	*	3	14	18	13	9	8	*	0	0	0	0	0	*	*	0	0	32	100
Atlantic NC	1,442,373	4	*	4	8	20	21	2	*	3	1	0	0	0	0	0	0	0	0	40	100
Jacksonville FL	^	cr	0	*	*	*	***	*	*	*	0	0	0	0	0	*	0	0	0	55	100
Cape Canaveral FL	^^	cr	*	*	*	*	*	*	*	*	0	*	*	0	*	0	0	0	0	72	100
Miami FL	^	cr	**	*	****	*	**	*	*	*	0	0	0	0	0	0	0	0	0	7	100

Note: only includes those with at least 200,000 lbs scallops landed in the five year period, and with greater than 20% of these landings from the total set of rotational areas. Point Pleasant NJ includes Point Pleasant Beach. Cannot report full information when less than 3 entities involved: * refers to less than or equal to 10% of landings; ** refers to less than or equal to 20%; and *** refers to less than or equal to 40%; **** refers to less than or equal to 65%. ^ = less than or equal to 500,000 lbs; ^^ refers to less than or equal to 1,100,000 lbs. Source: logbooks.

Table 352. **Fishing activity in the draft rotational areas by vessel size class for calendar years 1997-2001.**

Vessel Size	Five yr total, all areas	No. vessels, all areas	MA1 %	MA2 %	MA3 %	MA4 %	MA5 %	MA6 %	MA7 %	MA8 %	MA9 %	GB1 %	GB2 %	GB3 %	GB4 %	GB5 %	GB6 %	GB7 %	GB8 %	Other %	Total %
Large	111,987,799	348	1	2	3	6	5	3	6	5	2	0	3	2	3	2	1	2	1	53	100
Medium	11,159,329	204	0	2	3	5	4	6	8	5	1	1	3	1	*	0	0	1	0	58	100
Small	3,235,645	291	0	*	0	*	*	1	1	1	2	3	6	0	*	0	0	0	0	87	100

Note: Large are vessels greater than 70 ft in length, medium are between 50 and 70 ft, and small are less than 50 ft. Source: logbooks.

Table 353. **Predicted Catch Distribution and Closures for Draft Rotational Areas, 2002-2007.**

	Annual average, 1997-2001*		7/2001-6/2002		7/2002-6/2003		7/2003-6/2004			7/2004-6/2005			7/2005-6/2006			7/2006-6/2007		
Region	Catch MT	%	CatchMT Mean	%	CatchMT Mean	%	CatchMT Mean	%	PctCl Mean	CatchMT Mean	%	PctCl Mean	CatchMT Mean	%	PctCl Mean	CatchMT Mean	%	PctCl Mean
MA1	155.9	1.7	40.4	0.2	57.4	0.3	19.2	0.2	85.0	15.6	0.1	85.0	18.8	0.2	87.0	326.2	2.0	14.0
MA2	312.6	3.4	259.8	1.3	289.9	1.3	0.6	0.0	99.0	0.8	0.0	99.0	0.8	0.0	99.0	564.1	3.4	1.0
MA3	654.7	7.1	1807.7	8.8	1669.9	7.5	182.6	1.6	80.0	147.0	1.2	80.0	130.4	1.1	80.0	1136.4	6.9	17.0
MA4	1118.3	12.2	1392.3	6.8	1432.7	6.5	13.2	0.1	97.0	15.3	0.1	97.0	24.7	0.2	97.0	1352.2	8.2	3.0
MA5	989.3	10.8	3406.5	16.6	4209.8	19.0	5150.0	44.0	0.0	5347.5	42.5	0.0	4830.7	39.0	0.0	2489.3	15.0	3.0
MA6	708.9	7.7	1374.8	6.7	1699.5	7.7	2141.9	18.3	0.0	2363.3	18.8	0.0	2287.9	18.4	0.0	551.8	3.3	53.0

	Annual average, 1997-2001*		7/2001-6/2002		7/2002-6/2003		7/2003-6/2004			7/2004-6/2005			7/2005-6/2006			7/2006-6/2007		
Region	Catch MT	%	CatchMT Mean	%	CatchMT Mean	%	CatchMT Mean	%	PctCl Mean	CatchMT Mean	%	PctCl Mean	CatchMT Mean	%	PctCl Mean	CatchMT Mean	%	PctCl Mean
MA7	1277.9	13.9	2154.7	10.5	2242.5	10.1	440.5	3.8	60.0	521.0	4.1	60.0	554.7	4.5	60.0	2071.0	12.5	21.0
MA8	1033.3	11.3	2226.4	10.8	2534.8	11.4	441.4	3.8	35.0	652.7	5.2	35.0	798.1	6.4	35.0	1885.8	11.4	12.0
MA9	349.4	3.8	172.4	0.8	203.8	0.9	21.6	0.2	66.0	31.2	0.2	66.0	42.4	0.3	66.0	504.2	3.0	18.0
GB1	84.9	0.9	18.4	0.1	21.8	0.1	2.5	0.0	49.0	4.2	0.0	51.0	7.6	0.1	53.0	125.1	0.8	19.0
GB2	642.5	7.0	4692.9	22.9	4126.2	18.6	1280.6	10.9	33.0	1380.3	11.0	33.0	1666.8	13.4	33.0	2361.8	14.2	54.0
GB3	362.0	3.9	1316.2	6.4	1219.4	5.5	215.2	1.8	34.0	231.1	1.8	34.0	233.6	1.9	34.0	414.5	2.5	17.0
GB4	456.8	5.0	464.7	2.3	632.1	2.8	475.3	4.1	16.0	425.4	3.4	16.0	366.5	3.0	16.0	399.2	2.4	0.0
GB5	385.6	4.2	545.2	2.7	795.2	3.6	595.9	5.1	0.0	660.8	5.3	0.0	632.6	5.1	0.0	505.6	3.0	0.0
GB6	91.9	1.0	430.9	2.1	527.3	2.4	431.3	3.7	18.0	434.1	3.5	18.0	426.4	3.4	18.0	502.7	3.0	10.0
GB7	314.5	3.4	185.8	0.9	472.1	2.1	283.1	2.4	57.0	331.8	2.6	57.0	359.3	2.9	57.0	1296.1	7.8	13.0
GB8	238.3	2.6	44.5	0.2	60.0	0.3	17.7	0.2	43.0	20.2	0.2	43.0	20.7	0.2	43.0	100.1	0.6	4.0
Total	9177	100.0	20534	100.0	22194	100.0	11713	100.0		12582	100.0		12402	100.0		16586	100.0	

* NB: The average annual for 1997-2001 is based on logbook records; it was estimated by averaging the total recorded pounds in the logbook over the five-year period 1997-2001 in these areas with trips giving valid geo-positions, and multiplying by 1.7 to account for the discrepancy between the logbook total for scallops and the scallop total using only valid geo-positions. All other figures come from estimates provided by biological modeling (work by Dvora Hart). % refers to the distribution of fishing activity across the regions in terms of the percentage of the total pounds landed. CatchMT Mean refers to the expected total fleet catch in metric tons estimated from the biological models; and PctCl Mean refers to the expected percentage of area in that region that would be closed in a rotational management scenario.

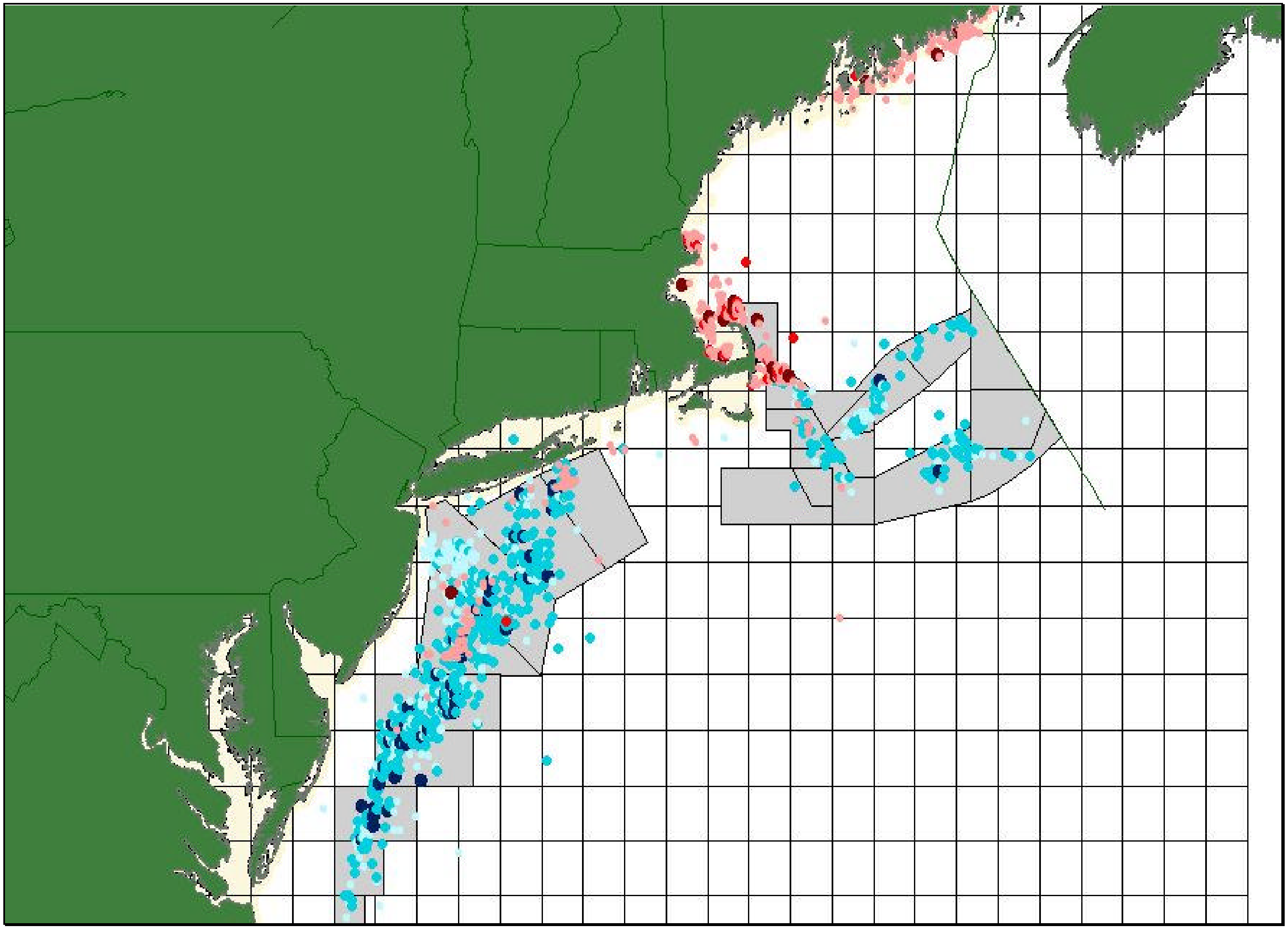

Figure 150. Fishing activity (days per location) by small and large vessels. The red color scheme represents small vessels and the blue represents large vessels, with darker colors implying increased effort. Source: 2001 logbooks**.**

It is important to note that the biological models used in predicting catch levels assume that high biomass presence determines fishing location choice, modified to some degree by cost of travel (e.g. petrol) and broad regional variations in fishing effort. Such models may capture the practices of the highliners, and the majority of the fishing impact on the biomass. However, they do not necessarily correspond to the practices of fishermen who, for example, are less mobile (those with small vessels or those with fishing knowledge of particular areas). Thus in terms of *social impacts*, although 75% of the scallop *biomass* will remain open in measures Sections 5.1.3.2 and 5.3.2.7, this accessibility would not necessarily ease the situation for less mobile fishermen. Depending on which areas are closed, such area regulations (Sections 5.1.3.2 and 5.3.2.7, and 5.3.2.2) could have differential affects on communities, if for example the closed areas were in "traditional" fishing areas or if the only open areas would entail long-distance travel. Such differential impacts might be borne more by smaller vessels and communities where smaller vessels predominate, especially if closed areas are close to shore (for example, Fig. 16 in the Affected Human Environment Section). Since it appears that most of the smaller vessels have not been fishing in the proposed rotational areas, this impact from closures may be mitigated somewhat. However, those fishermen and communities that do not practice a mobile fishing strategy may also see an influx of effort by other fishermen into their traditional areas if the biological projections and changes in fleet catch effort and distribution capture the activity of the highliners. For example, the area GB2 would change from accounting for 7.0% of the scallop catch (according to logbook records for the period 1997-2001), doubling to 14.2% in 2007 (Table 353), which could for example affect the landings of some of the smaller Maine and Cape Cod ports (Table 350 to Table 351). In general, if fishermen were unable to fish during their usual areas or seasons because of closures, such regulations could have a profound impact on personal and family incomes and reduce the flexibility of fishing operations, both impacts that may be more difficult for smaller vessels and operations to absorb. The closures could affect the safety of fishing operations if fishermen begin to fish further from shore and on longer trips; and they could have significant impacts on families, communities, and patterns of interaction if fishermen do stay away from shore for significantly longer periods, including the disruptions from longer periods at home as well. Such closures could also have an impact on processors and other on-land businesses if landing patterns changed in response to closures. Finally, the areas subject to rotational closures exhibit a higher degree of estimated variability when the harvesting policy is constant, compared to a ramped policy or to non-rotational management measures (i.e. status quo or no action alternatives) with further impacts on social and economic stability (Table 354).

Table 354. **Catch Variability: a comparison of 1D to the status quo.**

		No Rotation*		Adaptive Rotation *			No Rotation*		Adaptive Rotation *			No Rotation*		Adaptive Rotation *	
Year	Region	CatchMT		CatchMT		Region	CatchMT		CatchMT		Region	CatchMT		CatchMT	
		mean	std	mean	std		mean	std	mean	std		mean	std	mean	std
2003	MA1	57	26	57	26	MA8	2535	367	2535	367	GB5	795	199	795	199
2004		136	112	19	49		650	202	441	369		604	331	596	347
2005		156	119	16	39		841	276	653	540		577	292	661	322
2006		187	143	19	59		1033	356	798	662		550	261	633	282
2007		191	132	326	234		1087	313	1886	1417		479	235	506	272
2003	MA2	290	67	290	67	MA9	204	76	204	76	GB6	527	231	527	231
2004		149	101	1	6		51	35	22	38		474	336	431	371
2005		243	161	1	8		80	65	31	58		424	230	434	322
2006		305	180	1	8		124	111	42	80		429	213	426	294
2007		330	203	564	266		155	129	504	419		404	201	503	405
2003	MA3	1670	219	1670	219	MA All	14344	1788	14344	1788	GB7	472	213	472	213
2004		927	221	183	376		10810	1956	8412	1592		525	377	283	405
2005		668	188	147	300		11386	2230	9096	1685		639	468	332	461
2006		621	214	130	272		11247	2315	8690	1681		747	566	359	506
2007		580	199	1136	610		7501	1770	10884	2269		769	654	1296	1127
2003	MA4	1433	231	1433	231	GB1	22	10	22	10	GB8	60	24	60	24
2004		694	229	13	76		12	46	3	4		33	37	18	28
2005		638	205	15	89		39	123	4	8		38	44	20	32

		No Rotation*		Adaptive Rotation *			No Rotation*		Adaptive Rotation *			No Rotation*		Adaptive Rotation *	
Year	Region	CatchMT		CatchMT		Region	CatchMT		CatchMT		Region	CatchMT		CatchMT	
		mean	std	mean	std		mean	std	mean	std		mean	std	mean	std
2006		654	234	25	150		55	145	8	15		41	40	21	28
2007		636	261	1352	415		70	190	125	239		40	33	100	107
2003	MA5	4210	1363	4210	1363	GB2	4126	1156	4126	1156	GB All	7858	1309	7858	1309
2004		5150	1514	5150	1514		2193	965	1281	1088		4659	946	3304	687
2005		5347	1468	5347	1468		2259	1111	1380	1201		4668	1044	3490	774
2006		4831	1293	4831	1293		2755	1756	1667	1705		5233	1563	3716	1219
2007		2386	893	2489	892		2762	1816	2362	3186		5121	1844	5708	2389
2003	MA6	1699	576	1699	576	GB3	1219	411	1219	411					
2004		2142	666	2142	666		299	175	215	197					
2005		2363	669	2363	669		291	130	231	197					
2006		2288	596	2288	596		303	114	234	199					
2007		913	367	552	661		294	107	415	340					
2003	MA7	2243	630	2243	630	GB4	632	301	632	301	All	22202	2273	22202	2273
2004		908	409	440	587		516	383	475	379		15469	2022	11717	1597
2005		1045	419	521	689		396	203	425	275		16054	2261	12586	1731
2006		1200	465	555	753		350	138	367	210		16481	2568	12406	1977
2007		1219	405	2071	1424		299	99	399	223		12623	1949	16593	3351

* "No rotation" here manages for F=0.2, using 3.5" rings. "Adaptive Rotation" here manages for 25% growth rates, 3 year closures, no more than 25% closed, and 3.5" rings. All figures taken from the estimates provided by biological modeling (work by Dvora Hart).

In general, an adaptive system of openings and closures (1B and 1C) places additional burdens on fishermen and businesses to keep abreast of changing regulations. However, if participatory, the research and decision-making could contribute to stakeholders regaining a stake in the resource and management, with positive benefits for compliance and the incorporation local knowledge and needs. Likewise, while mechanical closures (Section 5.3.2.2) might increase the ability to plan in the long term, it may come at the possible expense of increases in yield; at the same time, the large areas proposed may not represent the social space of fishermen. The participatory incorporation of all scallop fishermen into such decisions regarding demarcation would be essential. Similarly, while the lack of closures in measure 1E might increase industry support (given a fear of indefinite closures), a finely tuned area management strategy needs the participatory incorporation of all scallop fishermen into decision-making, i.e. a change in the institutional design of management more in line with co-management thinking (see also section on National Standard 8). Given the projected benefits are rather low overall, the status of Section 5.1.3.2 is particularly important for fully evaluating the social costs and benefits of area management alternatives, since a significant proportion of the scallop biomass is contained in the groundfish closed areas (see Biological section). The gear changes (Section 5.3.2.9) may have a negative short-term financial impact on the majority of scallop fishermen who currently use 3.5" rings (Table 355), an impact presumably on the boat (rather than crew) share. Ports with a significant proportion of their scallop landings coming from vessels in conformance or by other gear groups would less affected by Section 5.3.2.9 (Table 356). However these mainly Mid-Atlantic ports, such as Cape May and Hampton VA, would be more affected by the gear-specific DAS of Section 5.3.2.10(Table 357). As a positive impact, these measures could increase compliance or satisfaction with regulations if fishermen feel that others are not having a greater negative impact per se, whether from trawl gear or small-ringed dredge gear. 1I (no action) could have dramatically negative affects on the scallop limited access fleet if DAS reductions continue at the original schedule. The status quo would continue the closures of Georges Bank groundfish areas and thus a significant proportion of the scallop biomass, with negative financial implications in the short-term for scallop limited-access fishing operations.

Table 355. **Use of 4" ring size by trip, calendar year 2000.**

Size of Mesh	Number of Trips	Scallops landed (in lbs)	Number of Vessels
Bigger	81	657,733	37
Smaller	3,988	26,881,452	296
Unknown	151	1,341,369	49

* shows only those trips landing at least 40 pounds of scallops in year 2000. Source: logbooks.

Table 356. **Use of 4" ring size by port, calendar year 2000.**

Port Landed	Number of Vessels	Scallops landed (in lbs) by vessels using dredge with smaller than 4" rings	% of vessels using smaller than 4" rings, out of all vessels using dredge in port	% of scallops out of all scallops landed in port
Southwest Harbor ME	12	271,048	92.3	99.0
Rockland ME	5	81,815	100.0	100.0
Newington NH	1	cr	cr	cr
Gloucester MA	9	167,011	81.8	97.7
Provincetown MA	9	113,204	81.8	98.6
Wellfleet MA	1	cr	cr	cr
Barnstable MA	6	158,044	75.0	98.8
Sandwich MA	11	182,025	78.6	93.3
Fairhaven MA	5	221,293	83.3	76.5
New Bedford MA	156	14,226,995	84.8	92.9
Newport RI	8	156,367	100.0	93.5
Point Judith RI	4	114,147	80.0	91.4
Stonington CT	5	589,536	71.4	94.3
New London CT	1	cr	cr	cr
Point Pleasant NJ	21	520,304	70.0	68.8
Barnegat NJ	8	67,622	100.0	100.0
Long Beach NJ	11	969,362	73.3	88.4
Cape May NJ	51	2,000,940	85.0	70.3
Chincoteague VA	1	cr	cr	cr
Seaford VA	18	1,987,986	66.7	91.8
Hampton VA	9	755,852	69.2	43.2
Newport News VA	38	3,755,218	76.0	74.0

* shows only those ports that had at least 50,000 pounds of scallops landed in year 2000, and includes only those trips landing at least 40 pounds of scallops. Source: logbooks.

Table 357. **Trawl vessel scallop catch by port**

	% of port value from trawl (limited access)			% of port value from dredge (limited access) or general category			Total value of scallops landed in port			Number of trawl (limited access) vessels		
Port Landed	1999	2000	2001	1999	2000	2001	1999	2000	2001	1999	2000	2001
New Bedford MA	0.2	0.3	0.3	99.8	99.6	99.7	70,553,861	88,490,629	76,114,639	3	3	4
Newport RI	nr	**	nr	100.0	88.8	***	446,693	700,021	cr	nr	1	nr
Point Pleasant NJ	*	3.7	*	99.4	96.3	99.1	1,854,369	3,784,457	2,835,499	2	5	1
Cape May NJ	37.6	24.4	19.4	61.9	74.8	80.6	9,765,197	14,158,301	18,626,149	18	20	25
Ocean City MD	*	21.9	**	24.4	53.1	40.3	24,921	118,037	65,017	1	3	2
Chincoteague VA	*	23.7	*	93.2	76.3	100.0	6,955	209,641	803,171	2	6	1
Hampton VA	43.2	41.7	34.9	56.8	58.3	65.1	5,083,750	8,288,677	9,264,501	11	14	9
Newport News VA	20.3	16.6	14.9	79.4	82.8	85.1	15,207,152	23,092,409	25,448,670	12	17	14
Wanchese NC	***	*	24.4	12.1	4.1	54.4	31,077	64,384	1,350,475	1	2	11

* only shows those ports in AHE table 2. Cannot report (cr) less than 3 entities: * le 10%, ** le 25% , *** 100%. Source: logbooks

8.8.3 Alternatives For Allocating Effort (Section 5.3.3)

Section 5.3.3.2 is similar to the area-access program that was used in Framework 14 to allow access into the groundfish closed areas, coupling a trip possession limit with a DAS tradeoffs mechanism. Trips into the closed areas under this program were reportedly seen by some vessels and fishermen as a welcome fishing trip due to the high density of large scallops, and the regulated access moderated any tendency towards derby-style fishing. At the same time, the high biomass outside the closed areas resulted in the closed areas not being fully utilized, in part because of the DAS tradeoffs which effectively penalized the more efficient operations (RFA analysis, Framework 14). Section 5.3.3.1 would distribute DAS among the rotational areas, which could only be used as long as a given area remained open to fishing. Without any otherwise regulated access, the opening of areas with large scallops might induce derby-style fishing and a more intense work environment for crew, and possibly a crew tending to be younger and more numerous (R. Smolowitz, pers. comm.).

Section 5.3.3.4 (status quo) would have no controls on access and could have an even stronger tendency towards derby-fishing, given the predicted conditions in a reopened area. Moreover, such a derby-style environment would favor the larger or more mobile vessels, and with implications for the safety of all participating fishermen. As well, the even distribution of area-specific DAS allocations among vessels in Section 5.3.3.3 does not take into account the overall tendency for most vessels to fish in particular areas (see discussion of area alternatives above and Affected Human Environment section), and would effectively advantage again those vessels that are larger or which favor a mobile fishing strategy. Section 5.3.3.3 would potentially enable this area-specificity to continue, by allowing exchange of DAS or trips and thus operational flexibility. However, if vessels are not in an equal trading position, those more dependent on particular areas or less mobile may still be relatively disadvantaged.

8.8.4 Alternatives For Reducing Habitat Impacts (Section 5.3)

The EFH measures using area closures (Sections 5.3.4.1 to 5.3.4.9) vary in the extent to which they would affect scallop fishermen. Section 5.3.4.9 would continue to close off a significant proportion of the total scallop biomass and its Section 5.3.4.3, affect the most vessels overall, primarily large and medium-sized vessels (Table 358). These two measures also have the most impact at the homeport (Table 359) and landing port (Table 360) level, mostly southern New England ports such as New Bedford/Fairhaven but also some Mid-Atlantic ports. Like the potential closures from the rotational management measures, many of the potentially affected ports depend on scallops for a significant portion of their total catch value (Section 7.1.1). Such closures reduce the operational flexibility of fishing businesses, particularly for smaller or less mobile vessels. Fishermen either forego income and fishing possibilities from former fishing grounds, or redirect their activity elsewhere, and if doing so results in longer trips or trips further from home, the impacts can disrupt family and community life and affect safety at sea.

The gear change measure for dredges (Section 5.3.4.10) would affect less than half of all scallop vessels and trips but would affect the vessels landing the majority of the scallop catch (Table 361). The impacts from Sections 5.3.4.10 and 5.3.4.11—from the financial cost of gear replacement to changes in catch composition and changes in choice of fishing grounds—would affect the larger ports that depend on dredge landings, such as New Bedford/Fairhaven, Stonington CT, Point Pleasant, Seaford, and Newport News (Table 362). Section 5.3.4.1 (status quo) would have no known short-term impacts on scallop fishermen since closures are unspecified, but the long-term impacts on scallop fishermen, fishing families, and fishing communities could be considerable if the lack of habitat protection affects the long-term health of the scallop biomass and overall ecosystem.

Table 358. Fishing activity in the draft EFH areas (Sections 5.3.4.3 to 5.3.4.9) by vessel size class for calendar years 1997-2001.

	5.3.4.1			5.3.4.6			5.3.4.8.1			0			5.3.4.3			5.4.7			5.4.7		
Vessel Size	5-yr total	No. vessels	%	5-yr total	No. vessels	%	5-yr total	No. vessels	%	5-yr total	No. vessels	%	5-yr total	No. vessels	%	5-yr total	No. vessels	%	5-yr total	No. vessels	%
Small	54	15	1.7	20	12	0.6	0	0	0.0	0	0	0.0	55	21	1.7	cr	1	lt1%	cr	2	lt1%
Medium	854	22	7.7	50	9	0.4	cr	1	lt1%	131	5	1.2	431	17	3.9	138	12	1.2	44	10	0.4
Large	7,001	165	6.3	272	35	0.2	72	6	0.1	1,723	57	1.5	7,417	133	6.6	2,340	121	2.1	517	61	0.5

Note: Landings are in thousands of pounds. Source: logbooks.

Table 359. Fishing activity in the draft EFH areas (4A-D) by homeport for calendar years 1997-2001.

	5.3.4.1			5.3.4.6			5.3.4.8.1	0			5.3.4.3			5.4.7			5.4.7		
Homeport	5-yr total	No. vessels	%	5-yr total	No. vessels	%	5-yr total	5-yr total	No. vessels	%	5-yr total	No. vessels	%	5-yr total	No. vessels	%	5-yr total	No. vessels	%
Bedford MA							0 lbs				cr	1	lt50%						
Mattapoisett MA											cr	1	lt80%						

	5.3.4.1			5.3.4.6			5.3.4.8.1	0			5.3.4.3			5.4.7			5.4.7		
Homeport	5-yr total	No. vessels	%	5-yr total	No. vessels	%	5-yr total	5-yr total	No. vessels	%	5-yr total	No. vessels	%	5-yr total	No. vessels	%	5-yr total	No. vessels	%
Fairhaven MA	484	12	7.5					162	5	2.5	586	11	9.1						
New Bedford MA	3,528	80	7.9	157	26	0.3		1,400	42	3.1	5,621	87	12.5	1,166	40	2.6	154	14	0.3
Davisville RI	156	3	18.0																
Point Judith RI	131	3	19.3																
Stonington CT	325	5	10.4								135	5	4.3	264	6	8.5			
Barnegat Light NJ	422	9	9.3								117	5	2.6						
Cape May NJ	977	23	7.7								238	13	1.9	119	16	0.9			
Hampton VA	206	5	5.1																
Newport News VA	312	10	3.5											164	14	1.8			
Carrollton VA	cr	2	lt25%																
Norfolk VA	227	10	1.6											281	18	1.9	121	12	0.8
Atlantic NC	132	3	9.2																

Note: Landings are in thousands of pounds. Source: logbooks.

Table 360. Fishing activity in the draft EFH areas (4A-D) by port of landing for calendar years 1997-2001.

	5.3.4.1			5.3.4.6			5.3.4.8.1			0			5.3.4.3			5.4.7			5.4.7		
Port landed	5-yr total	No. vessels	% total	5-yr total	No. vessels	% total	5-yr total	No. vessels	% total	5-yr total	No. vessels	% total	5-yr total	No. vessels	% total	5-yr total	No. vessels	% total	5-yr total	No. vessels	% total
Fairhaven MA	195	6	12.3										126	7	8.0						
New Bedford MA	6,100	157	10.3	261	33	0.4	106	6	0.2	1,796	56	3.0	7,126	125	12.0	1,337	54	2.2	215	22	0.4
Stonington CT	337	6	10.3										133	7	4.1	297	7	9.1			
Long Beach NJ	335	8	8.7																		
Cape May NJ	128	12	1.1													241	29	2.0	107	21	0.9
Hampton VA																166	13	2.4			
Newport News VA	220	12	1.2													244	24	1.3			

Note: Landings are in thousands of pounds. Source: logbooks.

Table 361. Dredge size use by trip, fishing year 2000.

Size of dredge (total)	Number of Distinct Vessels	Number of Distinct Trips	Percent of trips	Scallops (in pounds)	Percent of scallop catch
Greater than 26 feet, total dredge width	201	1,952	41.9	20,741,502	69.3
Less than or equal to 26 feet, total dredge width	221	2,706	58.0	9,152,382	30.6
Unknown	4	4	0.1	45,298	0.2

Source: logbooks.

Table 362. Dredge size use by port of landing, fishing year 2000.

Port of Landing	Total scallops landed in port (pounds)	% of scallops caught by large dredge, out of all scallops landed in port	Number of vessels using large dredge and landing in port
Newington NH	**	^^	less than 3
Gloucester MA	181,983	^^	less than 3
Provincetown MA	120,928	14.9	3
Sandwich MA	221,273	1.9	3
Fairhaven MA	324,717	63.4	5
New Bedford MA	16,059,176	69.7	125
Newport RI	146,782	41.8	4
Point Judith RI	137,395	^^	less than 3
Stonington CT	635,446	92.8	6
New London CT	**	^^^	less than 3
Shinnecock NY	*	^	less than 3
Point Pleasant NJ	781,613	53.6	12
Barnegat NJ	125,051	29.4	4
Long Beach NJ	1,037,773	43.9	8
Cape May NJ	2,876,998	45.4	37
Chincoteague VA	*	^^^	less than 3
Seaford VA	2,189,881	80.7	16

Port of Landing	Total scallops landed in port (pounds)	% of scallops caught by large dredge, out of all scallops landed in port	Number of vessels using large dredge and landing in port
Hampton VA	1,685,177	47.6	9
Newport News VA	5,101,019	67.4	33

Note: Only includes ports with at least 50,000 lbs of scallops landed. Cannot report if less than 3 entities: ^ = 0-25%; ^^ = 25-50%; ^^^ = 50-100%; * = 50,000-100,000; ** = 100,000-200,000. Source: logbooks.

8.8.4.1 Community Impacts of proposed habitat closure alternatives

Community impacts of the proposed habitat closures have a bearing on their practicality and on achieving equity. Habitat alternatives that have unequal costs across various ports and communities, with benefits accruing elsewhere, may not be as practicable as other alternatives whose costs are spread out more evenly.

An estimate of the direct potential loss of scallop landings as a proportion of the total scallop landings at each port is a first-order analysis of community impacts. One measure of this is the total expected loss of landings had the habitat closures been in place during 1995-2001, when VTR data useful for this analysis had been collected. This potential, retrospective loss in landings and the percent of scallop landings affected by the closures for each port is shown in Table 364 to Table 366, for four of the most different habitat closure alternatives. Since most of the proposed closures occur in New England, the greatest impacts occur at MA ports, such as New Bedford, Fairhaven, Chatham, and Gloucester. Fewer impacts are estimated for Mid-Atlantic ports and for ports in ME. Scallop vessels from ME ports tend to target scallops along the coastline north of Portland or on Fippinees Ledge where no habitat closures are proposed.

Another measure of the equitability of the proposed habitat closure alternatives is the variation in the proportion of landings impacted. This variation can be measured and standardized with respect to the average level of impact, by calculating a coefficient of variation (CV). High CVs (see) indicate a greater amount of variation of impacts among ports/communities. In fact, some of the habitat closure alternatives with the lowest overall impacts (e.g. Alternative 8b) have the highest variation of impacts, primarily occurring in few ports.

Second-order analyses of the overall impact of the proposed closures is not available at this time. Such an analysis would include the multipliers for each port that capture the total economic activity that include suppliers, wholesalers, and markets. Also, to really understand the effect on the community, the total economic impact with the multipliers would be compared with the total economic activity of the community or port. Information on the multipliers for the commercial scallop industry are only available for a few ports, making such an analysis difficult to complete.

Table 363. Summary of the disparity of impacts by port, estimated by the coefficient of variation of the percent of 1995-2001 landings impacted by the proposed closure alternatives. Alternatives are ranked from most even impact (low CV) to most uneven impact (high CV). The most uneven impact, for example, may have the lowest total impact on historic landings but the impacts are concentrated in few ports.

	Coefficient of Variation	Rank
Habitat Alternative 1	3.18	5
GF Mortality Alternative 1	2.19	2
Habitat Alternative 3a	3.43	6
Habitat Alternative 3b	3.44	7
Habitat Alternative 4	3.53	8
Habitat Alternative 5a	3.89	10
Habitat Alternative 5b	2.79	3
Habitat Alternative 5c	3.55	9
Habitat Alternative 5d	4.20	11
Habitat Alternative 6	4.61	12
Habitat Alternative 7	1.03	1
Habitat Alternative 8a	10.55	14
Habitat Alternative 8b	5.25	13
Habitat Alternative 9	3.17	4

Table 364. Summary of the retrospective impact on total scallop landings by port of landing in 1995-2001, assuming that habitat alternative 3a would have been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.

		1995		1996		1997		1998		1999		2000		2001	
Port State	**Port**	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent
CT	GROTON		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NEW LONDON		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	STONINGTON		0.0%	3,519	0.1%	21,669	0.6%	12,400	0.3%		0.0%	83,327	2.3%	11,910	0.3%
CT Total			**0.0%**	**3,519**	**0.1%**	**21,669**	**0.6%**	**12,400**	**0.3%**		**0.0%**	**83,327**	**2.2%**	**11,910**	**0.3%**
MA	BEVERLY		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BEVERLY/SALEM														
	BOSTON		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	CHATHAM		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%	2,163	1.6%
	DENNIS		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	FAIRHAVEN		0.0%	45,505	3.5%	12,104	0.9%		0.0%		0.0%	68,496	5.3%	89,475	7.0%
	FALL RIVER	73,146	8.5%	44,851	5.2%		0.0%		0.0%		0.0%		0.0%		0.0%
	FALMOUTH		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	GLOUCESTER	13,136	1.7%	390	0.0%	8,289	1.0%		0.0%		0.0%	53,313	6.7%	106,863	13.5%
	HARWICHPORT		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%	374	0.3%
	MARSHFIELD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	MATTAPOISETT		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NANTUCKET	2,260	1.0%	32,321	14.1%	8,665	3.8%	5,025	2.2%	120,874	52.7%		0.0%		0.0%
	NAUSET		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NEW BEDFORD	1,234,074	1.6%	1,715,101	2.2%	1,905,542	2.4%	2,003,643	2.6%	2,309,769	3.0%	4,306,372	5.5%	3,155,006	4.0%
	NEWBURYPORT	397	0.2%	13,700	7.3%		0.0%	11,424	6.1%	30	0.0%	16,000	8.5%		0.0%
	ORLEANS		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER BARNSTABLE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER MASS	31,237	28.4%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	PLYMOUTH		0.0%		0.0%	1,657	1.3%		0.0%		0.0%		0.0%		0.0%
	PROVINCETOWN	1,032	0.1%	10,003	1.2%	12,667	1.5%	11,446	1.3%	6,300	0.7%	8,046	0.9%	1,368	0.2%
	ROCKPORT		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SALISBURY		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SANDWICH		0.0%	8,780	1.2%		0.0%		0.0%		0.0%		0.0%	6,900	1.0%
	TISBURY		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	TOWN OF BARNSTABLE		0.0%	18,284	3.9%	3,121	0.7%	3,137	0.7%		0.0%	3,099	0.7%		0.0%
	WELLFLEET		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	WOODS HOLE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%	400	15.0%

Port State	Port	1995 Prorated scallop landings (lbs.)	1995 Percent	1996 Prorated scallop landings (lbs.)	1996 Percent	1997 Prorated scallop landings (lbs.)	1997 Percent	1998 Prorated scallop landings (lbs.)	1998 Percent	1999 Prorated scallop landings (lbs.)	1999 Percent	2000 Prorated scallop landings (lbs.)	2000 Percent	2001 Prorated scallop landings (lbs.)	2001 Percent
MA Total		**1,355,282**	**1.6%**	**1,888,935**	**2.2%**	**1,952,045**	**2.3%**	**2,034,675**	**2.4%**	**2,436,973**	**2.9%**	**4,455,326**	**5.3%**	**3,362,549**	**4.0%**
MD	OCEAN CITY		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
MD Total			**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**
ME	ADDISON		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BAR HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BEALS ISLAND		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BLUE HILL		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BOOTHBAY HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BREMEN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BROOKLIN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BUCKS HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	CAPE ROSIER		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	CUNDYS HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	CUTLER		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	DYERS BAY		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	EASTPORT		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	HARPSWELL		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	JONESPORT		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	KITTERY		0.0%		0.0%	535	12.7%		0.0%		0.0%		0.0%		0.0%
	LONG ISLAND		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	LUBEC		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	MACHIAS		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	MILBRIDGE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	MONHEGAN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NEW HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NORTHEAST HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NORTHWEST HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER CUMBERLAND		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER HANCOCK		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER KNOX		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER MAINE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OWLS HEAD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	PEMAQUID														
	PIGEON HILL		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%

		1995		1996		1997		1998		1999		2000		2001	
Port State	Port	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent
	PORT CLYDE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	PORTLAND		0.0%	151	0.2%	3,907	5.2%	626	0.8%		0.0%	2,035	2.7%		0.0%
	ROCKLAND		0.0%	2,694	2.5%		0.0%		0.0%		0.0%	11,120	10.3%		0.0%
	ROGUE BLUFFS		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SEAL HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SOUTH BRISTOL		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SOUTHWEST HARBOR		0.0%	1,068	0.1%	10,016	1.0%	1,740	0.2%		0.0%	47,826	5.0%	17,000	1.8%
	SPRUCEHEAD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	STONINGTON		0.0%	415	0.4%		0.0%		0.0%		0.0%		0.0%		0.0%
	STUEBEN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SUNSHINE/DEER ISLE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SWANS ISLAND		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	TENANTS HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	VINALHAVEN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	WEST GOULDSBORO		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	WINTER HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
ME Total			**0.0%**	**4,328**	**0.2%**	**14,458**	**0.8%**	**2,366**	**0.1%**		**0.0%**	**60,981**	**3.2%**	**17,000**	**0.9%**
NC	BAYBORO		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BEAUFORT		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	ENGELHARD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	LOWLAND		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	ORIENTAL		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER BEAUFORT		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER CARTERET		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER PAMLICO		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	VANDEMERE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	WANCHESE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
NC Total			**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**
NH	HAMPTON		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	HAMPTON/SEABROOK		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NEWINGTON		0.0%		0.0%		0.0%		0.0%		0.0%	750	2.1%		0.0%
	PORTSMOUTH		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	RYE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SEABROOK		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
NH Total			**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**	**750**	**0.4%**		**0.0%**

		1995		1996		1997		1998		1999		2000		2001	
Port State	**Port**	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent
NJ	ATLANTIC CITY		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BARNEGAT		0.0%		0.0%		0.0%		0.0%		0.0%	9,694	3.9%		0.0%
	BELFORD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	CAPE MAY		0.0%		0.0%		0.0%		0.0%	10,218	0.1%	119,088	0.8%		0.0%
	ELIZABETH		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	HIGHLANDS		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	LONG BEACH/BARNEGAT LIGHT		0.0%		0.0%		0.0%		0.0%		0.0%	156,419	3.0%	53,711	1.0%
	OTHER NJ		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	PT. PLEASANT		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	WILDWOOD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
NJ Total			**0.0%**		**0.0%**		**0.0%**		**0.0%**	**10,218**	**0.0%**	**285,201**	**1.2%**	**53,711**	**0.2%**
NY	BROOKLYN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	FREEPORT														
	GREENPORT		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	HAMPTON BAY		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	MATTITUCK		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	MONTAUK		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NEW YORK CITY		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER NASSAU		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER RICHMOND		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SHINNECOCK		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
NY Total			**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**
RI	NEW SHOREHAM		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NEWPORT		0.0%		0.0%		0.0%		0.0%		0.0%	546	0.1%		0.0%
	NORTH KINGSTOWN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER R.I.		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	POINT JUDITH		0.0%		0.0%		0.0%		0.0%		0.0%	25,280	7.0%		0.0%
	PROVIDENCE		0.0%		0.0%		0.0%		0.0%		0.0%	9,586	6.6%		0.0%
RI Total			**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**	**35,412**	**3.5%**		**0.0%**
VA	CAPE CHARLES		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	CHINCOTEAGUE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	CITY OF SEAFORD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	HAMPTON		0.0%		0.0%	3,453	0.0%	29,604	0.3%		0.0%		0.0%		0.0%
	NEWPORT NEWS		0.0%		0.0%	5,148	0.0%		0.0%		0.0%	94,314	0.4%		0.0%

		1995		1996		1997		1998		1999		2000		2001	
Port State	Port	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent
	NORFOLK		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OYSTER		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SANFORD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	VIRGINIA BEACH/LYNNHAVEN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
VA Total			**0.0%**		**0.0%**	**8,601**	**0.0%**	**29,604**	**0.1%**		**0.0%**	**94,314**	**0.2%**		**0.0%**
Grand Total		**1,355,282**	**0.8%**	**1,896,782**	**1.2%**	**1,996,773**	**1.2%**	**2,079,045**	**1.3%**	**2,447,191**	**1.5%**	**5,015,311**	**3.0%**	**3,445,170**	**2.1%**

Table 365. Summary of the retrospective impact on total scallop landings by port of landing in 1995-2001, assuming that habitat alternative 5a would have been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.

		1995		1996		1997		1998		1999		2000		2001	
Port State	Port	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent
CT	GROTON		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NEW LONDON		0.0%		0.0%		0.0%		0.0%	800	0.4%		0.0%	3,340	1.5%
	STONINGTON		0.0%		0.0%	392	0.0%		0.0%		0.0%	400	0.0%		0.0%
CT Total			**0.0%**		**0.0%**	**392**	**0.0%**		**0.0%**	**800**	**0.0%**	**400**	**0.0%**	**3,340**	**0.1%**
MA	BEVERLY		0.0%		0.0%	1,387	100.0%		0.0%		0.0%		0.0%		0.0%
	BEVERLY/SALEM														
	BOSTON		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	CHATHAM		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%	39,752	29.3%
	DENNIS		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	FAIRHAVEN		0.0%	4,431	0.3%		0.0%		0.0%		0.0%		0.0%	1,121	0.1%
	FALL RIVER	250	0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	FALMOUTH		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	GLOUCESTER	31,966	4.0%	7,765	1.0%	18,233	2.3%	72	0.0%		0.0%	1,861	0.2%	1,806	0.2%
	HARWICHPORT		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%	42,341	29.1%
	MARSHFIELD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	MATTAPOISETT		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NANTUCKET		0.0%	43	0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NAUSET		0.0%	200	100.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NEW BEDFORD	97,210	0.1%	301,284	0.4%	267,277	0.3%	105,893	0.1%	104,550	0.1%	1,468	0.0%	269,148	0.3%
	NEWBURYPORT		0.0%	517	0.3%		0.0%	7,800	4.2%		0.0%		0.0%	27,000	14.4%
	ORLEANS		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER BARNSTABLE	15,413	23.6%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER MASS	968	0.9%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	PLYMOUTH	1,473	1.1%		0.0%	2,287	1.7%		0.0%		0.0%		0.0%		0.0%
	PROVINCETOWN	7,440	0.9%	15,643	1.8%	10,312	1.2%	11,171	1.3%	4,275	0.5%	3,119	0.4%		0.0%
	ROCKPORT		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SALISBURY		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SANDWICH	3,185	0.4%		0.0%		0.0%	406	0.1%	674	0.1%		0.0%	1,190	0.2%
	TISBURY		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	TOWN OF BARNSTABLE		0.0%	9,647	2.1%	14,051	3.0%	6,381	1.4%	2,842	0.6%		0.0%	27,800	5.9%

		1995		1996		1997		1998		1999		2000		2001	
Port State	Port	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent
	WELLFLEET		0.0%	1,428	1.1%		0.0%		0.0%		0.0%		0.0%		0.0%
	WOODS HOLE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
MA Total		**157,905**	**0.2%**	**340,958**	**0.4%**	**313,547**	**0.4%**	**131,723**	**0.2%**	**112,341**	**0.1%**	**6,448**	**0.0%**	**410,158**	**0.5%**
MD	OCEAN CITY		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
MD Total			**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**
ME	ADDISON		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BAR HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BEALS ISLAND		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BLUE HILL		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BOOTHBAY HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BREMEN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BROOKLIN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BUCKS HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	CAPE ROSIER		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	CUNDYS HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	CUTLER		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	DYERS BAY		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	EASTPORT		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	HARPSWELL		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	JONESPORT		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	KITTERY		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	LONG ISLAND		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	LUBEC		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	MACHIAS		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	MILBRIDGE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	MONHEGAN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NEW HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NORTHEAST HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NORTHWEST HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER CUMBERLAND		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER HANCOCK		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER KNOX		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER MAINE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OWLS HEAD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%

		1995		1996		1997		1998		1999		2000		2001	
Port State	**Port**	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent
	PEMAQUID														
	PIGEON HILL		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	PORT CLYDE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	PORTLAND	1,620	2.1%		0.0%	2,354	3.1%	2,496	3.3%		0.0%		0.0%		0.0%
	ROCKLAND		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	ROGUE BLUFFS		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SEAL HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SOUTH BRISTOL		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SOUTHWEST HARBOR	4,533	0.5%	7,274	0.8%	13,089	1.4%		0.0%		0.0%		0.0%	104,000	10.9%
	SPRUCEHEAD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	STONINGTON		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	STUEBEN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SUNSHINE/DEER ISLE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SWANS ISLAND		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	TENANTS HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	VINALHAVEN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	WEST GOULDSBORO		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	WINTER HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
ME Total		**6,153**	**0.3%**	**7,274**	**0.4%**	**15,443**	**0.8%**	**2,496**	**0.1%**		**0.0%**		**0.0%**	**104,000**	**5.5%**
NC	BAYBORO		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BEAUFORT		0.0%		0.0%		0.0%	2,541	1.5%		0.0%		0.0%		0.0%
	ENGELHARD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	LOWLAND		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	ORIENTAL		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER BEAUFORT		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER CARTERET		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER PAMLICO		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	VANDEMERE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	WANCHESE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
NC Total			**0.0%**		**0.0%**		**0.0%**	**2,541**	**0.3%**		**0.0%**		**0.0%**		**0.0%**
NH	HAMPTON		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	HAMPTON/SEABROOK		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NEWINGTON		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	PORTSMOUTH	985	26.2%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%

		1995		1996		1997		1998		1999		2000		2001	
Port State	Port	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent
	RYE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SEABROOK		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
NH Total		**985**	**0.5%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**
NJ	ATLANTIC CITY		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BARNEGAT		0.0%		0.0%		0.0%		0.0%		0.0%	365	0.1%		0.0%
	BELFORD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	CAPE MAY		0.0%		0.0%	899	0.0%	6,812	0.0%	4,582	0.0%		0.0%	26,825	0.2%
	ELIZABETH		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	HIGHLANDS		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	LONG BEACH/BARNEGAT LIGHT	17,092	0.3%		0.0%		0.0%	15,645	0.3%	4,828	0.1%	100	0.0%		0.0%
	OTHER NJ		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	PT. PLEASANT	5,429	0.2%	7,429	0.2%	21,709	0.7%	21,262	0.7%	36,343	1.2%	28,583	0.9%	10,482	0.3%
	WILDWOOD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
NJ Total		**22,521**	**0.1%**	**7,429**	**0.0%**	**22,608**	**0.1%**	**43,719**	**0.2%**	**45,753**	**0.2%**	**29,048**	**0.1%**	**37,307**	**0.2%**
NY	BROOKLYN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	FREEPORT														
	GREENPORT		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	HAMPTON BAY		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	MATTITUCK		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	MONTAUK		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NEW YORK CITY		0.0%		0.0%		0.0%		0.0%		0.0%	5,269	21.7%		0.0%
	OTHER NASSAU		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER RICHMOND		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SHINNECOCK		0.0%		0.0%		0.0%		0.0%	20	0.1%		0.0%		0.0%
NY Total			**0.0%**		**0.0%**		**0.0%**		**0.0%**	**20**	**0.0%**	**5,269**	**4.0%**		**0.0%**
RI	NEW SHOREHAM		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NEWPORT	4,619	0.9%	1,351	0.3%		0.0%		0.0%		0.0%		0.0%		0.0%
	NORTH KINGSTOWN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER R.I.		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	POINT JUDITH		0.0%		0.0%		0.0%	395	0.1%		0.0%	397	0.1%		0.0%
	PROVIDENCE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
RI Total		**4,619**	**0.5%**	**1,351**	**0.1%**		**0.0%**	**395**	**0.0%**		**0.0%**	**397**	**0.0%**		**0.0%**
VA	CAPE CHARLES		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%

		1995		1996		1997		1998		1999		2000		2001	
Port State	Port	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent
	CHINCOTEAGUE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	CITY OF SEAFORD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%	37,176	0.3%
	HAMPTON		0.0%	11,057	0.1%		0.0%	5,617	0.1%	10,671	0.1%		0.0%		0.0%
	NEWPORT NEWS		0.0%	5,199	0.0%	2,750	0.0%	16,711	0.1%		0.0%		0.0%		0.0%
	NORFOLK		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OYSTER		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SANFORD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	VIRGINIA BEACH/LYNNHAVEN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
VA Total			**0.0%**	**16,256**	**0.0%**	**2,750**	**0.0%**	**22,328**	**0.0%**	**10,671**	**0.0%**		**0.0%**	**37,176**	**0.1%**
Grand Total		**192,183**	**0.1%**	**373,268**	**0.2%**	**354,740**	**0.2%**	**203,202**	**0.1%**	**169,585**	**0.1%**	**41,562**	**0.0%**	**591,981**	**0.4%**

Table 366. Summary of the retrospective impact on total scallop landings by port of landing in 1995-2001, assuming that groundfish mortality alternative 1 would have been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.

		1995		1996		1997		1998		1999		2000		2001	
Port State	**Port**	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent
CT	GROTON		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NEW LONDON		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	STONINGTON		0.0%		0.0%	6,780	0.2%	13,000	0.4%	34,148	0.9%	146,905	4.0%	59,437	1.6%
CT Total			**0.0%**		**0.0%**	**6,780**	**0.2%**	**13,000**	**0.3%**	**34,148**	**0.9%**	**146,905**	**3.8%**	**59,437**	**1.5%**
MA	BEVERLY		0.0%		0.0%	1,387	100.0%		0.0%		0.0%		0.0%		0.0%
	BEVERLY/SALEM														
	BOSTON		0.0%		0.0%	1,026	10.4%	249	2.5%		0.0%		0.0%		0.0%
	CHATHAM		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%	2,562	1.9%
	DENNIS		0.0%	1,060	24.4%		0.0%		0.0%		0.0%		0.0%		0.0%
	FAIRHAVEN		0.0%	10,630	0.8%	6,406	0.5%		0.0%	29,133	2.3%	101,328	7.9%	36,909	2.9%
	FALL RIVER	45,714	5.3%	35,611	4.1%		0.0%		0.0%		0.0%		0.0%		0.0%
	FALMOUTH		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	GLOUCESTER	32,350	4.1%	23,397	2.9%	187,916	23.7%	18,933	2.4%	20,718	2.6%	124,726	15.7%	240,709	30.3%
	HARWICHPORT		0.0%	4,177	2.9%		0.0%		0.0%		0.0%		0.0%	4,718	3.2%
	MARSHFIELD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	MATTAPOISETT		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NANTUCKET	2,260	1.0%	52,716	23.0%	21,664	9.4%	5,025	2.2%	118,557	51.7%		0.0%		0.0%
	NAUSET		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NEW BEDFORD	1,538,154	2.0%	2,179,649	2.8%	2,546,074	3.3%	1,837,046	2.4%	4,607,708	5.9%	5,025,754	6.4%	2,449,044	3.1%
	NEWBURYPORT	397	0.2%	1,882	1.0%	20,828	11.1%	11,833	6.3%	4,978	2.7%	18,497	9.9%	11,849	6.3%
	ORLEANS		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER BARNSTABLE	18,269	28.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER MASS	35,642	32.4%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	PLYMOUTH	1,473	1.1%	196	0.1%	4,109	3.1%	543	0.4%	155	0.1%	14,419	11.0%	24,551	18.7%
	PROVINCETOWN	10,717	1.2%	31,081	3.6%	41,672	4.9%	59,750	7.0%	16,280	1.9%	22,172	2.6%	490,339	57.1%
	ROCKPORT		0.0%		0.0%	15,244	99.1%		0.0%		0.0%		0.0%		0.0%
	SALISBURY		0.0%		0.0%	1,306	48.1%		0.0%	385	14.2%		0.0%	1,025	37.7%

		1995		1996		1997		1998		1999		2000		2001	
Port State	**Port**	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent
	SANDWICH	6,738	0.9%	21,990	3.1%	12,805	1.8%		0.0%	13,543	1.9%	13,442	1.9%	76,250	10.6%
	TISBURY		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	TOWN OF BARNSTABLE		0.0%	63,404	13.5%	39,714	8.5%	11,845	2.5%	39,381	8.4%	3,099	0.7%	24,429	5.2%
	WELLFLEET		0.0%	1,747	1.3%	519	0.4%		0.0%		0.0%		0.0%		0.0%
	WOODS HOLE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%	400	15.0%
MA Total		**1,691,714**	**2.0%**	**2,427,540**	**2.9%**	**2,900,670**	**3.4%**	**1,945,224**	**2.3%**	**4,850,838**	**5.8%**	**5,323,437**	**6.3%**	**3,362,785**	**4.0%**
MD	OCEAN CITY		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
MD Total			**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**
ME	ADDISON		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BAR HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BEALS ISLAND		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BLUE HILL		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BOOTHBAY HARBOR		0.0%	261	0.7%		0.0%		0.0%		0.0%		0.0%		0.0%
	BREMEN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BROOKLIN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BUCKS HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	CAPE ROSIER		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	CUNDYS HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	CUTLER		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	DYERS BAY		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	EASTPORT		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	HARPSWELL		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	JONESPORT		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	KITTERY		0.0%		0.0%	535	12.7%		0.0%	182	4.3%		0.0%		0.0%
	LONG ISLAND		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	LUBEC		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	MACHIAS		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	MILBRIDGE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	MONHEGAN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NEW HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NORTHEAST HARBOR		0.0%	39,150	36.9%	1,140	1.1%		0.0%		0.0%		0.0%		0.0%
	NORTHWEST HARBOR		0.0%	5,323	81.4%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER CUMBERLAND		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER HANCOCK		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%

		1995		1996		1997		1998		1999		2000		2001	
Port State	Port	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent
	OTHER KNOX		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER MAINE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OWLS HEAD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	PEMAQUID														
	PIGEON HILL		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	PORT CLYDE		0.0%	1,647	4.0%	768	1.9%	434	1.0%	78	0.2%		0.0%		0.0%
	PORTLAND	1,620	2.1%	5,559	7.3%	10,853	14.3%	4,517	6.0%	5,153	6.8%	2,035	2.7%		0.0%
	ROCKLAND		0.0%	6,547	6.1%		0.0%		0.0%		0.0%	23,120	21.4%	10,000	9.3%
	ROGUE BLUFFS		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SEAL HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SOUTH BRISTOL		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SOUTHWEST HARBOR	6,292	0.7%	20,430	2.1%	15,674	1.6%	3,073	0.3%	104,921	11.0%	128,721	13.5%	67,800	7.1%
	SPRUCEHEAD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	STONINGTON		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	STUEBEN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SUNSHINE/DEER ISLE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SWANS ISLAND		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	TENANTS HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	VINALHAVEN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	WEST GOULDSBORO		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	WINTER HARBOR		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
ME Total		**7,912**	**0.4%**	**78,917**	**4.2%**	**28,970**	**1.5%**	**8,024**	**0.4%**	**110,334**	**5.8%**	**153,876**	**8.1%**	**77,800**	**4.1%**
NC	BAYBORO		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BEAUFORT		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	ENGELHARD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	LOWLAND		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	ORIENTAL		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER BEAUFORT		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER CARTERET		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER PAMLICO		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	VANDEMERE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	WANCHESE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
NC Total			**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**
NH	HAMPTON		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%	150	0.1%

		1995		1996		1997		1998		1999		2000		2001	
Port State	**Port**	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent
	HAMPTON/SEABROOK		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NEWINGTON		0.0%		0.0%		0.0%		0.0%	22,200	62.6%	750	2.1%		0.0%
	PORTSMOUTH	985	26.2%		0.0%	270	7.2%		0.0%	1,905	50.7%		0.0%		0.0%
	RYE		0.0%		0.0%	277	6.7%	3,805	92.5%		0.0%		0.0%		0.0%
	SEABROOK		0.0%		0.0%		0.0%	135	6.0%	1,439	63.5%	486	21.4%	206	9.1%
NH Total		**985**	**0.5%**		**0.0%**	**547**	**0.3%**	**3,940**	**2.0%**	**25,544**	**12.8%**	**1,236**	**0.6%**	**356**	**0.2%**
NJ	ATLANTIC CITY		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	BARNEGAT		0.0%		0.0%		0.0%		0.0%		0.0%	9,694	3.9%		0.0%
	BELFORD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	CAPE MAY		0.0%		0.0%		0.0%		0.0%	44,666	0.3%	134,488	0.9%		0.0%
	ELIZABETH		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	HIGHLANDS		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	LONG BEACH/BARNEGAT LIGHT		0.0%		0.0%		0.0%		0.0%	167,831	3.2%	243,054	4.6%	58,660	1.1%
	OTHER NJ		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	PT. PLEASANT		0.0%		0.0%		0.0%		0.0%	52,169	1.7%		0.0%		0.0%
	WILDWOOD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
NJ Total			**0.0%**		**0.0%**		**0.0%**		**0.0%**	**264,666**	**1.1%**	**387,236**	**1.6%**	**58,660**	**0.2%**
NY	BROOKLYN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	FREEPORT														
	GREENPORT		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	HAMPTON BAY		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	MATTITUCK		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	MONTAUK		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NEW YORK CITY		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER NASSAU		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER RICHMOND		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SHINNECOCK		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
NY Total			**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**		**0.0%**
RI	NEW SHOREHAM		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	NEWPORT		0.0%		0.0%		0.0%		0.0%	22,439	4.6%	53,593	11.0%		0.0%
	NORTH KINGSTOWN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OTHER R.I.		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	POINT JUDITH		0.0%		0.0%		0.0%		0.0%		0.0%	32,932	9.1%		0.0%

		1995		1996		1997		1998		1999		2000		2001	
Port State	Port	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent	Prorated scallop landings (lbs.)	Percent
	PROVIDENCE		0.0%		0.0%		0.0%		0.0%		0.0%	9,586	6.6%		0.0%
RI Total			**0.0%**		**0.0%**		**0.0%**		**0.0%**	**22,439**	**2.2%**	**96,111**	**9.6%**		**0.0%**
VA	CAPE CHARLES		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	CHINCOTEAGUE		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	CITY OF SEAFORD		0.0%		0.0%		0.0%		0.0%	28,043	0.3%		0.0%		0.0%
	HAMPTON		0.0%		0.0%	4,108	0.0%	29,604	0.3%	11,879	0.1%		0.0%	648	0.0%
	NEWPORT NEWS	19,265	0.1%		0.0%		0.0%		0.0%	167,544	0.6%	123,352	0.5%		0.0%
	NORFOLK		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	OYSTER		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	SANFORD		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
	VIRGINIA BEACH/LYNNHAVEN		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%		0.0%
VA Total		**19,265**	**0.0%**		**0.0%**	**4,108**	**0.0%**	**29,604**	**0.1%**	**207,466**	**0.4%**	**123,352**	**0.3%**	**648**	**0.0%**
Grand Total		**1,719,876**	**1.0%**	**2,506,457**	**1.5%**	**#######**	**1.8%**	**#######**	**1.2%**	**#######**	**3.3%**	**#######**	**3.8%**	**#######**	**2.2%**

8.8.5 Alternatives For Reducing Bycatch (Section 5.3.5)

Possession limits for bycatch (Section 5.3.5.5) would affect the income of those vessels using a generalist strategy, landing scallops and a variety of other species on a trip-by-trip basis (see Section 7.1.1.1.2). This is primarily the general category vessels and some smaller limited access vessels. To what extent this would have differential community impacts will depend on the specifics of the measure. Section 5.3.5.6 might allow bycatch to continue as part of a generalist strategy, but at the same time possibly encourage derby-style fishing (if the scallop fishery is thought be threatened with closure), thus disadvantaging certain classes of vessels, such as the smaller ones, and possibly affecting safety-at-sea.

The impacts from the seasonal measures (Sections 5.3.5.7 and 5.1.7) will ultimately depend upon which seasons and areas are chosen for further regulation. In general, however, there are seasonal differences in the scallop fishing of the different segments of the fleet—for example between limited access and general category vessels and how their landings are apportioned between seasons (Figure 151)—so seasonal closures may have differential impacts on the fleet. Such seasonal differences in scallop harvesting also extend to ports (Figure 152), with implications for differential community impacts. So too, the precise impacts from the area closure measure (Section 5.3.5.8) will depend on which areas are closed, given the differential use of fishing grounds (as detailed in Section 7.1.1.1). With the proposed long-term nature of the closures, it is likely such a measure would negatively impact the operational flexibility of fishing businesses, particularly for smaller or less mobile vessels. Fishermen either forego income and fishing possibilities from former fishing grounds, or redirect their activity elsewhere, and if doing so results in longer trips or trips further from home, the impacts can disrupt family and community life and affect safety at sea.

The impacts from gear modifications (Sections 5.3.5.2 to 5.3.5.4) would stem from the financial costs of changing to the new gear specifications, as well as any lost revenue generated by the former bycatch. Status quo (Section 5.3.5.10) would have no additional short-term impacts on scallop fishermen except for the continued lack of access to biomass in the groundfish closed areas, but the long-term impacts on fishermen, fishing families, and fishing communities in general could be considerable if not reducing bycatch affects the long-term health of fisheries and the overall ecosystem.

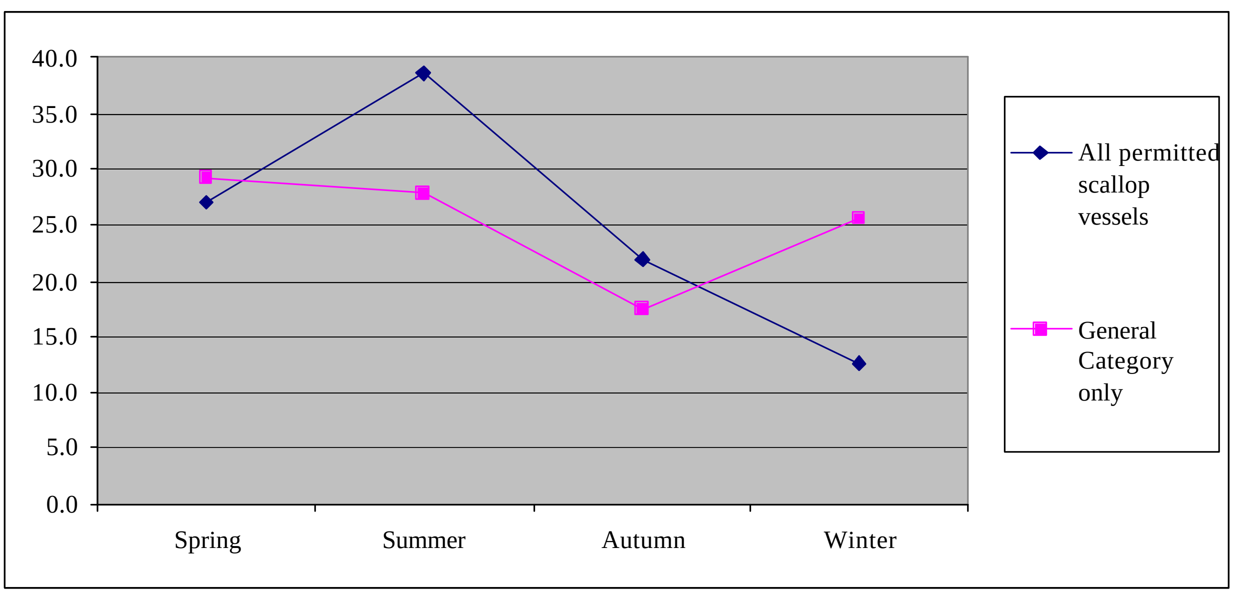

Figure 151. Proportion of scallop landings by season by plan type, 1997-2001. Source: logbooks.

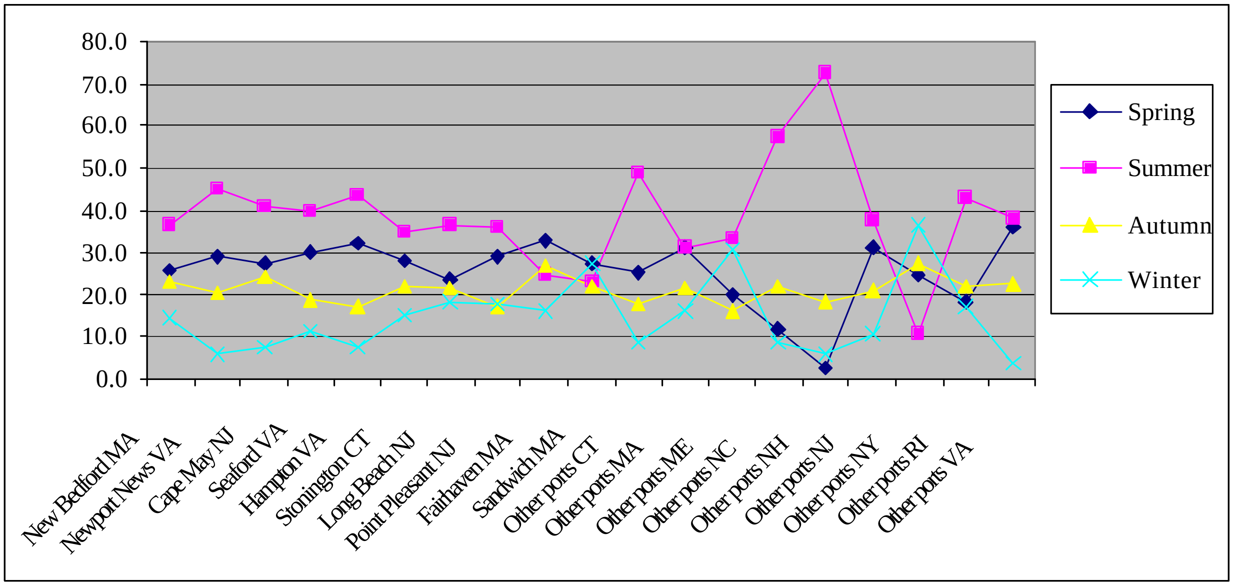

Figure 152. Proportion of scallop landings by season by port or state of landing, 1997-2001. Source: logbooks.

8.8.6 Alternatives For Managing General Category Permits (Section 5.3.6)

All three measures proposed would continue to keep part of the scallop fishery an open-access fishery, in that any vessel could obtain a general category permit. This can be seen as both positive and negative, positive in that continues a customary use and access to New England fisheries, but negative if the proposed higher limits (Sections 5.3.6.1.1 and 5.3.6.2.1) and the increase in scallop biomass will attract additional effort in to the fishery. Although to-date the percentage of general category landings has declined relative to limited access landings, the number of vessels in the fishery has increased (see Section 7.1.1.1.1) and might further increase with a higher trip limit. An increase in effort could have the ultimate effect of disenfranchising or reducing access to the scallop fishery for those fishermen who can make a demonstrable historical connection to small-scale scallop fishing, such as in Maine or Cape Cod Bay.

Additional impacts from Sections 5.3.6.1.1 and 5.3.6.2.1 include the financial costs of installing and maintaining a VMS system, and the derby-style fishing that could result from the proposed hard TAC. The positive impacts from Sections 5.3.6.1.1 and 5.3.6.2.1 compared to status quo include access to any reopened areas from area management measures, thus mitigating the effects from being closed out from customary fishing grounds (as detailed earlier), and the proposed higher trip limits would be a financial benefit to general category fishermen (though with the risk of increased effort into the fishery).

8.8.7 Social Impact Assessment Conclusions

Many of the measures approved for the final amendment were analyzed individually in the DSEIS. The following attempts to summarize the social impact analyses for the Amendment taken as a whole. Of central importance to Amendment 10 is the management of the scallop resource through an area rotation program. The initial rotation scheme is a continuation of some regulations already in place, for example, the Hudson Canyon Controlled Access Area. But the flexible rotational plan itself represents a change in the institutional structure of scallop management to regularly incorporate area-specific biomass and growth rates, namely for the purpose of protecting small scallops until they reach larger sizes. As explained in the accompanying SIA analyses, area management may offer the benefits of an increase in productivity, but such benefits may not necessarily be equally distributed. While fishermen who practice a mobile fishing strategy would be more able to take advantage of area management, its costs may be borne more heavily by smaller vessels (and consequently the communities to which they belong) or others who cannot switch areas as easily. Similarly, vessels and especially small vessels dependent on inshore waters may be affected by offshore closures if they cause an influx of larger vessels into the inshore areas. And whether or not vessels are capable of intensifying or switching to mobile fishing, institutionally favoring such practices can have such social costs as disruptions to family and community life with related social problems, as well as increased risk to safety at sea.

In terms of the initial proposed close area in the Mid-Atlantic, such a closure would more negatively impact in the short-term those Mid-Atlantic ports close by and in particular those less mobile vessels; however, the concentration of small scallops that the closure is designed to protect would imply positive benefits in the future to those who will harvest the matured scallops in the area when the area reopens. Its closure would presumably also be mitigated by the nearby Hudson Canyon Controlled Access Area. As the DSEIS argues, an increase in the minimum biomass threshold for the overfishing definition will in the short-term decrease DAS but should, by increasing the resource biomass, lead to higher or more stable DAS in the future. But the retention of the status quo definition itself coupled with rotational area management could have the effect of actually increasing DAS (see the biological impact assessment) if the expected access to groundfish closed areas (actions dependent on other management plans and frameworks) is not obtained. That is to say, DAS would increase because fishing days would be less efficient in terms of catch quantities, thereby actually increasing costs to the industry in terms of petrol for example, though perhaps stabilizing employment. Thus contingent on other actions, the impacts on industry DAS use could be significant.

The amendment includes several measures which strive to include the knowledge base of industry members in setting management decisions, such as the inclusion of cooperative industry surveys, whose positive impacts would include not only incorporating industry's ecological knowledge into the management process (which, as many scholars have argued, can be rich in local interactions and historical depth), but would also hopefully have positive impacts on industry-government relations. Area-specific DAS to control access to newly reopened areas has the potential to insure industry flexibility, especially coupled with the trading of area-specific days. But these access controls in themselves may only control the impact on the biomass while inducing derby-style fishing with the consequent impacts on safety at sea and revenue impacts. Moreover, less mobile vessels may find that their bargaining position for trading area-specific days is less favorable, not in the terms of trade (since days are supposed to trade one to one), but terms of limited trading options. Further, both the unpredictability of rotational closures and the retention of the sometimes-cumbersome framework mechanism as the method for altering rotational area closures could negatively impact the way fishermen plan their long-term fishing strategies. The provision for trip and DAS adjustments in the case of emergencies will positively impact industry.

The increase in ring size to 4" would have negative short-term impacts on the majority of scallop dredge vessels from the initial cost of gear replacement, based on logbook records (see the SIA in the DSEIS). This would similarly impact those ports whose scallops are primarily landed with dredge, with somewhat less impact on ports where net boats predominate (e.g. Mid-Atlantic ports like Hampton VA). But compensating the financial outlay will be a gear that is supposed to catch scallops more efficiently in the context of a robust biomass. The long-term impacts of the ring size increase are predicted to be positive for the industry as a whole, given the predicted increase in biomass expected from reducing the take of small scallops.

General category measures continue the status quo. As argued in the social impacts analysis above, this can be seen as both positive and negative: positive in that continues a customary use of and access to New England fisheries and provides a stable fishery for fishermen practicing annual rounds, but negative if high catches from the scallop biomass attract unsustainable additional effort into the fishery. The inclusion of general category vessels into newly reopened areas will positively impact these fishermen in that it obviates the potential problem of closing out small vessels from traditional areas, though, as stated above, small vessels (generally synonymous with general category vessels) may be more vulnerable to the specificities of rotational area management. The prohibition on limited access vessels use of general category permits when not using DAS will probably have a negligible effect on the biomass and industry (see Table below) but will help close the perception of an unfair loophole in regulations.

Table 367. Proportion of reported landings by various scallop permit categories, 1997-2003 fishing years. Source: 1997-2003 logbooks.

	1997		1998		1999		2000		2001		2002		2003	
	% of Total lbs.	No. of Vessels	% of Total lbs.	No. of Vessels	% of Total lbs.	No. of Vessels	% of Total lbs.	No. of Vessels	% of Total lbs.	No. of Vessels	% of Total lbs.	No. of Vessels	% of Total lbs.	No. of Vessels
Limited access vessels that land scallops on non-DAS trips	0.0	0	0.2	1	0.2	1	0.6	2	0.1	1	0.0	0	0.0	0
Limited Access Only	95.6	226	95.2	232	97.9	242	97.7	255	96.4	282	96.7	290	95.9	143
General Category Only	4.4	166	4.5	153	1.9	152	1.6	170	3.5	236	3.3	240	4.1	82
Total	100	392	100	386	100	395	100	427	100	519	100	530	100	225

Finally, the amendment contains no EFH-specific measures but rather relies on other measures to mitigate impacts on Essential Fish Habitat. Such an approach to EFH may have impacts in terms of its cumulative effects and impacts on other fisheries, however, for whatever the impacts to habitats may or may not be, it most certainly contributes to inter-fishery perceptions of unfairness and hurts industry-government relations in other fisheries.

8.9 *Enforceability Assessment (T. DuBois)*

An enforceability assessment was prepared by the Enforcement Committee, working closely with Council staff. Management alternatives that required active enforcement related to proposed measures are assessed in the discussion below. This discussion does not include alternatives for defining overfishing (Section 3.4) and for adjusting management measures (Section 5.3.9), because by themselves they have no enforcement implications. Habitat alternatives (Section 5.3.4) are not discussed separately and individually because they mainly rely on the application of closed areas, a subject that is assessed in Section 8.9.1 below. Management measures using closed areas, as described for area rotation, are easier to enforce and have better compliance when they are large, use straight boundaries, run along lines of latitude and longitude, and apply to a broad class of easily observed vessels. VMS helps enforcement of area closures.

8.9.1 Alternatives To Improve Scallop Yield

8.9.1.1 General area rotation policies

Overall enforcement guidance related to implementation of closed area management measures is based in the "Precepts for Efficient Fisheries Enforcement". This alternative provides for four types of areas (closed, recently re-opened, open, and long-term closure), and the overriding recommendation from enforcement is to ensure that areas are "clearly defined in large, plain shapes" and that their status (open, closed, open to some vessels) is maintained for reasonably long periods of time. Enforceability is further enhanced by limiting exemptions or transiting provisions (except for compelling safety reasons).

Under the general policies, closed areas would be closed to all vessels fishing with scallop dredge or scallop trawl gear. Also included will be a provision for zero possession limit on scallops when in the area. This alternative could mainly be enforced through the use of VMS currently installed on limited access scallop vessels. These closed areas could also be effectively enforced through the use of aerial and surface patrols and at-sea boardings by USCG units.

The second category of area implemented under the general area rotation rules would be "recently re-opened" areas. These areas would allow limited access and general category vessels to fish for scallops only on "authorized trips" in these areas. It would also allow vessels with "incidental catch permits" to retain more than 40 lbs. In order to effectively enforce the access of scallop vessels "on authorized trips" to these areas, enforcement would need to have up to date listings of vessels authorized to be in a given area. VMS on all scallop vessels authorized to operate in the "recently re-opened" areas would significantly enhance the ability to enforce authorized vessels operating within these areas. Enforcement will be compromised to the extent that vessels without VMS are allowed in these areas because vessel identification becomes too difficult and incidental catch vessels may be used to pass off any illegally possessed amounts.

The third category of area under the area rotation plan is the open area which allows for any vessel to fish for any species under applicable rules. This poses no enforcement concerns.

The fourth category, long-term closure, is enforceable through the use of both VMS (to ensure VMS equipped vessels do not fish within the closed area) and aerial/surface patrols. This closure would allow only vessels using gear not prohibited under the closure to fish.

8.9.1.2 Mechanical area rotation with fixed area boundaries

This alternative would require areas to open and close according to a fixed schedule (3 years open/3 years closed or 5 years closed/1 year open). The shapes/sizes of some of the areas designed off of the New England coast (such as GB3) do not meet the general enforcement recommendation of large, plain shaped areas however the proposed areas off the mid-Atlantic do meet the area criteria. Larger areas with straight line boundaries and the ability to provide a buffer between the area boundary and the scallop stocks would enhance enforceability of this alternative. Overall, the long duration of the closures and a predetermined rotational schedule are very helpful to enforcement of this area rotation alternative.

8.9.1.3 Adaptive closures, for a fixed duration and with fixed area boundaries

Adaptive closures with fixed duration and fixed area boundaries make notification and planning of enforcement resources possible. Boundaries need to be set sufficiently back from scallop beds to allow for effective protection of stocks. If transit of closed areas is an option, gear stowage requirements must be used. The current gear stowage requirements are adequate and allow for effective enforcement from aerial and surface enforcement platforms. VMS continues to be an extremely valuable enforcement monitoring tool in any closed area management plan.

Adaptive closures and re-openings with fixed area boundaries

Adaptive closures of areas with fixed boundaries are addressed in 8.9.1.2 above. The change in this alternative from that above is the varying re-opening schedule. The only enforcement concern is that there must be adequate notice to fishermen to ensure reasonable ability to comply with the closure. The same adequate notice should be sufficient for enforcement personnel and patrol units to effectively enforce the closure. VMS would also be a valuable enforcement tool in this situation as well.

Adaptive closures and re-openings, with fixed boundaries and mortality targets or frequency of access that vary by area

The enforcement issues raised above would also apply to this alternative.

Adaptive closures and re-openings, with adaptive boundaries identified by survey when the areas are closed

Any management plan that changes the dates and shapes of closed areas will include a significant cost of notice for, and identification of, the closed areas to fishermen and the Agency. Closure dates must be set well in advance and closure area boundaries must be well known prior to any closures. The enforcement concerns in adaptive closures and adaptive boundaries is to ensure adequate notice is provided to fishermen and enforcement. Historically, vessels have "accidentally" entered newly closed areas and significant time (both fishermen's, enforcement's and NOAA General Counsel's) has been spent trying to determine whether such incursions were intentional or accidental. With sufficient notice and with areas following the precepts for enforceable closed areas, this alternative does not provide additional enforcement concerns from other closed areas.

Closure shaping rules

This alternative would create "blocks", "each approximately 75 square nautical miles in size, by the existing grid of latitude and longitude lines at 10 minute intervals." The blocks would be further grouped into five areas (Gulf of Maine, Georges Bank, South Channel, Hudson Canyon, Southern). Closures would be applied to these areas in various ways by this alternative. From the enforcement perspective, the discussion of possible scenarios of closed and open areas created by this alternative seems fairly complicated. We again recommend a simple, long term closure practice whenever possible.

Closure process

Enforcement concerns related to the closure process is limited to ensuring that whatever process is selected provides adequate notice to both fishermen and enforcement units/personnel to ensure there is a legitimate ability to comply with, and enforce, closures. Short notice closures obviously create a difficulty for both patrolling units and fishermen at sea. The process outlined in this alternative provides adequate notice to be provided to all concerned.

Area based management – with area specific fishing mortality targets without formal area rotation

This proposal suggests that vessels would receive area specific effort (trips, days, etc.) allocations to reduce localized overfishing. This proposal would remove area closures and there would be no formal rotational system. In addition to area specific effort allocations for each vessel, this proposal also would allow for "voluntary participation in a trading day-at-sea mechanism".

From the enforcement perspective, this proposal would pose significant challenges to effective enforcement. The overall proposal would require monitoring of every vessel's activity to ensure they did not exceed their individual effort allocation in each specified area. The only effective mechanism to approach this from the enforcement perspective would be mandatory VMS on all vessels involved in the scallop fishery. This, in and of itself, would increase resource needs by enforcement in order to determine if the VMS system and personnel can adequately monitor the additional vessels.

Trading of allocations poses additional concerns and administrative burden on the agency. If considered, enforcement would need to continually know the amount of allocation effort held by all vessels. The enforcement stand would be to set an annual deadline by which all trading/transferring of allocation is completed by with no allowance for trades/transfers beyond that date for the current fishing year. Enforcement by air/sea patrols would be considerably more challenging when each vessel holds varying, individual allocations for each specified area. It would require a constant "feed" of vessel allocation use and remaining amounts. Effective enforcement is unlikely under this proposal.

Georges Bank access to groundfish closed areas

Under this alternative, portions or all of the four groundfish closed areas may be opened for scallop fishing on a periodic basis. The three options proposed under this alternative are 1) access to all non-HAPC areas by scallopers, 2) access to areas opened by Framework Adjustment 13 and 3) no access.

Increasing the minimum ring size to 4 inches in all or select areas

The first option under this alternative will increase ring size to 4 inches everywhere. A region wide (all areas) increase in the dredge ring size does not introduce any difficulties for enforcement.

The second option under this alternative would increase the ring size only for vessels fishing within re-opened areas. Varying gear requirements from area to area presents similar challenges to enforcement as those faced with proving the use of net liners. This would be very difficult to catch and extremely resource intensive. If varying gear restrictions are imposed, it will be critical to require vessels fishing within the re-opened areas to possess only dredges with four-inch rings. Enforcement of this alternative will rely mainly on at-sea boardings of vessels engaged in fishing. Dockside enforcement could only be accomplished with a regulation prohibiting possession of gear not compliant with requirements in the area fished combined with VMS tracking to verify area fished.

Gear specific day-at-sea allocation adjustments based on equal mortality per day-at-sea

Gear specific DAS allocations - No specific enforcement concern. Though a standard baseline on DAS, regardless of gear type, would enhance the enforcement effort.

8.9.2 Alternatives For Allocating Effort

Individual day-at-sea allocations by management area

Day-at-sea accounting for various areas would be significantly enhanced through the use of VMS on all vessels involved in this management regime.

Area-specific trip allocations with possession limits and day-at-sea tradeoffs

This alternative offers a management system similar to what is in use with the Hudson Canyon area now. Vessels with limited access permits would be allowed to take a specified number of trips into a "re-opened" area. There would be a possession limit and a day at sea tradeoff for trips into these areas. Since limited access vessels have VMS requirements already, there are no enforcement concerns with tracking vessel trips into the "re-opened" areas and for the day at sea accounting for these area trips. Without universal VMS coverage, reliance will be on at sea/aerial enforcement to detect non-VMS vessels from entering the area as well as to prevent transferring of scallops harvested beyond the possession limit to non-VMS vessels. Furthermore, a vessel must not enter or exit a "re-opened" area more than once per trip.

One-to-one exchanges of area-specific allocations (days-at-sea or trips)

Allocation trading occurs now in the surf clam/ocean quahog fisheries with trading limited to one time per year which is controlled by NOAA/NMFS. Enforcement's recommendation on any consideration of a similar trading/exchanging of allocation effort in the scallop fishery should be patterned after the surf clam/ocean quahog system, which has been successful.

Closures

These alternatives all discuss closed areas for varying reasons. Enforcement recommends following the guidance provided in the "Precepts for Efficient Fisheries Enforcement". Again, use of VMS for all involved vessels would enhance enforceability of the closed area regardless of the reason for the closure. Increased use of VMS would, however, require additional enforcement resources for monitoring as well as verification that the system is prepared to handle the increased vessel monitoring load.

Reduce the maximum dredge width to 13 feet

Region wide reduction of dredge size does not pose any enforcement related problems. As the current dredge width requirements, this alternative would rely on at-sea boardings to determine compliance with a reduced dredge width.

Restrictions on rock chains

Region wide restriction on rock chains does not pose any significant enforcement related concerns. As with other gear restrictions, this alternative would rely on at-sea boardings to determine compliance with this restriction.

Habitat research funded through scallop TAC set-asides

No enforcement issues for this alternative beyond ensuring enforcement entities are notified of authorized research occurring in areas and/or with gear not authorized for other vessels.

Area based management and rotation

These alternatives are addressed in Section 8.9.1.

Increasing dredge ring size to 4-inches

Region wide increase in ring size does not pose any enforcement related problems. As the current ring size requirements, this alternative would rely mainly on at-sea boardings to determine compliance with increased ring size.

8.9.3 Alternatives For Reducing Bycatch And Bycatch Mortality

Area rotation

This alternative is addressed Section 8.9.1.

Increasing the minimum ring size to 4-inches in all or select areas

Any changes to gear requirements should be uniform throughout the industry regardless of areas fished as discussed previously. Beyond that concern, there are no additional enforcement issues related to increasing the minimum ring size.

Increase minimum twine top mesh to 10-inches in all or select areas, and/or specify how twine tops should be installed in dredges

Any changes to gear requirements should be uniform throughout the industry regardless of areas fished as discussed previously. Beyond that concern, there are no additional enforcement issues related to increasing the minimum twine top mesh to 10 inches.

Gear modifications based on recent research

No enforcement related concerns can be raised until specific gear modification requirements are identified.

Area-specific possession limits for some finfish species

Varying possession limits for different species in different areas likely will be difficult to enforce, especially without universal VMS coverage. Prohibition of retention of certain species would be readily enforceable in both at-sea and dockside enforcement boardings. If bycatch limits of various finfish is dependent upon area fished, universal VMS coverage would greatly assist in this effort and make such limits much more enforceable.

Area specific TACs for some finfish species

With area specific TACs on finfish and area closures based on the bycatch of finfish taken by scallop vessels, there will be an increased emphasis on the need for accurate reporting. This alternative calls for an increase in observer coverage to help improve the accuracy of estimated bycatch in the various areas. The enforcement concerns related to increased observer coverage are addressed in Section 8.9.5.

Area-specific seasons to avoid bycatch

Seasons set in advance to avoid bycatch in the various areas do not pose any unique enforcement concerns. Areas should continue to follow the precepts laid out by the enforcement committee and the Council when delineating closed areas which are enforceable.

Long-term, indefinite closures to avoid areas with high bycatch levels

Long term closures of areas which meet the general recommendations for closed areas (large areas, straight boundaries etc.) would be the most enforceable option to protect high bycatch areas. This closure would be most effective toward vessels equipped with VMS as other vessels would require at sea or aerial patrol units to enforce the closed areas.

Develop a protected species program

This alternative focuses on the data collection procedures, observer training, and analyses needed to address the Council's concerns related to protected species (turtles). At this time, there are no enforcement issues raised by this measure until specific gear alterations are recommended based on the increased data gathering/analysis.

8.9.4 Alternatives For Managing Scallop Fishing By Vessels With A General Category Permit Or Fishing For Scallops When Not On A Day-At-Sea

Incidental catch permit with a reduced possession limit; general category permit for targeting scallops and enhanced reporting requirements and area specific or overall TACs

This alternative would have a new general category permit issued to vessels who intend to target sea scallops, with enhanced monitoring and reporting requirements. This permit would allow the option of general category vessels being authorized to fish in "re-opened" areas. A second permit would allow vessels to retain smaller amounts of scallops as bycatch when targeting other species. Vessels would be allowed to obtain one or both permits. This permit would also allow for the sale of the scallop bycatch unlike the present 40 lb personal use provision. The sale of incidental take scallops will complicate enforcement efforts to ensure accurate reporting and increase the need for enforcement presence to ensure incidental take scallops are reported.

General Category Permit

The requirement to obtain a VMS unit to participate under this "new" general category permit would enhance enforcement's ability to ensure area rotation compliance. Furthermore, enforcement would be able to adapt VMS to meet future regulatory changes that may deal with monitoring DAS use per area fished. There will be an increase in enforcement resources needed to monitor increased VMS usage in this alternative if it is adopted.

Incidental Catch Permit

In order to enforce the possession limits fairly, a vessel must not be able to combine the limit prescribed under the General permit with that prescribed under the incidental permit when a vessel carries both permits.

Open access for vessels to obtain either an incidental or general category scallop permit; no TAC would apply except possibly in re-opened scallop management areas; possession limits for each open access permit

This alternative also provides for two permits as outlined above however this option has vessels participate in the call in system and would have the operator call in to report any trip which exceeded the incidental catch possession limit. Once a vessel exceeded 45 days of scallop fishing trips, he would be required to operate a VMS in lieu of the call in system. This alternative poses several enforcement concerns including enforcement of a provision requiring call in for trips which exceed the incidental catch limit. A potential scenario would be for the vessel to call in and report when enforcement is present while claiming the incidental amount or less when enforcement is not present. By requiring VMS after 45 days, there will be increased incentive to risk fishing without calling in so to prevent hitting the 45 day threshold. This will require an increased enforcement presence both dockside and at sea to detect/prevent these types of violations.

General Category Permit

This alternative (as outlined above) would be similar to the current system up to the 45 day threshold and would require trip limits (preferred option is same as current 400 lb limit per trip). Enforcement currently has insufficient resources to adequately address enforcing trip limits in many areas due to the need to be present when the vessel hits the dock. Without an ability to monitor vessel location (VMS), this will continue to be an enforcement problem under this alternative.

Incidental Catch Permit

This alternative will allow for retention of bycatch amounts of scallops (proposed 20 lbs per day-at-sea up to 160 lbs per trip) for commercial sale. The enforcement issues are similar to those outlined above as to resources needed to ensure trip limits are complied with. By allowing sale of the scallops, incentives are increased to exceed the limits when enforcement presence is low and scallop prices are high.

8.9.5 Alternatives For Improving Data Collection And Monitoring

Adequate observer coverage and funding by day-at-sea or TAC set aside

As acknowledged in other alternatives, the accuracy and reliability of bycatch reporting is questionable. In order to achieve the level of reliability necessary for appropriate management decisions, this alternative outlines the need for an increase in observer coverage to monitor non-target species TACs as well as to comply with National Standard 9. An increase in observer coverage does not pose any enforcement related concerns and is beneficial to overall monitoring of fishing activity. In other regions of the country, increases in observer coverage have had associated increases in enforcement related situations requiring resources to respond to. The level of any potential increase in enforcement related situations associated with this alternative appear to be minimal initially however sustained increases in observer coverage could raise the number of incidents requiring enforcement response. This alternative also raises the need to evaluate observer related regulations to ensure they are adequate to encompass the needs of an increased observer presence at sea. Included with the increase in observer coverage will be the need for involved vessels to comply with the safety requirements (obtaining USCG Safety Exam decal) in order to carry an observer.

Bag tags and standard bags – Alternative 1

Although there are potential enforcement gains from a bag tag requirement, it remains unclear as to what the intent of this program is. The limited benefits appear to be far outweighed by the costs and administrative burden of implementing a bag tag program that would be able to truly enhance the enforcement of possession limits. A number of concerns have been raised regarding this alternative including the following: The administrative burden of accounting for and issuing tags would need to be placed on NOAA/NMFS; enforcement time/resource intensive to document a violation and make a case; fairly easy to falsify tags; creation of a "black market" for untagged scallop bags which will include bags with no vessel identifiers on them. Dealers would be able to argue that such bags came from other dealers. Getting paperwork for such transactions would be difficult, especially with NOAA's current lack of subpoena power.

Issues likely to arise with a bag tag system include "mis-tagged" cases where vessels have the wrong tags or some bags in a trip have missing tags (overlooked, fell off, etc.). In order to overcome some of the enforcement concerns, bag tags would have to be required to remain on the bags through the first point of sale beyond the dock or the likelihood of bags being opened immediately upon landing will complicate enforceability. Possession of untagged bags would need to be a violation either on the vessel or at the dealer level.

Issues related to standard bag enforcement would require agents/officers to measure bags unless there is a standardized/certified bags. The level of enforcement resources needed to empty bags in order to measure and ensure compliance with standard bag dimensions during boardings would not be feasible. If this alternative were adopted, the standard bag material would have to be identified, the dimensions set and consideration of a "certification process" would need to be considered.

With the ease of being able to offload untagged bags if enforcement is not present at the moment of landing, this alternative may not be as effective at preventing trip limit violations as is projected. If this alternative becomes a preferred alternative by the council, it should be anticipated that it will require an extensive regulatory scheme in order to add benefits to enforcement.

Bag tags and standard bags – Alternative 2

See above discussion on "bag tag" enforcement concerns.

Require vessels to make daily reports of vessel trip report (VTR) data through the vessel monitoring system (VMS)

The goal of improving the accuracy and monitoring of harvest information in a more "real time" manner is supported by enforcement. As explained below, there are enforcement concerns to the portion of this alternative proposing that these reports replace the VTRs currently signed and submitted by the vessel operator. Unless the accountability and accuracy concerns outlined below can be adequately addressed, enforcement can not support the replacement of the VTR through the use of daily electronic reports.

Replacement of vessel trip report (VTR) with effort reporting via VMS, real-time landings reporting by dealers, and discard characterization by enhanced observer coverage.

There is currently a strong reliance upon written reports in order to identify "knowing" violators from those simply making a mistake. Removal of the "paper trail" will increase the likelihood of enforcement resources being needed to respond to unintentional errors (entering the wrong electronic information) in order to determine veracity of suspected violations. In addition, there is a strong enforcement need to be able to definitively identify the individual responsible for making the report (i.e. signature). If this alternative is to be enforceable, technology for electronic signatures as well as the legality of accepting electronic signatures through the VMS unit must be examined and fully analyzed. Until such time that the verification of the reporting person's identity is possible and methods for minimizing unintentional errors, there will remain a need from the enforcement community to have a written record retained/submitted. One potential solution for this alternative would be use of an electronic signature or code combined with a print out capability which would allow the report to be submitted electronically while a copy of the report must be printed, signed and retained by the responsible party.

Require all limited access vessels to operate a vessel monitoring system (VMS)

Under this alternative, the term "limited access vessels" means "occasional" scallop fishing vessels. Enforcement supports the goal of this alternative to ensure "equitable" monitoring for the various sectors of the scallop fishing vessels. In addition, VMS has demonstrated its ability as a reliable enforcement tool and increased use would likely enhance enforceability of several provisions being considered by amendment 10. One caveat which must be considered in evaluating any increase in VMS use is that expansion of the system will likely require an increase in enforcement resources in order to adequately monitor the increased number of vessels operating under the VMS system.

Scientific resource surveys conducted with industry vessels and crew, funded by TAC/day-at-sea set-aside and authorized as scientific research

No enforcement related concerns exist in this alternative beyond the need for enforcement to have prior notification of authorized scientific research activities which would otherwise be a violation of existing regulations (i.e. in closed area, prohibited gear type, exceeding possession limits etc.).

8.9.6 Alternatives For Enabling Scallop Research

The only enforcement related concern in this section of amendments is the need for prior notification of vessels authorized to conduct research or experimental fishing. In addition, enforcement must have knowledge of the research authorized (i.e. surveys in closed areas, use of unlawful gear etc.). Prior notice is required in order to ensure patrolling aircraft and vessels can be notified on the research ahead of time. Vessels conducting scientific research or experimental fishing should also be required to have onboard a letter of authorization of experimental fishing permit onboard the vessel to present to boarding personnel if necessary. It also seems reasonable that only vessels that have no significant violations would be allowed to participate, unless authorized by NOAA GCEL.

9.0 INITIAL REGULATORY FLEXIBILITY ANALYSIS (IRFA)

9.1 Introduction

The purpose of the Regulatory Flexibility Analysis (RFA) is to reduce the impacts of burdensome regulations and record-keeping requirements on small businesses. To achieve this goal, the RFA requires government agencies to describe and analyze the effects of regulations and possible alternatives on small business entities. Based on this information, the Regulatory Flexibility Analysis determines whether the proposed action would have a "significant economic impact on a substantial number of small entities."

The main elements of the RFA are fully discussed in several sections of the Amendment 10 document, and the relevant sections are identified by reference to this document.

Problem Statement and Objectives

The purpose and need for management (statement of the problem) is described in Section 4.0 of the Amendment 10 document. The management objectives are enumerated in section 4.2 of this document.

Management Alternatives and Rationale

The proposed action is described in Section 5.1 of the amendment document. Alternatives to the proposed action are summarized in Section 5.3. Economic impacts are examined in Section 8.7.

9.2 Determination of Significant Economic Impact on a Substantial Number of Small Entities

9.2.1 Description of the small business entities

The RFA recognizes three kinds of small entities: small businesses, small organizations, and small governmental jurisdictions. It defines a small business in any fish-harvesting or hatchery business as a firm that is independently owned and operated and not dominant in its field of operation, with receipts of up to $3.5 million annually. The vessels in the Atlantic sea scallop fishery could be considered small business entities because all of them grossed less than $3 million according to the dealer's data for the 2001 and 2002 fishing years (unreported NMFS data). Table 288 shows that annual scallop revenue averaged about $615,000 to $665,600 per full-time vessel, $194,790 to $209,750 per part-time vessel, and $14,400 to $42,500 per occasional vessel during the 2001 and 2002 fishing years. Total revenues per vessel, including revenues from species other than scallops, exceeded these amounts, but were less than $3 million per vessel. Table 289 shows the revenues per full-time vessel by tonnage class.

The proposed regulations of Amendment 10 would affect vessels with limited access scallop and general category permits. Section 7.1 (Description of the Fishery) and Section 8.8 (Social Impacts) of the Amendment 10 document provide extensive information on the number, the port, the state, and the size of vessels and small businesses that will be affected by the proposed regulations. The information on the number and characteristics of vessels by the region of their principal port and permit category are also shown in Table 287. The current information on the number of scallop permits for the years 1994 to 2003 are provided in Table 286. According to the recent permit data, there were 278 vessels that obtained full-time limited access permits in 2003, including 32 small-dredge and 16 scallop trawl permits. In the same year, there were also 32 part-time and 16 occasional limited access permits in the sea scallop fishery. In addition, 2,257 permits were issued to vessels in the open access General Category. These numbers could increase as the fishing year progresses. Therefore, the proposed alternatives of Amendment 10 are expected to have impacts on a substantial number of small entities.

9.2.2 Determination of significant effects

The Office of Advocacy at the SBA suggests two criteria to consider in determining the significance of regulatory impacts, namely, disproportionality and profitability.

The disproportionality criterion compares the effects of the regulatory action on small versus large entities (using the SBA-approved size definition of "small entity"), not the difference between segments of small entities. Amendment 10 is not expected to have significant regulatory impacts on the basis of the disproportionality criterion for the following reasons:

1. The majority of the permit holders in the sea scallop fishery are considered small business entities.
2. The alternatives included in this Amendment, including the proposed action and the nonpreferred alternatives, propose to allocate area-specific DAS allocations and controlled access area trips in the same proportion for each category of the limited access scallop permit compared to the no-action levels. The resulting changes in profits, costs, and net revenues are not expected to be disproportional for small versus large entities.
3. The proposed action and the nonpreferred options are not expected to place a substantial number of small entities at a significant competitive disadvantage relative to large entities.

The profitability criterion will apply if the regulation significantly reduces profit for a substantial number of small entities. The impacts of the final proposed alternatives on revenues, costs, and profits of an average vessel are summarized in Section 8.7.2.4 and were contrasted with the estimated values for no action. All the economic values presented in this section are expressed in 1996 constant dollars. Section 8.7.3 provides an economic analysis of the broad-range alternatives for improving the yield from the scallop stock from a long-term perspective. The analyses include scenarios considered by the Council during the development of Amendment 10 with various rotational and non-rotational options, fixed or adaptive area boundaries, mechanical and adaptive rotations with different closure duration or maximum biomass closed, and with 3.5-inch or 4-inch rings. The short-term economic impacts of various measures, including rotation, area-access options, overfishing definitions, habitat closures, trip limits, and other proposed measures, are analyzed in Section 8.7.4.6, including the impacts on small business entities and on an average vessel in Section 8.7.4.8. These results are summarized below.

9.2.3 Economic impacts of the proposed measures (i.e., final alternatives)

Section 5.1 describes the final alternatives proposed by the Council and discusses the rationale for the Council's choice of each component of the proposed option. The final alternatives include rotation with 4-inch rings, habitat closures, controlled access to the protected areas of Georges Bank and Hudson Canyon, area-specific DAS schedules, trip limits and one-to-one exchange controlled access trips. As a part of the rotation system, Amendment 10 will also close and area in the Mid-Atlantic, known locally as "the elephant trunk", where small scallops are abundant. The rationale and impacts of this closure is discussed in Section 5.1.3.3. The economic impacts of the final alternatives are analyzed in Section 8.7.2. Section 8.7.2.4 provides an analysis of the combined economic impacts of these measures on vessel revenues, costs, and gross profits with and without access to the Georges Bank groundfish areas and relative to no action. "No action" is defined as the continuation of the Amendment 10 DAS schedule with no access to the Georges Bank groundfish areas. The combined economic impacts of the proposed option will be positive on the majority of small business entities in scallop fishing industry. The following provides a summary of the impacts of each individual measure on economic benefits and compliance costs, although the numerical results were estimated and presented for combined impacts only:

- **Annual DAS allocations**: Amendment 10 will allocate annual DAS access vessels to achieve optimum yield from the scallop resource (Section 8.2.3). The DAS allocations will be area-specific, and one-to-one exchange will be allowed between vessels for the controlled access area trips. The initial DAS allocations and catch levels proposed by this amendment will greatly exceed no-action levels because the condition of the scallop resource allows higher fishing activity and landings at sustainable levels. As a result, vessel landings, revenues and gross profits will increase compared to no action in the short-term, as discussed below in combination with the access options.

- **Rotation with area access**: The proposed area-rotation alternative with access to the Georges Bank groundfish areas will have positive economic impacts on vessels compared to the no-action levels in the short-term from 2004 to 2007. Gross revenues will increase by over 50% during the period from 2004 to 2007. The average gross profits per year are estimated to be positive during these first four years and to exceed the no-action levels by approximately $72,000 during the period from 2004 to 2007. The impacts will be positive over the next four years (2008-2011) as well. Therefore, if all vessels were able use their area-specific DAS allocations, and if access were provided to the Georges Bank groundfish areas by Framework 16, the impacts on vessel revenues and profits would be positive both in the short- and long-term.

- **Rotation without access**: Area rotation without access will increase estimated gross and net revenues for the first three years, from 2004 to 2006, but will have negative impacts starting as early as 2007 (Table 292) if access to the Georges Bank groundfish areas is not approved. With this scenario, annual average gross revenues would also decrease by 4% per year during the period from 2008 to 2011. Gross profits are estimated to be negative in 2007 and also over the period from 2008 to 2011, whereas with no action they would be positive. In short, the proposed rotation without access to the Georges Bank groundfish areas will have a negative impact on revenues and profits compared to no action after the first 3 years of implementation (Section 8.7.2.4).

- **Distributional impacts of area rotation**: Although the proposed regulations are expected to benefit most vessels in the scallop fishery by increasing the productivity of the scallop resource, these benefits may not necessarily be equally distributed. Area rotation and closures could have differential effects on fishing families and communities, on scallop vessels, and on processors and ports. The proximity of these entities to open and controlled access areas, as well as to the areas closed for fishing because of rotation and/or habitat protection, may result in differential impacts from area rotation. These impacts may also vary according to the mobility of the vessels in accessing alternative fishing areas. Section 8.7.2.3 provided an empirical analysis of the vessels that could be impacted negatively from area-specific DAS allocations for the controlled access areas and indicated how the one-to-one exchange provision for the access allocations could mitigate some of these impacts. A comprehensive discussion of the distributional impacts from area rotation, from alternative effort allocation and habitat closures, and from other measures included in this Amendment is also provided in Section 8.8, Social Impact Assessment. These impacts are discussed below.

- **Impacts of controlled area trips and area-specific DAS allocations**: The economic impacts discussed above assumed that all vessels would be capable of fishing in the controlled access areas. There is uncertainty, however, regarding the number of vessels that will be able to fish in those areas or that will be able to trade their trips in one access area for trips to their preferred access area. The analysis presented in Section 8.7.2.3 showed that although the majority of the full-time vessels that were active in 2002 previously fished both in the controlled access areas of Georges Bank and Hudson Canyon, about 9% of them never fished in the Mid-Atlantic controlled access areas, another 17% never fished in the Georges Bank groundfish areas, and about 8% never fished in any of these areas. These three groups of vessels constitute about one third of the full-time vessels that were active in the 2002 fishing year and will be allocated trips in areas that they have not fished in the past.

  When the analysis was conducted, however, based on a sample of vessels that were active during all the years when access was provided to these areas, the percentage of full-time vessels that did not access one or more of the controlled access areas in Georges Bank and the Mid-Atlantic was reduced to 22%. Therefore, the proportion of vessels that could be affected by area-specific DAS allocations ranges from one-fourth to one-third of the full-time fleet.

  These vessels could face negative economic impacts from area-specific trip and DAS allocations if they are unable to take their trips to specific controlled access areas due to the limitations in vessel size and equipment, safety concerns, or cost factors. Although the provision that allows one-to-one exchange of controlled access area trips may mitigate these impacts, some vessels may be unable to find other vessels to exchange their allocations for the areas they would be able to fish. As shown in Table 293, controlled access revenue is estimated to constitute 45% the total scallop revenue in 2004 if no access is given and 66% of the total scallop revenue if access is provided to the Georges Bank groundfish areas. The same proportions in 2005 are estimated to be about 35% for no access and 60% with access (Table 293). The scallop revenue from even one access area trip could amount to more than 10% of the annual revenue in 2004 without access and close to 10% of the annual revenue with access to the Georges Bank groundfish areas (Section 8.7.2.4). Therefore, the loss of revenue and gross profits from controlled access trips could be significant, even if one or two of these trips could not be taken.

  In addition, because controlled access trip allocations cannot be used in open areas, overall fishing costs could increase even for a vessel that has the capability to fish in all areas. This is because if some vessels did not fish in some of the controlled access areas, it could be either because accessing them was more costly or involved some intangible costs as compared to fishing in the open areas of their choice.

- **One-to-one exchange of controlled access area DAS allocations**: To mitigate the adverse impacts from area-specific controlled access trips discussed above, the Council's proposed action includes a provision that allows for one-to-one exchange of controlled access area DAS allocations. This is expected to provide flexibility to vessels regarding which areas to fish, thereby reducing the possibility of revenue loss to those vessels that are unable to access some offshore areas due to their capacity constraints. Although, there will be some transaction costs associated with the exchange of the controlled area trips with another vessel, such as notifying NMFS of such exchange, the net impacts of exchange should result in a reduction in overall costs of fishing if a vessel is engaged in such a transaction. Administrative and enforcement costs associated with the exchange of controlled access trip authorizations should be relatively modest when compared with the potential improvement in controlled access allocation programs and reduced economic costs to the industry.

- **Habitat alternatives**: Amendment 10 proposals include measures that minimize the adverse effects of fishing on EFH, habitat and bycatch to the extent practicable. The Council's proposed habitat closure alternative-6 is described in Section 5.3.4.6. The economic impacts of the final alternatives analyzed in Section 8.7.2.4, which include analysis of impacts on vessels and small business entities, consist of the combined impacts of area rotation, habitat closures, 4-inch rings, area-specific DAS, and trip limits with and without access to the Georges Bank groundfish areas. Since the areas closed to fishing under habitat alternative 6 will also remain closed under the no-action alternative, Amendment 10 will have no additional economic impacts on vessel revenues and profits with this closure compared to no action. The areas within the boundaries of habitat closure 6, however, contain valuable scallop biomass, and as with any closure, they represent a potential revenue loss to the scallop fishery. For a further discussion of this, see below for the summary of the impacts with alternative habitat closures (Section 9.2.4).

- **Possession limits**: The proposed 18,000 lb. possession limit with 12 DAS trade-off results in maximum annual net revenues per vessel from the controlled access areas in 2004 as well as from 2004 to 2007 as an average of these years. This limit is slightly lower than the status quo trip limit of 21,000 lb. and could constrain larger vessels with the capacity to land more scallops per trip. Because of the TAC constraints and rounding method used in allocating trips to each limited access permit holder for each area, however, larger possession limits at higher DAS allocations result in a smaller number of trips per vessel. As result, a 21,000-lb. or larger possession limit generates lower average annual net revenues for 2004–2007, compared to the other possession limit alternatives (Table 3, Final Alternatives). On the other hand, it could be difficult for some vessels to land the possession limit within 12 days. In order to accommodate for this difficulty and to reduce the costs of controlled area trips to the vessels, the Council proposed that the limited access vessels should be charged no more than 12 days even if the actual trip length was longer.

- **Broken trip exemption:** Amendment 10 proposes a new broken trip procedure for controlled access area trips terminated prematurely due to an emergency, poor weather, or any other reason deemed appropriate by the captain as described in Section 5.1.2.4. This provision will allow a vessel to fish at 1,500 lb. per day for the remaining days of a broken trip. Therefore, this action will have positive economic impacts on vessels by reducing fishing costs and the losses from broken trips, and it will provide more incentive for vessels to take their controlled access trips. The vessels will need to submit a trip termination notice via VMS, and an application for DAS/trip adjustment with actual DAS use and landings. The costs of filling these applications are expected to be minimal, and be outweigh by the benefits from the broken trip adjustment.

- **Part-time and occasional vessels**: Although the economic analysis in Sections 8.7 was conducted for an average full-time vessel in the scallop fishery, the impacts will be similar to the impacts discussed for full-time vessels. This is because part-time and occasional DAS allocations will be adjusted in the same manner, proportionally to their allocation relative to full-time DAS allocations. These vessels will also be allocated trips in the controlled management areas of Georges Bank and Hudson Canyon and will have the flexibility to use these trips in any access area, provided that the number of trips does not exceed the maximum number of trips per vessel assigned to that area. In general, rotation and controlled access will have positive impacts on these vessels, at least in the short-term.

- **Impacts of general category rules:** The proposed option would prohibit vessels with limited access scallop permits from targeting scallops under the general category rules when not fishing on a scallop day-at-sea. The economic impacts of these general category rules were examined in Section 8.7.2.5. Although one-third of the limited access vessels landed some scallops under the general category rules during the 2002 fishing year, only 7% of these vessels derived more than 1% of their revenues from the general category trips. Therefore, this action will have an insignificant impact on the majority of the limited access vessels. Furthermore, this rule is expected to benefit most limited access vessels, since an increase in general category rule trips may lead to a further reduction in the DAS allocations in the future, which will penalize those vessels that do not take any general category trips. For these reasons, the Council did not select the status quo alternative of allowing the limited access vessels to continue targeting scallops under general category rules.

  Vessels holding general category scallop permits and limited access scallop vessels fishing under a multispecies or monkfish DAS would be subject to the 400 lb. scallop possession limit in open scallop fishing areas and reopened controlled access areas, including those reopened for species other than scallops. These measures will have positive economic impacts on these vessels by increasing their scallop revenues. Furthermore, Amendment 10 does not require VMS onboard for general category scallop vessels, and thus does not impose any new costs on these vessels.

- **Gear restrictions:** The gear requirements are discussed in Section 5.1.4 Increasing the minimum ring size to 4-inches is expected to have positive economic impacts. Larger rings allow more small scallops to escape capture, reducing discard mortality and improving yield. Improved yield in the future years will increase scallop revenues. In addition, gear efficiency for large scallops would increase, reducing the tow time needed to catch a possession limit or an amount that the crew can shuck. This in turn could result in lower operational expenses. Delayed implementation in regular, open fishing areas for 6 months until September 1, 2004 will allow suppliers to increase production to supply the fleet with new gear. Also, scallop vessels will be able to use existing gear for a phase-in period, replacing the old gear with new rings as it wears. Therefore, vessels may have low compliance cost from this requirement if they are able to use existing gear in open areas for the first six months after implementation. In addition, scallop vessels with limited access and general category permits must have twine tops with mesh no less than 10-inches, diamond or square mesh. Scallop vessels on controlled access trips have had to use 10-inch mesh twine tops since 1999, so the gear is readily available and can be easily adopted. A new twine top is relatively inexpensive and is frequently replaced due to wear.

- **Data collection and monitoring requirements, and TAC set-asides:** These requirements, including industry surveys and scallop research, are discussed in Section 5.1.8. Vessels with sea scallop fishing permits may be required by the Regional Administrator to carry an observer onboard. Increased observer coverage is needed to improve the estimated amount of finfish bycatch and to determine the level of sea turtle takes in the scallop fishery. The compliance costs of this requirement on vessels will be minimized, however, through the TAC and/or DAS set-asides that will allow compensation to vessel owners and crews that have paid for observers. NMFS will also initiate a cooperative industry survey to provide information for rotation area management. Vessel compensation and direct administrative costs of this survey will be recaptured from a two percent set-aside to fund research and resource monitoring. In short, although TAC/DAS set-asides will reduce part of the scallop revenue available to the scallop vessels, these funds will reduce the compliance costs for vessels by providing compensation for observer coverage. The scallop industry will also benefit from improved management made possible through research and surveys funded by TAC/DAS set-asides. Habitat research funded through these funds will improve information that could reduce habitat impacts and therefore, could eliminate the need for more conservative actions with adverse impacts on the small businesses in scallop industry.

- **Carry-over DAS:** The provision to carry over up to 10 unused open area days-at-sea from the previous year will provide flexibility to vessels about when and how long to fish, and therefore will reduce their costs and have positive economic and safety impacts (Section 5.1.2.3).

- **Bi-annual framework adjustment procedure**: As discussed in Section 5.1.9, framework process will have positive impacts on the scallop industry by adjusting the management actions to changing resource conditions. Bi-annual adjustment procedure will also reduce the uncertainty to scallop business operations from more frequent adjustments that was implemented in the past.

- **Proactive protected species program**: This program is expected to have positive impacts on the scallop fishery by helping to minimize the interactions between scallop gear and protected species and therefore, by reducing the need for more conservative actions that could have negatively impacts on the small businesses in scallop industry. (Section 5.1.7).

9.2.4 Comparison of the proposed measures with the non-selected alternatives, and mitigating factors

The RFA requires consideration of alternatives that accomplish the stated objectives of the applicable statutes and that minimize any significant economic impacts on small entities. According to the NMFS guidelines (Revised August 16, 2000). The IRFA should identify any significant alternatives that would minimize economic impacts on small entities, if such alternatives exist. If there is an alternative with less of an impact on small entities that meets the stated objectives, the IRFA should explain why the preferred alternative was selected over the alternative with lower impact. A rationale should be provided to explain any unavoidable adverse effects on small entities that are necessary to achieve the objectives.

The description of the management alternatives and rationale was provided in Section 5.0 of Amendment 10. Section 5.1 describes proposed action and discusses the rationale for the individual measures included as a part of the proposed action, whereas, Section 5.2 describes No Action and Status Quo options. Section 5.3 identifies and discusses the rationale for the alternatives to the proposed measures.

This section summarizes the economic impacts of the proposed option in comparison with the significant alternatives considered but not selected by the Council. This comparison could be done from two perspectives: 1) Proposed option is evaluated as a set of integrated measures, including effort control, area access, gear control, trip limits, bycatch reduction, and habitat protection measures; 2) The economic impacts of the individual components of the proposed option are compared to alternatives to the extent it is possible to separate the impacts of each measure from others. Validity of the second approach could be questionable, however, since the individual measures were selected by the Council to balance and complement the impacts of other measures, so that when they are implemented together they achieve the fishing mortality, habitat protection, and bycatch reduction objectives of the plan at the least practicable economic cost to the scallop industry. Nevertheless, the economic analyses from these two perspectives were provided in several subsections of Section 8.7, and relevant sections are referenced and the results are summarized below.

The impacts of the proposed option were compared to that of no action with and without access to the Georges Bank Groundfish areas in Section 8.7.2. Although these results were summarized above, in Section 9.2.3 in comparison to no action, Sections 8.7.2.1 and 8.7.2.4 compared the impacts of the proposed option also with "status quo", as an alternative to the proposed option. "Status quo" is defined as the adjustment of DAS allocations in accordance with the fishing mortality targets of Amendment 7 and current conditions of scallop resource, and includes 3.5-inch rings and no rotation (see Section 5.2 of Amendment 10 for further description of these options). The results showed that the combined economic impacts of the final alternatives, including access to Georges Bank groundfish areas, will be positive on the majority of the scallop vessels as compared to both no action and status quo alternatives. Without access, however, economic impacts from the proposed option could be negative after the first three years of implementation compared to no action. Status quo option would also have lower adverse impacts than Amendment 10 proposed action without access, both in the short- and the long-term. Georges Bank groundfish areas are a part of the rotational management areas, but access to these areas requires implementation of a joint Groundfish/Scallop framework action to allow access to a groundfish closed area and minimize impacts on finfish bycatch during the access program. The Council held the first framework meeting for Framework Adjustment 16/39 at its November 2003 meeting, which if approved will provide controlled access to the Georges Bank groundfish areas in 2004. In short, if this framework is approved, and access is provided to Georges Bank groundfish areas, the combined economic impacts of the measures included in the proposed option will be positive on small business entities in the scallop fishery. Therefore, no alternatives that minimize the adverse impacts could be identified in such a case.

In addition to the no action and status quo alternatives, other alternatives considered but not selected by the Council are described in detail in Section 5.3 along with the rationale for each alternative. Section 5.3.2 identifies and discusses the rationale for the alternatives to improve scallop yield. The long-term economic impacts of these alternatives on landings, revenues and producer benefits were analyzed in Section 8.7.3. The significant alternatives to rotational area management included no-rotation with 3.5-inch or 4-inch rings and various rotational area options with fixed area boundaries, mechanical and adaptive rotations with different closure durations or maximum biomass closed, and with 3.5-inch or 4-inch rings. No rotation options include the 'status quo" option with DAS allocations set at F=0.2, with no access to the groundfish Areas, no new habitat closures and 3.5- inch rings. Another no rotation option included 4-inch rings with uniform fishing mortality applied in all areas. The rotational alternatives included mechanical rotation and adaptive rotations with fixed or variable closure durations, various criteria for area openings and maximum biomass closed, fixed or flexible area boundaries, and rotation with 3.5-inch or 4-inch rings.

The detailed results for the rotational options are presented in Table 302 to Table 310, and the results are summarized in Section 8.7.3.1. The economic impacts on vessels and small business entities will be similar to those impacts analyzed on a fleet-wide basis. The final alternative proposed by the Council includes adaptive rotation with flexible area boundaries based on frequent surveys of the resource. The results showed that the proposed option would have positive impacts on the scallop industry compared to no rotation alternatives. This is because, it protects small scallops during their highest growth rates, and more accurately determine areas that should be closed, improving the yield and fishing efficiency. The proposed rotational option will also have positive impacts compared to the other rotational options with mechanical rotation and fixed area boundaries, and also compared to adaptive closures with more strict growth criteria[110]. In fact, these later alternatives may reduce the economic benefits slightly in the short-term compared to the proposed adaptive rotation. The economic benefits of the flexible area boundary option selected by the Council will be greater than the fixed area boundaries because closure areas could be determined optimally based on recent surveys. This option also makes it possible to devise the area boundaries so as to minimize the social and economic impacts on fishing communities located close to the controlled access and closed areas. The results also show that rotation combined with 3.5-inch rings may result in slightly higher economic benefits compared to the rotation with 4-inch rings during the first 10 years. The economic benefits of the 4-inch rings will, however, exceed the level that could be achieved from using 3.5-inch rings over the longer-term. Because of these reasons, the Council rejected no-rotation and the alternative rotation options as well as using 3.5-inch rings in favor of the proposed adaptive rotation with the 4-inch rings. Other factors in Council's decision are regarding gear changes are discussed below. Further discussion of the rationale for the proposed option and alternatives were provided in Sections 5.1 and 5.3.

Even though collective economic impacts of the final measures proposed by Amendment 10 are expected to be positive (compared to no action and status quo) with access to Georges Bank groundfish areas, some individual components of the proposed option, such as gear restrictions and area specific DAS allocations, may increase the short-term costs for some small business entities. The following provides a discussion of the individual measures in comparison with the significant alternatives.

For some components, no action and/or status quo constitute the main alternative to the proposed option. These include the proposed gear changes, broken trip exemption, carry-over days, general category rules regarding the prohibition of limited access vessels, bi-annual framework adjustment procedure, and proactive protected species program, the measures with mostly positive impacts. The discussion provided above in Section 9.2.3, summarized the economic impacts of these actions, which explained why Council selected them instead of the alternative status quo options. Also, Sections 5.1 through 5.3 provide comprehensive discussion on these proposed measures and alternatives. These analyses will not be repeated here except when needed for purposes clarification. However, the impacts of gear changes are discussed in more detail below and alternatives other than status quo and/or no action are also summarized.

Again, the proposed option, as a collection of all individual measures, including the 4 inch rings, will increase economic benefits for the small business entities compared to the no action or status quo with 3.5 inch rings. When analyzed in isolation from other measures (such as DAS allocations, rotation and access) included in the proposed option, however, 4-inch rings may have some negative impacts in the short-term compared to using 3.5-inch rings, even though in the long-term their benefits exceed 3.5 inch rings. For example, the analysis provided in Section 8.7.3 rotation for 3.5-inch rings could result in higher landings and revenues during the short-term compared to 4-inch rings. However, compliance costs associated with 4-inch ring requirement will be modest since scallop vessels will be able to use existing gear for a phase-in period, replacing the old gear with new rings as it wears. The 4-inch rings are expected to have positive impacts on the scallop industry over the long-term by reducing mortality on small scallops, and as a result, improve yield and increase scallop revenues. Also, by increasing dredge efficiency for larger scallops, 4-inch rings will reduce bottom contact time, potentially reducing EFH and bycatch impacts.

Similarly, changing twine top mesh to a minimum of 10-inch may increase costs for some vessels, although this the extra cost is expected to be small. A new twine top is relatively inexpensive and is frequently replaced due to wear. In addition, scallop vessels on controlled access trips have had to use 10-inch mesh twine tops since 1999, so the gear is readily available and can be easily adopted. More

[110] The proposed option is a revised version of the scenario ACR-3 examined in Section 8.7.3.

importantly, these gear changes are the expected to have positive impacts on EFH and will reduce bycatch. The 10-inch twine top will allow for greater escapement of many finfish species, thus minimizing bycatch. Therefore, these gear restrictions will help to prevent the need for more strict measures in the future with potential negative impacts on revenues and profits in the scallop industry. For example, without measures to keep bycatch low, it is unlikely that scallop vessels would be allowed to fish in Georges Bank groundfish areas.

In conclusion, the potential benefits from 4-inch rings and 10-inch twine top mesh are expected to outweigh the short-term costs. For these reasons, the Council rejected the status quo option, and selected to increase the ring size to 4-inch from 3.5-inch and minimum size for twine top mesh from 8-inch for the open areas to 10-inch. For further discussion on the rationale for these gear changes please see Section 5.1.4, and for their impacts on bycatch reduction. For rationale for why a mesh larger than 10 inch was not selected, see Section 5.3.5.2 and 5.3.5.3.

The proposed option includes using the status quo overfishing definition to determine the level of effort consistent with the fishing mortality reduction targets. The management using the alternative proposed overfishing definition was not accepted in this Amendment because it would allow fewer DAS allocations and would have negative economic impacts on the scallop industry in the short-term. Further discussion on the rationale for status quo and alternative overfishing definitions are provided in Section 5.1.1 and 5.3.1.1. The economic impacts of these alternatives are compared in Section 8.7.4.7.

As discussed above, the proposed option includes area-specific DAS allocations and controlled access trips, which may have negative economic impacts on some vessels by restricting their ability to fish in the least-cost areas, or assigning them trips in areas they are not able to fish. The current annual DAS allocation scheme, combined with DAS trade-offs for fishing in the controlled access areas, provided more flexibility to vessels regarding spatial fishing choices. The Council selected the area-specific DAS and trip option instead of the status quo alternative because the proposed allocation mechanism reduces the potential for overfishing of scallops in open areas, thereby increasing yield, scallop revenues and economic benefits. Further discussion is provided on the rationale for the proposed allocation mechanism in Section 5.1.2.1 and on the alternatives for allocating effort in Section 5.3.3. The proposed one-to-one-exchange of controlled access area trips is expected to mitigate the adverse impacts of area-specific DAS allocations on some vessels that have restricted capability to fish in some areas (see Section 9.2.3). One other rejected alternative to area-specific DAS allocations included adaptive area closures with output controls as discussed in Section 5.4.1. According to this alternative, area-specific TACs would be divided among the limited access permits and each vessel would be allocated area-specific pounds or standard bags. The Council rejected this individual quota proposal, with or without transferability, because at the time of discussions the US Congress had implemented a moratorium on new ITQ management plans, which would prevent adoption of such a plan by the Council.

Other alternatives to the Council's proposed habitat alternative 6 were habitat closure alternatives 1 to 9 as described in Section 5.3.4. The impacts on revenues and economic benefits from various habitat closures combined with various area access alternatives are examined in Sections 8.7.4.6 and 8.7.4.8 (Table 316 and Table 348). The results presented in those tables should be used to evaluate the relative impacts rather than the absolute impacts of these closures because they were produced using the proposed overfishing definition rather than the status quo definition selected by the Council. These relative impacts show that proposed habitat alternative 6 was ranked in the middle in terms of its impact on scallop revenues and economic benefits. In other words, other habitat alternatives, including alternatives 5a, 5c, 5d, 8a and 8b, would have less negative impacts on the vessel revenues as compared alternative 6. These and other habitat alternatives were not chosen because they were either impracticable due to the negative social or economic impacts for some fishing communities and/or did not quite meet the SFA requirements to minimize adverse impacts of fishing on EFH to the extent practicable. Further discussion on the impacts and rationale for these alternatives were provided in Section 5.1.6 and Section 5.3.4. Sections 8.5.4.14 and 8.5 provide a comprehensive analysis of the habitat alternatives including practicability assessment.

The alternative Georges Bank area access options are described in Section 5.3.2.8 and their economic impacts are discussed in Section 8.7.4.4. Overall, all options that allow access to the Georges Bank areas increase revenues, gross profits and employment significantly. The Council rejected alternative access options based on the current analysis, and because the preferred alternative allows sufficient access with positive economic benefits for the fishing industry over the next few years, while refining the shape and location of potential habitat closures. Therefore, future framework adjustments or amendments might be needed to allow controlled access to other areas of the groundfish closed areas if they are not chosen as habitat closures.

The proposed option would prohibit vessels with limited access scallop permits from targeting scallops under the general category rules when not fishing on a scallop day-at-sea. The rationale for this option was discussed in Section 5.1.5 and the economic impacts are discussed in Section 8.7.2.5, and summarized in Section 9.2.3. The impacts of and the rationale for alternatives for general category management options are discussed in Section 5.3.6, and the economic impacts are summarized in Section 8.7.4.10. One alternative option required all general category permits to carry VMS all the time. In combinations with this requirement, alternative options also included setting hard TAC 's for the General category landings either for all or for only re-opened scallop areas. These alternatives were not selected by the Council in order not to increase compliance costs on these vessels.

The alternatives for reducing bycatch and bycatch mortality are described in Section 5.3.5. Area rotation, proposed gear changes including 4-inch rings and 10-inch twine top mesh are expected to reduce bycatch, although future framework actions could include area-specific finfish TAC, and/or possession limits for the scallop vessels as discussed in that section. As discussed above, the proposed measures for data collection, monitoring and scallop research will benefit scallop industry and the compliance costs for these measures will be minimized through funding with TAC set-asides. Section 5.1.8 provides more discussion on these measures, whereas the non-selected alternatives for improving data collection and monitoring are discussed in Section 5.3.7. The Council also rejected the change in the fishing year (Section 5.3.9.4) to avoid increasing business risk associated with vessels getting new annual DAS allocations after the end of the preferred fishing season (March – June) when scallop meat yield is highest. With a later fishing year (which the Council did not select), vessels would have needed to reserve DAS until the end of the alternative fishing year to take trips during this favorable seasonal period.

9.2.4.1 Indirectly affected industries

The overall impacts of the proposed measures on regional revenues and incomes will be higher than the estimates given above because of the indirect and induced impacts. Indirect impacts include the impacts on the sales, income, employment and value-added of industries that supply commercial harvesters, such as the impacts on marine service stations that sell gasoline and oil to scallop vessels (Table 368). The induced impacts represent the sales, income and employment resulting from expenditures by crew members and employees of the indirect sectors. An input/output analysis conducted by NMFS (1998) estimated that sales, income and employment multipliers for the sea scallop fishery in the Northeast Region. Table 368 provides a list of indirectly affected sectors for the sea scallop fishing industry. Each column of this table shows the estimated proportions of revenue by directly affected sectors on purchased inputs from each of the indirectly affected sectors. The increase in the scallop landings and revenues will have positive economic benefits on these sectors as well.

The sales multiplier for the coastal counties in the Northeast was estimated to be approximately 1.8 in 1997 for the scallop dredge and trawls. If the overall multiplier for both the Northeast and Mid-Atlantic regions were close to this value, then the increase in overall sales for rotation alternatives compared to no action, on average, would range from $67 million with no access to $104 million per year with access to the Georges Bank groundfish areas during the 2004-2007 period.

These estimates should be interpreted with caution, however, since the multipliers were estimated for 1997 including only the backward linkages associated with the harvest of sea scallops, in other words, the linkages between the sea scallop harvest sector and its suppliers. The forward linkages, or the value added to sea scallops from wholesalers and retailers, are not captured by these multipliers. A lack of detailed data on dealers and wholesalers, particularly the level of imports/exports associated with the purchase of sea scallops, prohibited a proper impact assessment of these sectors. Therefore, the total sales, income and employment impacts attributed to the commercial harvest of sea scallops are likely to be higher than those indicated here.

Section 7.1.1.2 describes the processing sector. The processors, while not directly subject to the regulations, are expected to be positively affected by the increase in the domestic harvest of sea scallops from rotation and area access.

Table 368. **List of Indirectly Affected Industry Sectors**

	Percentage of total gross revenues	
SIC Sector (cost categories)	**Dredge vessels**	**Trawl vessels**
Value added	37.76	51.0
Service stations (fuel, oil, travel)	23.39	13.48
Insurance carriers	7.26	7.96
Grocery stores (food)	7.03	2.55
Iron and steel forgings (gear - dredges)	7.33	4.25
Wholesale trade (supplies, mis. expenditures,	3.97	2.76
Ship repairing (repairs)	6.99	7.18
Manufactured ice	2.09	1.80
Water transportation (rent, docking)	1.90	0.86
Prepared fresh of frozen seafood (storage,	0.96	1.06
Accounting (professional)	0.50	1.10
Combination utilities (electric, gas)	0.18	0.35
Water supply (water)	0.15	0.05
Management services (office)	0.14	0.15
Motor freight transportation	0.11	0.05
Business associations (dues)	0.11	0.07
Banking	0.10	5.33
Advertising	0.03	0.0

9.2.4.2 Enforcement and compliance costs

See Section 10.0, RIR for a discussion of enforcement costs and summary of economic impacts above (Section 9.2.3) for a discussion compliance costs of individual measures.

9.2.4.3 Identification on Overlapping Regulations

The proposed regulations do not create overlapping regulations with any state regulations or other federal laws.

10.0 REGULATORY IMPACT REVIEW (RIR)

10.1 Introduction

The Regulatory Impact Review (RIR) provides an assessment of the costs and benefits of proposed actions and other alternatives in accordance with the guidelines established by Executive Order 12866. The regulatory philosophy of Executive Order 12866 stresses that in deciding whether and how to regulate, agencies should assess all costs and benefits of all regulatory alternatives and choose those approaches that maximize the net benefits to the society.

The RIR also serves as a basis for determining whether any proposed regulations are a "significant regulatory action" under the criteria provided in Executive Order 12866 and whether the proposed regulations will have a significant economic impact on a substantial number of small entities in compliance with the Regulatory Flexibility Act of 1980 (RFA).

This RIR summarizes the effects of the proposed management plan and other alternatives considered in this amendment that has been developed to rebuild the scallop resource. The Amendment 10 document contains all the elements of the RIR/RFA, and the relevant sections are identified by reference to the document. The Initial Regulatory Flexibility Analysis, which evaluates the impacts of management alternatives on small businesses, is provided in Section 9.0.

10.2 Summary of Regulatory Impacts

- Section 8.7.3 evaluated the economic impacts of a broad-range alternatives for improving the yield from the scallop stock considered by the Council. Economic impacts of the rotational area management and non-rotational alternatives are summarized in Section 8.7.3.1. The impacts of these alternatives on fleet revenues for the first 10 years of the program are discussed in detail in Section 8.7.3.3. The impacts on producer and consumer surpluses, total benefits, and employment are discussed in Section 8.7.3.4. The long-term impacts are discussed further in Sections 8.7.3.5 and 8.7.3.6. The results included the variability of landings, revenues and benefits. Sources of uncertainty are identified in Section 8.7.3.7. The results of the long-term analyses show that the rotational management will have positive impacts on the scallop industry. Overall, all options that allow access to the Georges Bank areas increase fleet revenues, consumer and producer surpluses, and employment significantly.

- Section 8.7.4 analyzed the short-term economic impacts of alternatives considered by the Council, including rotation, area-access options, habitat closures, overfishing definitions, trip limits, and other measures. Although habitat closures will have negative impacts on scallop revenues and net national benefits to the nation (as measured by the total economic benefits comprising consumer and producer surpluses), the positive impacts of rotation and area access alternatives will offset these negative impacts. As a result, the total economic benefits relative to the no-action levels would be positive even when additional areas were closed under the various habitat alternatives. The combined economic impacts of various rotation, area access, and habitat alternatives are summarized in Section 8.7.4.6. The impacts on vessels are analyzed in Section 8.7.4.8. The economic impacts of the alternative overfishing definitions are compared in Section 8.7.4.7. Although, management by the alternative proposed overfishing definition would produce higher stock biomass and greater benefits in the long-term, but would reduce fleet revenues and total benefits in the short-term by allowing fewer DAS allocations. The final alternative selected by the Council, which requires 4-inch rings and applies a higher DAS-tradeoff for controlled access with area-specific DAS allocations will improve the results for the status quo overfishing definition by reducing the fishing mortality and increasing the selectivity of gear towards larger scallops.

- Final alternatives proposed by Amendment 10 include adaptive area rotation with 4-inch rings, habitat closures, controlled access to the protected areas of Georges Bank and Hudson Canyon, area-specific DAS schedules, trip limits, one-to-one exchanges of controlled access trips, and general category rules. The Council also decided to adopt the status quo overfishing definition to determine target F, the area-specific DAS's and TACs. The impacts of these measures are discussed individually in Sections 8.7.2.2 through 8.7.2.5, and the results are summarized in IRFA in Section 9.0 above from the perspective of vessel impacts. This section provides a summary of the combined impacts of the proposed regulations on scallop fishery, consumers and on total economic benefits to the nation. The economic costs and benefits of the final alternatives are compared with the no action alternative in Section 8.7.2.1. "No action" is defined as the continuation of the Amendment 7 DAS schedule, which will remain in effect unless these measures are amended. It also includes no access to the groundfish areas and no new habitat closures:

    - As analyzed in Section 8.7.2.1 (Final Alternatives), the proposed area rotation alternatives, with or without access to the Georges Bank groundfish areas, will result in larger landings, lower prices, larger fleet revenue, producer and consumer surpluses, and greater total benefits during the first four years of the program (2004 to 2007) compared to no action.

    - The annual fleet revenues will exceed no-action levels by $58 million during the first four years of implementation (i.e., 2004-2007) with access and by $37 million with no access. If the overall multiplier for both the Northeast and Mid-Atlantic regions were close to the value of the Northeast multiplier, then the increase in overall sales for rotation alternatives compared to no action, on average, would range from $67 million with no access to $104 million per year with access to the Georges Bank groundfish areas during 2004-2007 period.

    - The increase in the abundance of scallops available for consumption, coupled with lower prices, will increase the cumulative present value of consumer benefits (measured by consumer surplus) by $260 million with access and by almost $118 million with no access compared to no action during the first four years of the program (2004 to 2007).

    - The benefit to the producers, as measured by increase in the present cumulative value of the producer surplus for the period from 2004 to 2007, is estimated to be $112 million with access, but only $6 million with no access.

    - As a result, the annual economic impacts on the economy will be positive. The cumulative value of the net economic benefits, as measured by the sum of consumer and producer surpluses, net of no-action values, will reach $371 million with access and $124 million without access during the first four years of the proposed implementation (2004 to 2007).

    - The economic impacts of the final alternative during the following four years and in the long-term will also be positive if access is provided to the groundfish areas. Total benefits are estimated to increase by $53 million during the 2008-2011 period and by $95 million over the long-term compared to no action.

    - With no access to the Georges Bank groundfish areas, however, the economic impacts are estimated to be positive in the short-term (2004-2007) but negative in the following period and over the long-term compared to the no-action levels. Although, the proposed rotation with no access will generate revenues similar to the levels with no action, the fleet operating costs will be much higher for this option compared to no action due to a decline in landings per day-at-sea (LPUE). Consequently, the producer surplus, net of no action, will be negative during the period from 2008 to 2011 and in the long-term, resulting in a decline in total net benefits by $161 million and by $27 million, respectively.

- The increase in DAS allocations from the Amendment 7 levels will result in higher employment in the scallop fishing industry. Employment is estimated to more than double for the proposed alternatives relative to the no-action option.

- By increasing the scallop catch rates in the long run and reducing operating costs, the proposed measures expected to increase the productivity of the scallop industry.

- The proposed regulations could have some distributional impacts on fishing families and communities, on scallop vessels depending on their size, and on processors and ports as discussed in Section 8.8, Social Impact Assessment. The proximity of these entities to open and controlled access areas as well as to the areas closed for fishing because of rotation and/or habitat protection may result in differential impacts from area rotation Area-specific DAS allocations for the controlled access areas could also have varying impacts on vessels depending on their capacity to fish in those areas as discussed in Section 8.7.2.3 However, the one-to-one exchange provision for the access allocations could mitigate some of these impacts. See also Section 9.0 (IRFA) for a summary of these impacts.

- The combined economic impacts of the final alternatives including of rotation, area-specific DAS allocations, area access, habitat closures, and 4-inch rings are presented net of ‘no action’ in accordance with the regulatory guidelines, which require that the economic impacts of the proposed options be compared relative to the impacts likely to occur if ‘no action’ is taken. These impacts could also be assessed, however, by comparing the impacts of the proposed alternatives with the “status quo” scenario which approximates the management policies of the recent years. Status quo is defined as no rotation with DAS allocations are adjusted to achieve F=0.2 at the current scallop resource conditions, no access to the groundfish areas and no change in the ring size. This option was not selected by the Council because it applies a uniform fishing mortality to all areas and fails to maximize yield from the scallop resource. Table 280 includes the landings, revenue and economic benefits estimates for ‘status quo’ along with proposed rotation with and without access to the groundfish areas. Results show that the final rotation alternative would have positive impacts relative to status quo if there is access to the groundfish areas, but negative impacts in the short-term if there is no access. Over the long-term, however, the economic benefits of the proposed alternatives will exceed status quo management even with no access (see Section 8.7.2.1for further discussion).

- The cumulative impacts of the measures from Amendment 10 proposed measures, and the past actions including the Framework 11 to 15 to the scallop FMP, are estimated to be positive. Adjustment of the DAS allocations, implementation of trip limits and DAS trade-offs for controlled area access had positive impacts on the scallop industry by increasing the revenues, producer and consumer surpluses and net benefits in the past. The economic benefits of the actions proposed by Amendment 10 exceed the benefits from past actions, as reflected by the positive benefits net of ‘no action’ as well as net of ‘status quo’ with access to the groundfish areas. As a result, cumulative benefits, which measures the sum of benefits from previous and proposed actions, are expected to be positive (See also Table 152 for a summary of cumulative impacts).

The sources of the uncertainty for the economic results were identified in each major section. In addition, the sensitivity of the results to various parameters and biological inputs including the variability in the estimates, the values of the discount rate and the future values of the variables that went into the economic model, such as the future trends in disposable income and import prices, and uncertainties regarding area access are discussed in Appendix IV.

10.3 Enforcement Costs

A qualitative analysis of the enforcement concerns, cost and benefits of the proposed options is provided in Section 8.9. These include a comprehensive discussion of the pros and cons of the area rotation alternatives, alternatives for allocating effort, reducing bycatch and bycatch mortality, and alternatives for general category and incidental catch permits from an enforcement perspective. Section 8.9.5 also provides a description of the alternatives for improving data collection and monitoring, and discuss the implications of these in terms of the enforcement costs and benefits.

Despite the fact that rotational management, proposed area access programs and closures of other areas may increase the enforcement requirements and administrative burden, the monetary costs for the government may not appreciably change as long as the budgetary allocations for enforcement do not allow such an increase. Allocation of the existing resources to improve enforcement of new scallop regulations, however, would result in reduced enforcement of other management actions. In other words, the enforcement of the rotational management, area access and closures may reduce the overall efficiency of enforcement for fishery regulations in general if such enforcement requires a reallocation of resources. On the other hand, the proposed alternatives for improving data collection and monitoring, such as increased observer coverage, cooperative industry surveys and scallop research are expected to improve management of the scallop resource and increase the enforcement efficiency, offsetting some of these costs. The costs of these programs will be funded by the TAC and/or DAS set-asides as discussed in Section 8.2.4.

10.4 Determination of Significant Regulatory Action

Executive order 12866 defines a “significant regulatory action” as one that is likely to result in: a) an annual effect on the economy of $100 million or more, or one which adversely affects in a material way the economy, a sector of the economy, productivity, jobs, the environment, public health or safety, or state, local, or tribal governments or communities; b) a serious inconsistency or interference with an action taken or planned by another agency; c) a budgetary impact on entitlements, grants, user fees, or loan programs, or the rights and obligations of recipients thereof; d) novel legal or policy issues arising out of legal mandates, the President’s priorities, or the principles set forth in this executive order.

The preceding analysis shows that Amendment 10 would constitute a “significant regulatory action” since it will raise novel legal and policy issues because it introduces rotational area management, area-specific DAS allocations, one-to-one exchange of controlled access trips, automatic broken trip DAS adjustments, cooperative industry surveys, closures to protect complex and sensitive habitats, prohibiting limited access vessels from targeting scallops while not on a DAS, and the proactive protected species framework. The proposed regulations may not have an annual impact on the economy of $100 million or more, unless access is provided to the Georges Bank groundfish areas through Framework 16, in which case regional revenues could increase by $104 million, on average, during the 2004-2007 period. The proposed alternatives will not, however, adversely affect in a material way the economy, productivity, competition and jobs, public health or safety, or state, local, or tribal governments or communities in the long run. The proposed action also does not interfere with an action planned by another agency, since no other agency regulates the level of scallop harvest. It does not materially alter the budgetary impact of entitlements, grants, user fees, or loan programs, or the rights and obligations of recipients.

11.0 COMPLIANCE WITH THE DATA QUALITY ACT

11.1 SECTION 515 INFORMATION QUALITY DOCUMENTATION

11.1.1 Utility of Information Product

Explain how the information product meets the standards for **utility**:

Is the information helpful, beneficial or serviceable to the intended user?

The final rule includes: A description of Amendment 10, the changes to the implementing regulations of the FMP, and a description of the alternatives considered and the reasons for selecting the preferred management measures. This final rule implements the FMP's conservation and management goals consistent with the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) as well as all other existing applicable laws.

Is the data or information product an improvement over previously available information? Is it more current or detailed? Is it more useful or accessible to the public? Has it been improved based on comments from or interactions with customers?

This final rule was developed as a result of a multi-stage process that involved review of the source document (Amendment 10 to the FMP) by affected members of the public (through the Regional Fishery Management Council (Council) public review process). The latest information available from the Fisheries Statistics Office was used to update landings and quota figures from the proposed rule to the final rule.

What media are used in the dissemination of the information? Printed publications? CD-ROM? Internet? Is the product made available in a standard data format? Does it use consistent attribute naming and unit conventions to ensure that the information is accessible to a broad range of users with a variety of operating systems and data needs?

The Federal Register notice that announces the final rule and the implementing regulations will be made available in printed publication and on the website for the Northeast Regional Office. The notice provides metric conversions for all measurements. The Final Amendment 10 document is also available on the Council's web site in standard PDF format.

11.1.2 Integrity of Information Product

Explain (Circle) how the information product meets the standards for **integrity:**

All electronic information disseminated by NOAA adheres to the standards set out in Appendix III, "Security of Automated Information Resources," OMB Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

If information is confidential, it is safeguarded pursuant to the Privacy Act and Titles 13, 15, and 22 of the U.S. Code (confidentiality of census, business and financial information).

Other/Discussion (e.g., Confidentiality of Statistics of the Magnuson-Stevens Fishery Conservation and Management Act; NOAA Administrative Order 216-100, Protection of Confidential Fisheries Statistics; 50 CFR 229.11, Confidentiality of information collected under the Marine Mammal Protection Act.)

11.1.3 Objectivity of Information Product

Indicate which of the following categories of information products apply for this product:

Original Data
Synthesized Products
Interpreted Products
Hydrometeorological, Hazardous Chemical Spill, and Space Weather Warnings, Forecasts, and Advisories
Experimental Products
Natural Resource Plans
Corporate and General Information

Describe how this information product meets the applicable objectivity standards. (See the DQA Documentation and Pre-Dissemination Review Guidelines for assistance and attach the appropriate completed documentation to this form.)

What published standard(s) governs the creation of the Natural Resource Plan? Does the Plan adhere to the published standards? (See the NOAA Sec. 515 Information Quality Guidelines, Section II(F) for links to the published standards for the Plans disseminated by NOAA.)

In preparing the Amendment and Final Supplemental Environmental Impact Statement document, the Council(s) must comply with the requirements of the Magnuson-Stevens Act, the National Environmental Policy Act, the Regulatory Flexibility Act, the Administrative Procedure Act, the Paperwork Reduction Act, the Coastal Zone Management Act, the Endangered Species Act, the Marine Mammal Protection Act, the Data Quality Act, and Executive Orders 12612 (Federalism), 12630 (Property Rights), 12866 (Regulatory Planning), and 13158 (Marine Protected Areas). NOAA Fisheries has determined that the final rule to implement Amendment 10 to the FMP is consistent with the National Standards of the Magnuson-Stevens Act and all other applicable laws.

Was the Plan developed using the best information available? Please explain.

This final rule and the Amendment to the FMP that it implements have been approved for compliance with all the applicable National Standards, including National Standard 2. National Standard 2 states that the FMP's conservation and management measures shall be based upon the best scientific information available. Despite current data limitations, the conservation and management measures implemented under this rule were selected based upon the best scientific information available.

This information includes NOAA Fisheries dealer weighout (weight of fish landings) data from 1998 to 2002, which was used to characterize the economic impacts of the management proposals. These data, as well as the NOAA Fisheries Observer program database (1994 – 2002) and the Vessel Effort Monitoring System (VMS) program database (1998 – 2000), were used to characterize historic landings and effort, species co-occurrence in the scallop catch, and discarding. Standardized scallop survey data (1982 – 2002) collected annually by the R/V Albatross were also used to assess the stock size and fishing mortality rates, as well as used in projections of various management strategies and alternatives. Also standardized finfish survey data (1963 – 1998) were used to determine EFH designations and for comparing the effectiveness of various habitat alternatives to protect EFH. Sediment data from Poppe et al. (1989) were used to characterize bottom substrates to describe complex and sensitive bottom habitats that might be vulnerable to adverse impacts by scallop fishing.

Specialists (including professional members of plan development teams, technical teams, committees, and Council staff) who worked with these data are familiar with the most recent analytical techniques and with the available data and information relevant to the scallop fishery. A fuller description of the data used and the process the Council followed in analyzing the current status of the fishery and the potential future impacts is presented in Section 8.0.

Have clear distinctions been drawn between policy choices and the supporting science upon which they are based? Have all supporting materials, information, data and analyses used within the Plan been properly referenced to ensure transparency?

The policy choices (i.e., management measures) implemented by this rule are supported by the available scientific information and, in cases where information was unavailable, proxy reference points are based on observed trends in survey data. The management measures contained in the rule and developed in Amendment 10 to the FMP are designed to meet the conservation goals and objectives of the FMP, and prevent overfishing, while maintaining sustainable levels of fishing effort for to ensure a minimal impact on fishing communities and the environment.

The supporting materials and analyses used to develop the measures in the final rule are contained in amendment and FSEIS document to the FMP (or in previous amendments to the FMP); the various sections of the amendment document that contain the analyses and information are referenced in the rule as appropriate.

Describe the review process of the Plan by technically qualified individuals to ensure that the Plan is valid, complete, unbiased, objective and relevant. For example, internal review by staff who were not involved in the development of the Plan to formal, independent, external peer review. The level of review should be commensurate with the importance of the Plan and the constraints imposed by legally enforceable deadlines.

The amendment review process involves the responsible Council, the Northeast Fisheries Science Center (Center), the Northeast Regional Office, and NOAA Fisheries Headquarters. The Center's technical review is conducted by senior level scientists with specialties in population dynamics, stock assessment methods, demersal resources, population biology, and the social sciences. The Council review process involves public meetings at which affected stakeholders have opportunity to provide comments on the amendment document. Review by staff at the Regional Office is conducted by those with expertise in fisheries management and policy, habitat conservation, protected species, and compliance with the applicable law. The Council furthermore utilized the expertise of a Scientific and Statistical Committee and a Social Sciences Advisory Committee to review and provide critical advise on the analysis in Amendment 10. Members of these two committees are drawn from academia and state marine resource divisions to provide independent technical review (see

Section 8.1.1 for a list of membership to these committees and other technical committees that worked on Amendment 10 analyses). Final approval of the Amendment and clearance of the rule is conducted by staff at NOAA Fisheries Headquarters, the Department of Commerce, and the U.S. Office of Management and Budget.

12.0 Executive Order 13158 (Marine Protected Areas)

The Executive Order on Marine Protected Areas requires each federal agency whose actions affect the natural or cultural resources that are protected by an MPA to identify such actions, and, to the extent permitted by law and to the maximum extent practicable, in taking such actions, avoid harm to the natural and cultural resources that are protected by an MPA.

The E.O. directs federal agencies to refer to the MPAs identified in a list of MPAs that meet the definition of MPA for the purposes of the Order. The E.O. requires that the Departments of Commerce and the Interior jointly publish and maintain such a list of MPAs. As of the date of submission of this FMP, the list of MPA sites has not been developed by the departments. No further guidance related to this Executive Order is available at this time.

13.0 IMPACTS ON STATES (CZMA)

The Council has determined that the final proposed alternatives comply with the rules and regulations of the Coastal Zone Management Act. This document has been sent to coastal states from Maine to North Carolina for review of compliance with individual state's CZMA management regulations.

14.0 PAPERWORK REDUCTION ACT (PRA)

This section describes and estimates the burden (time and cost) of preparing, submitting, and administration of new data collection requirements for the proposed action. The proposed action is not identified until the Council approves the final amendment and this section is therefore reserved. The proposed action is described in Section 5.1, but this PRA analysis is under development and will be submitted with the draft proposed action.

Due to timing constraints, this document and analysis is being prepared separately, in conjunction with the proposed rule for Amendment 10, to clear the new collection of information requirements throught OMB. New collection of information requirements and their need are explained below. A formal burden-hour analysis of these new reporting requirements in Amendment 10 will be available with the proposed rule.

14.1 Broken trip procedure

The broken trip procedure allows adjustment of DAS for the controlled access area trips terminated prematurely due to an emergency, poor weather, or any other reason deemed appropriate by the captain as described in Section 5.1.2.4. The intent of this action is to reduce fishing costs and the losses from broken trips, and to provide more incentive for vessels to take their controlled access trips. This provision will allow a vessel to fish at 1,500 lb. per day for the remaining days of a broken trip. The vessels will need to submit a trip termination notice via VMS, and an application for DAS/trip adjustment with actual DAS use and landings. The costs of filling these applications are estimated to be minimal, and be outweighed by the benefits from the broken trip adjustment.

14.2 One-to-one exchange controlled access trips

The intent of the provision for "one-to-one exchange controlled access trips" is to provide flexibility to the vessels about where to fish. Under Amendment 10 regulations, DAS allocations will be area-specific in order to achieve optimum yield from individual areas with differing scallop abundance and growth potential, and thus to maximize the yield from the overall scallop resource. Although this action is expected to benefit most vessels in the scallop fishery by increasing the productivity of the scallop resource, the benefits may not necessarily be equally distributed. Some vessels could incur losses from area-specific trip and DAS allocations if they are unable to take their trips to specific controlled access areas due to the limitations in vessel size and equipment, safety concerns, or cost factors. To mitigate these adverse impacts, Amendment 10 includes a provision that allows for one-to-one exchange of controlled access area DAS allocations. This is expected to provide flexibility to vessels regarding which areas to fish, thereby reducing the possibility of revenue loss to those vessels that are unable to access some distant areas due to their capacity constraints. Although, there will be some transaction costs associated with the exchange of the controlled area trips with another vessel, such as notifying NMFS of such exchange, the net impacts of exchange should result in a reduction in overall costs of fishing if a vessel is engaged in such a transaction. Administrative and enforcement costs associated with the exchange of controlled access trip authorizations should be relatively modest when compared with the potential improvement in controlled access allocation programs and reduced economic costs to the industry.

14.3 Open area DAS set-aside for the extension of the observer program to include open scallop areas.

Vessels with sea scallop fishing permits may be required by the Regional Administrator to carry onboard an observer, whose costs will be borne by the vessel. Unlike the existing controlled access set aside, Amendment 10 expands this program to the entire fishery, applied to both controlled access areas and regular open scallop fishing areas (Section 5.1.8.1). More observer coverage is needed to improve the estimated amount of finfish bycatch in order to comply with National Standard 9, and to determine the level of sea turtle takes in the scallop fishery. Amendment 10 establishes a one percent DAS set aside to provide partial funding for this program, and to allow compensation to vessel owners and crews, which will pay for observers. The Regional Administrator will adjust the DAS charge for an observed trip or increase the vessel's annual DAS allocation by applying a constant adjustment factor that applies to each DAS on an observed trip, taking into account the average open area catch per day expected from open fishing areas and the effect that the amount has on sampling frequency. To facilitate the random observer selection process a vessel must provide NMFS with notice at least five working days prior to the date it intends to depart into a specific area via VMS e-mail messaging system or a personal computer equipped with e-mail messaging. For further discussion and analysis on this program see Section 8.2.4.

14.4 Cooperative surveys

NMFS will also initiate a cooperative industry survey to provide information for rotation area management (Section 5.1.8.2). These surveys will increase the sampling intensity and assist in estimating the distribution and biomass of scallops in specific areas. Vessel compensation and direct administrative costs of this survey will be recaptured from a two percent set-aside to fund research and resource monitoring. The vessel owners will need to submit an application form to enroll in this program which supply information on vessel specifications, including size, horsepower, and number of berths, on vessel and captain availability, vessel owner/captain experience, and estimated cost per DAS for vessel use. Although this requirement will increase the burden on respondents, the funds obtained through set-asides will reduce the compliance costs for vessels by providing compensation for observer coverage. The scallop industry will benefit from improved management made possible through cooperative industry surveys and research funded by TAC/DAS set-asides. In addition to the cooperative industry surveys, there will be a scallop research program, which will continue using the existing administrative procedures with an increase in funding to a two-percent TAC/DAS set aside (Section 5.1.8.3). The research projects under these set-aside programs are entirely covered under PRA already cleared for grants applications; thus, they do not need any additional collection.

15.0 GLOSSARY

Annual fishing mortality target – a rate of removals that when applied over a fishing year is consistent with the objectives of the FMP.

Annual potential increase – the percent increase in total or relative biomass that would occur during a one-year interval if no fishing occurs (i.e. zero fishing mortality). Projection models take into account the size frequency distribution of the population, the expected growth of individuals at each size class, and natural mortality.

Area based management – in contrast to resource wide allocations of TAC or days, vessels would receive authorization to fish in specific areas, consistent with that area's status, productivity, and environmental characteristics. Area based management does not have to rotate closures to be effective.

Area rotation – a management system that selectively closes areas to fishing for short to medium durations to protect small scallops from capture by commercial fishing until the scallops reach a more optimum size. Closed areas would later re-open under special management rules until the resource in that area is similar to other open fishing areas. Area rotation is a special subset of area based management that relies on an area closure strategy to achieve the desired results when there are sufficient differences in the status of the management areas.

B_{max} – a theoretical value when the scallop stock with median recruitment is fished at Fmax. For a stock without a stock-recruitment relationship, like sea scallops, this stock biomass produces MSY when fished at Fmax.

Banked days – the amount of days automatically charged for fishing in a re-opened area minus the days actually fished to land a possession limit. Usually thought of as a day-at-sea tradeoff, banked days enable the Council to allocate more days-at-sea in open rotation areas than would be possible without a day-at-sea tradeoff. Banked days increase as the day-at-sea tradeoff increases or the possession limit decreases, and vice versa.

Biological Opinion – an ESA document prepared by either the NMFS or USFWS describing the impacts of a specific Federal action, including an FMP, on endangered or threatened species. The Biological Opinion concludes whether or not the NMFS/USFWS believe that the actions are likely to jeopardize the continued existence of any of the protected species, and provides recommendations for avoiding those adverse impacts.

Closed rotation area – an area that is temporarily closed to postpone mortality on abundant, small scallops.

Consumer surplus - The net benefit consumers gain from consuming fish based on the price they would be willing to pay for them. Consumer surplus will increase when fish prices decline and/or landings go up.

Contagious recruitment – similar amounts of scallop settlement in related areas. When scallop settlement is above average in one area, it tends to be above average in neighboring areas.

Controlled access – a program that allows fishing in a specified area under rules that differ from the normal fishery management rules that apply to normal, open fishing areas.

Critical habitat – an area that has been specifically designated under the ESA as an area within the overall geographical region occupied by an endangered or threatened species on which are found the physical or biological features essential to conservation of the species.

Day-at-sea – is each 24 hour period that a vessel is on a scallop trip (i.e. not declared out of the day-at-sea program) while seaward of the Colregs line.

Day-at-sea tradeoff – the number of days automatically charged for fishing for scallops in designated areas, regardless of the time actually fished.

Day-at-sea use – the amount of time that a vessel spends seaward of the Colregs line on a scallop trip.

Days-at-sea accumulated – days charged against a vessel's annual day-at-sea allocations, including day-at-sea tradeoffs.

Endangered species – a species that is in danger of extinction throughout all or a significant portion of its range

ESA - Endangered Species Act of 1973 as amended.

Exploitable biomass - the total meat weight of scallops that are selected by fishing, accounting for gear and cull size, at the beginning of the fishing year[111].

F_{max} – a fishing mortality rate that under equilibrium conditions produces maximum yield-per-recruit. This parameter serves as a proxy for Fmsy for stocks that do not exhibit a stock-recruitment relationship, i.e. recruitment levels are driven mostly by environmental conditions.

Fixed costs - These costs include expenses that are generally independent of the level of fishing activity, i.e., DAS-used, such as insurance, license, half of repairs, office expenses, professional fees, dues, utility, interest, dock expenses, bank, rent, store, auto, travel, and employee benefits.

Fixed duration closure – a rotational closure that would be closed for a pre-determined length of time.

Fixed rotational management area boundaries – pre-defined specifications of areas to be used to manage area rotation.

FMP – Fishery Management Plan.

Heterogeneity – spatial differences in the scallop resource, life history, or the marine environment.

Incidental Take Statement – a section of a Biological Opinion that allows the take of a specific number of endangered species without threat of prosecution under the ESA. For the Scallop FMP, an incidental take statement has been issued for a limited number of sea turtles to be taken by permitted scallop vessels.

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111 The **average exploitable biomass** is different and is defined as the total meat weight of scallops that are selected by fishing averaged over the fishing year, accounting growth, natural mortality, fishing mortality, and gear and cull size.

IWC – International Whaling Commission; an international group that sets international quotas and/or establishes moratoria on harvesting of whales.

Localized overfishing – a pattern of fishing that locally exceeds the optimum rate, considering the age structure of the population, recruitment, growth, and natural mortality. This effect may cause mortality that is higher than appropriate on small scallops while under-fishing other areas with large scallops (assuming that the overall amount of effort achieves the mortality target for the entire stock). The combined effect is to reduce the yield from the fishery through the loss of fast-growing small scallops and the loss of biomass from natural mortality on very large scallops.

Long-term closure area – an area closed to scallop fishing for reasons other than achieving area rotation objectives. These areas may be closed to minimize habitat impacts, avoid bycatch, or for other reasons.

LPUE – Similar to catch per unit effort (CPUE), commonly used terminology in fisheries, LPUE in the Scallop FMP refers to the amount of landings per DAS a vessel achieves. This value is dependent on the scallop abundance and catch rate, but also depends on the shucking capacity of the crew and vessel, since most of the scallop catch must be shucked at sea. Since discard mortality for sea scallops is low, discards are not included as a measure of catch in the calculation of LPUE.

Magnuson Act – Magnuson Stevens Act of 1976 as amended.

MMPA - Marine Mammal Protection Act of 1972 as amended.

NAAA - The Northwest Atlantic Analysis Area was a geographic area used in the habitat metric analysis. It's boundary to the North is the Hague line, the NC/SC border to the South, the coastline to the West, and the 500 fathom depth contour to the East. (*See* **Map 52**)

NEPA – National Environmental Policy Act of 1972 as amended.

Net economic benefits - Total economic benefits measure the benefits both to the consumers and producers and are estimated by summing consumer and producer surpluses. Net economic benefits show, however, the change in total economic benefits net of no action.

NMFS – National Marine Fisheries Service.

Nominal versus real economic values - The nominal value of fishing revenues, prices, costs and economic benefits are simply their current monetary values unadjusted for inflation. Real values are obtained, however, by correcting the current values for the inflation.

Open area – a scallop fishing area that is open to regular scallop fishing rules. The target fishing mortality rate is the resource-wide target.

Operating expenses or variable costs - The operating costs measures the expenses that vary with the level of the fishing activity including food, ice, water, fuel, gear, supplies and half of the annual repairs.

Opportunity cost - The cost of forgoing the next best opportunity. For example, if a fisher's next best income alternative is to work in construction, the wage he would receive from construction work is his opportunity cost.

PDT – Scallop plan Development Team; a committee of experts that contributed to and developed the technical analysis and evaluation of alternatives (Section 8.0).

Potential biomass increase - the annual change in the total biomass of scallop meats if no fishing occurs.

Producer surplus -Producer surplus for a particular fishery shows the net benefits to harvesters, including vessel owners and the crew, and is measured by the difference between total revenue and operating costs.

Recently re-opened area – an area that has recently re-opened to scallop fishing following a period of closure that postponed mortality on small scallops. The annual TAC and target fishing mortality rate is defined by time-averaged fishing mortality that allows the area-specific target to deviate from the norm. Special rules (i.e. day-at-sea allocations or trips with possession limits and day-at-sea tradeoffs may apply.

Recruitment – a new year class of scallops measured by the resource survey. Scallop larvae are pelagic and settle to the bottom after 30-45 days after spawning. The resource survey, using a lined dredge, is able to capture scallops between 20 – 40 mm, but more reliably at between 40 and 60 mm. Recruitment in this document refers to a new year class that is observable in the survey, at around two years after the eggs had been fertilized and spawned.

Recruitment overfishing – a high level of fishing mortality that causes spawning stock biomass to decline to levels that significantly depresses recruitment. Because sea scallops are very productive, this mortality rate is substantially higher than F_{max} and the biomass where recruitment is threatened is much lower than the present biomass target.

SAFE Report – A Stock Assessment and Fishery Evaluation Report, required by the Sustainable Fisheries Act. This report describes the present condition of the resource and managed fisheries, and in New England it is prepared by the Council through its Plan Development Teams (PDT) or Monitoring Committees (MC). The Scallop PDT is the MC for the Atlantic Sea Scallop FMP and prepares this report.

Scallop productivity – the maximum average amount of biomass that can be taken from a defined area.

Shucking – a manual process of cutting scallop meats from the shell and viscera.

Size selection – in the scallop fishery, size selection occurs at two points: when the fishing gear captures the scallop and when the crew culls the catch before shucking. At the first point, size selection depends on escapement through the dredge rings, twine top, or trawl meshes. At the second point, size selection depends on the size of the catch and marketability. Small scallops are less valuable and more time consuming to shuck a pound of meats. These factors influence whether the crew retains scallops at a smaller or larger size. Size selection by the fishery is the combined effect of mortality from landed scallops, from discard mortality, and from non-catch mortality from the fishing gear. Except under certain rare conditions, most of the mortality has been associated with the landed portion of the catch.

TAC – Total allowable catch is an estimate of the weight of scallops that may be captured by fishing at a target fishing mortality rate. The TAC could apply to specific areas under area based management rules.

Take – a term under the MMPA and ESA that means to harass, harm , pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct with respect to either a marine mammal or endangered species.

Ten-minute square – an approximate rectangle with the dimensions of 10-minutes of longitude and 10-minutes of latitude.

Threatened species – any species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

USFWS – US Fish and Wildlife Service

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17.0 ACKNOWLEDGMENTS; AGENCIES AND PERSONS CONSULTED

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18.0 PERSONS OR AGENCIES RECEIVING COPIES OF THE FINAL ENVIRONMENTAL IMPACT STATEMENT FOR REVIEW

As part of the review process for consistency with NEPA and applicable laws such as the CZMA and the ESA, the Council distributed the EIS to the following individuals:

Ms. Kathleen Leyden, State Planning Office, State House Station #38, Augusta, ME 04333
Mr. Charles Evans, Office of Long Island Sound Program, 79 Elm Street, 3rd floor, Hartford, CT 06106
Mr. Tom Skinner, Executive Office of Environmental Affairs, 251 Causeway Street, Suite 900 Boston, MA 02114
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Others who also received copies of the FSEIS document for review include:

Mr. Daniel Furlong, MAFMC, 300 S. New Street, Dover, DE
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19.0 COMMENTS

19.1 Scoping Comments

Meeting summaries and scoping comments are included in Appendices 2 and 7.

19.2 Written Comments on the Draft Amendment and EIS

Written comments received during the DSEIS comment period are included in Appendix X.

19.3 Public Hearing Summaries

Appendix XI includes summaries of the seven public hearings that the Council conducted to accept comment on Draft Amendment 10 and the DSEIS.

19.4 Response to Comments

The following responses to written public comment is based on the analyses of preferred alternative and non-preferred alternative in the DSEIS, the analyses of the final alternatives chosen by the Council, and the Council's rationale for choosing the final alternatives.

19.4.1 Comments on definition of overfishing, DAS & trip allocations, and area rotation

1. ***The status quo overfishing definition has effectively promoted rebuilding of the resource and no changes are therefore needed. If the day-at-sea allocations associated with the annual target mortality rate is too high, the Council has the authority to set a lower target than indicated by the overfishing definition. Sea scallops should be managed as one stock, throughout the range, regardless of closures and area rotation.***

   The Council agrees with this strategy and has approved final alternatives that are consistent with it. Future framework adjustments may adopt lower fishing mortality targets than the status quo overfishing definition indicates and apply area-specific DAS allocations to achieve OY. NMFS has recommended a single set of biological reference points to apply to the scallop resource, which has been included in the FSEIS.

2. ***Amendment 10 should not include a change to the overfishing definition.***

   The Council recommended that the status quo overfishing definition be maintained. The rationale for this decision is found in Section 5.1.

3. ***Close area in Mid-Atlantic with high concentration of small scallops.***

   The Council recommends that the "Elephant Trunk" area be closed beginning in 2004, through

February, 2007. The rationale for this closure is provided in Section 5.1.

4. ***The rotation area management policy should not require areas to be closed every year, only allow consideration of area closures when exceptionally strong year classes occur in specific areas.***

The Council agrees and has adopted an adaptive strategy that will evaluate areas for closures when exceptional strong recruitment occurs in a reasonably-sized area that can be defined. If it become necessary, the Council may also close areas that had been depleted and where few large scallops exist to conserve small scallops and achieve plan objectives, producing OY. Except in an exceptionally bad year, there are always some areas that experience above-average recruitment. Therefore while the Council may decide to take no action to close new areas in certain years, it appears that there will usually be one or more closed rotation management areas in place at any time.

5 ***How long would the initial proposed rotation closures exist before they re-open to fishing?***

The length of rotation area management closures will depend on resource conditions, which will be evaluated at least bi-annually in a regular framework adjustment. When significant growth potential exists if an area remains closed longer to fishing and there is sufficient resource available to the fishery, the Council may extend the closure for a longer period, and vice versa. In general, the SEIS analyses (Section 8.2.1) suggest that a three-year closure will provide substantial benefits, but that longer closures could provide marginally higher yield. It all depends on the size frequency of scallops when an area closes, the recruitment the area receives while closed, and the local growth rates that are characteristic of scallops in the closed area.

6. ***The document contains no description of the environmental impact of each alternative and makes no forecasts beyond 2004.***

The environmental impact of the preferred and non-preferred alternatives were evaluated in Section 8.0, both individually and in reasonable combinations. Projections and estimates were carried out in the short-term (2004 – 2007), in the intermediate term (2004-2014), and in the long term (2022 – 2031). The forecasts incorporated uncertainty by performing 400 bootstrap iterations that allowed recruitment to vary according to statistical characteristics observed in each rotation management area during 1982 – 2001.

7. ***The proposed overfishing definition does not comply with National Standard 1 guidance because there isn't a single measure of whether overfishing is occurring***

The Council approve continuing to use the status quo overfishing definition, but nonetheless believes that the alternative overfishing definition complies with the Magnuson Act and National Standard 1, as explained in a July 29, 2003 document. Compliance with National Standard 1 is discussed in Section 6.1.1, but does not address the proposed overfishing definition (Section 3.4.1), because the Council approved continued use of the status quo overfishing definition in the Scallop FMP.

8. ***The proposed overfishing definition provides insufficient flexibility to manage the scallop resource.***

It was for this reason that the Council decided to continue using the status quo overfishing definition, even though to achieve OY, it would require the Council to use a different fishing mortality objective in future actions than the fishing mortality target included in the status quo overfishing definition.

9. ***The status quo overfishing definition does not maximize sustainable yield from the resource, without re-accessing areas that are deemed long-term closures.***

This is at the same time true and one of the problems with the status quo overfishing definition. If the fishery cannot re-access long-term closure areas (which would be an oxymoron), the Council will need to adopt more conservative fishing mortality targets than that which is defined in the status quo overfishing definition. The Council therefore strengthened the framework adjustment process to ensure that future adjustments will optimize yield.

10. ***Analysis of the status quo overfishing definition without access or rotation is an unrealistic, academic exercise, because the Council can determine a lower day-at-sea target even though the definition may allow higher amounts.***

While it is certainly true that the Magnuson Act and National Standard 1 allows (even recommends) that Councils may establish optimum yield targets that are lower than the maximum fishing mortality threshold, it has to be recognized that justifying such an action has been difficult and related action is often rare. Instead, it has been much more acceptable to establish a fishing mortality target that is slightly under the maximum fishing mortality threshold, as a risk adverse strategy to prevent overfishing and maintain biomass near MSY conditions.

Nevertheless, the Council should be aware of and analyze foreseeable actions that may have an adverse impact. One of these is if the status quo DAS allocation continued and the fleet began utilizing 100% of the DAS allocations. Under such a scenario, the analysis shows that fishing mortality in open areas, particularly in the Mid-Atlantic region, would rise and total area swept (a useful indicator of adverse impacts) would increase considerably from present levels.

11. ***The issues with the status quo overfishing definition are long term and are unlikely to cause problems in the short term.***

Problems that will cause the Council to use lower fishing mortality targets than indicated by the status quo overfishing definition appear to become problematic as early as 2006. The Council will re-evaluate the current allocations and fishery management in the next framework action for the 2006 fishing year. If the Amendment 10 action is more conservative that we expect, or scallop recruitment is better than expected, the Council may be able to continue using the present fishing mortality target. Otherwise, it will need to adjust this target or take other actions to achieve OY and minimize adverse impacts on the environment.

12. ***DAS reductions are unnecessary, but if they are needed, effort should be reduced through a buyout program.***

Area-specific DAS adjustments are needed to keep fishing effort and scallop mortality in balance with the productivity of the resource to produce optimum yield. The scallop resource and the fishery have benefited from above average recruitment recently, but there is no reason to expect that above average recruitment will continue indefinitely.

The Council has therefore adopted an adaptive policy of setting DAS allocations, which may require reductions or possibly allow an increase compared with current DAS allocations. Capacity reductions were considered by the Council in the late 1990s and resoundingly rejected by the fishing industry. In future actions, the Council may re-consider capacity reductions, but cannot allocate or obligate funds for a buyout. Congress may authorize a buyout or the industry may initiate a buyout program, which could go hand-in-hand with permit stacking or consolidation through a future FMP action to provide the remaining fleet with more profitable allocations.

13. ***Actual DAS use should be counted in controlled access programs, taking into account factors such as breakdowns, weather, and medical emergencies.***

    Amendment 10 has liberalized the ability for a vessel to apply for a DAS rebate for trips that are terminated early due to factors such as the ones listed. A DAS tradeoff is applied to controlled access trips to allow vessels to fish at a more deliberate pace where catches are high, offering the vessel the ability to carry fewer crew members, fish more safely, seek areas with the most valuable scallops, and/or avoid areas with high bycatch.

14. ***Changing the fishing year from March 1 to September 1 would be a hardship to industry, because of the effects of weather in the fall and poor yield due to scallop spawning.***

    The Council agreed and retained the current scallop fishing year despite the short window between the release of survey results and the start of the next fishing year, allowing too little time to prepare a SAFE Report and prepare a framework adjustment. As a result, some analyses for the framework adjustment will depend on the prior year's scallop survey results, augmented where possible with more recent data.

15. ***Several comments opposed new closed areas.***

    Scallop area closures are a necessary and integral part of area rotation. At the present time, there are no new area closures where there are small scallops that should be protected while they grow to optimal size. With access to the Georges Bank closed groundfish areas and no closures, there would be no new areas to open under the area rotation program when the controlled access program for the Hudson Canyon Area no longer applies.

    As part of area rotation, the Council determined that closed areas may be necessary to protect large concentrations of small, vulnerable scallops. Accordingly, the Council recommends a closed area to the south of the existing Hudson Canyon Access Area to be called the "Elephant Trunk" area, based on a large concentrations of small scallops that would benefit from 3 years of closed area protection.

16. ***Many comments supported area rotation and specific area rotation alternatives and policies. Some commenters supported fully adaptive rotation, while others supported more simple approaches such as mechanical rotation. Many comments supported the inclusion of access to the Georges Bank groundfish closed areas in area rotation programs. Some supporters of area rotation only supported area rotation if access to the groundfish closed areas is allowed.***

    The Council recommends the fully adaptive area rotation program (Section 5.1.3.2) based on the expectation that the program will provide the most benefits to the resource and the industry, while providing flexibility for managers and integration of industry-based cooperative resource surveys. The rationale for the Council's selected area rotation program is provided in Section 5.1.

17. ***The number of area access trips must be increased from the projections included in Amendment 10.***

    Increasing the number of trips for controlled access areas would require either an increase in the TAC or a decrease in the possession limit and/or number of days-at-sea charged per trip. Raising the TACs would cause scallop biomass to decline quicker than is desired and reduce TACs and trip allocations in 2005 and future years. Reducing the scallop possession limit and/or the DAS charge per trip would increase fishing costs and reduce beneifits to the fishery. Strong support for either approach was not apparent in public comment.

Framework Adjustment 16 that is under development to consider alternatives to minimize finfish bycatch will also re-estimate the projected biomass using updated survey data from the annual NMFS resource survey and from a new SMAST video survey, which will become available for analysis. Re-estimating biomass may allow the FMP to allocate additional trips, or it may reduce the allocations where biomass has declined in comparision to projections in Amendment 10.

18. ***Do not reduce DAS from 120.***

The Council established DAS allocations based on the fishing mortality objective required by the FMP, most recent resource status information, and the area rotation program included in Amendment 10. Current analysis indicates that a 120 full-time vessel DAS allocation may not achieve plan objectives and fishing mortality targets. DAS may be lower or higher than 120 DAS for full time scallop vessels, as adjusted through the biennial framework process, based on the condition of the resource and the area rotation measures in place or recommended in each framework. If average scallop recruitment is higher than estimated from the 20-year time series, higher DAS allocations than estimated by Amendment 10 may be sustainable. If the rotation area management program works better than anticipated, it also may support a higher DAS allocation. Current projections, however, indicate that allocations of 120 days or more are not sustainable and would not prevent overfishing, unless large amounts of scallop biomass are unavailable to the fishery and local overexploitation occurs on scallops that remain accessible (causing catch per DAS to drop).

19. ***Allow broken trip exemption.***

The Council agrees and recommends the broken trip exemption program described in Section 5.1.2.4.

20. ***Replace Amendment 7 DAS schedule.***

Amendment 10 replaces the rigid DAS schedule with an adaptive process that response to resource conditions, mortality caused by a DAS, and the amount of vessels fishing to achieve the fishing mortality rate associated with optimum yield. In the absence of this adaptive process through bi-annual framework adjustments, the 2006 DAS estimates in Amendment 10 will replace the default DAS allocations from Amendment 7.

19.4.2 Comments on other scallop management proposals

21. ***Some comments urged the Council to maintain 3½" rings while others supported 4" rings either in selected areas/situations or in all areas.***

Analysis shows that the benefits of requiring a 4-inch ring greatly exceed the cost of the change-over. Extensive experiments and field trials show a substantial increase in efficiency and yield (Section 8.2.8), increasing yield-per-recruit by 5 percent and increasing catch efficiency by 10-15%. The Council approved delaying full implementation to September 1, 2004 to allow industry to adjust and allow for replacement of existing equipment as gear wears out.

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22. ***Use standard bags and bag tags.***

The Council disagrees that standard bag and bag tag programs are sufficiently developed at this time to apply to the entire fishery. A pilot study in cooperation with Law Enforcement agencies may be needed to evaluate the program's utility and cost (or savings).

23. ***Amendment 10 should include restrictions on net boats.***

Many opposed these proposed restrictions, because it would unfairly penalize a fishery sector that was incapable of switching to more selective gear. The Council will encourage research on improving the selectivity of scallop nets and the FMP will retain the opportunity for vessels with net-authorized limited access permits to switch to dredges, including an upgrade in the DAS category when using small dredges and fewer crew.

24. ***Amendment 10 does not take into account how the proposed alternatives affect families and will be unfair.***

The economic and social impacts are analyzed and discussed in Sections 8.7 and 8.8, and an analysis of fairness and equity is provided in Section 6.1.4. The proposed action is expected to improve yield and economic benefits to fishermen and coastal communities, even though less fishing may be required. Some reduction in landings to sustainable landings may be required, however, but these landings are expected to be higher than those estimated to occur under current regulations.

25. ***Scallop management is a success story and no major changes are needed.***

The Council disagrees that changes are unnecessary. Scoping comments indicated that the FMP was not doing enough to maximize yield from the scallop resource, to minimize bycatch and bycatch mortality, and to minimize impacts on EFH. Furthermore,NEPA requires NMFS to update the EIS and analyze the cumulative effects of the FMP on the human environment and NMFS was under a court order to re-evaluate the EFH components of the EFH, considering alternatives to minimize adverse effects on EFH.

Amendment 10 has been in development for over 3 years in order to devise an effective area rotation management scheme to improve yield from the scallop resource through area-based management. The rationale for the Council's selection of alternatives is provided in Section 5.1.

19.4.3 Comments on fishing under general category rules

26. Area rotation closures could have direct and indirect effects on small, general category vessels that target sea scallops inshore. The proposed area rotation alternatives could close some traditional inshore areas and vessels are not well equipped to travel to other offshore areas to fish. Indirectly, rotational closures could cause large limited access vessels to target scallops in these small inshore beds, where it would deplete the resource for the small inshore vessels.

The Council agrees, but will consider this issue on a case-by-case basis when evaluating the size and boundaries of area rotation closures under the flexible boundary rotation area management system.

27. ***If the rotation management area system includes inshore areas where small general category vessels fish, the boats should be exempted from the closure or have a lower possession limit while the area is closed to limited access vessels. Areas near Cape Cod should be split into two or more parts, so that the entire part of the rotation management area doesn't close at once.***

The Council decided that the best way to respond is through evaluation of flexible area boundaries. Exempting general category scallop vessels from rotation area management closures could create enforcement problems and cause a reduction of benefits from the closures.

28. ***Prohibiting scallop day fishing for vessels with limited access scallop permits is unfair and discriminates against scallop fishermen.***

The Council decided to prohibit vessels from targeting scallops by a single vessel under both limited access and general category regulations to close a loophole and promote conservation. This will prevent the erosion of limited access DAS allocations if this practice increases fishing mortality, and as a result vessels with limited access scallop permits will benefit. Vessels with limited access scallop permits that day-fish will need to do so on a scallop DAS or may relinquish the permit to obtain a general category scallop permit and continue fishing day-trips, since the general category permit does not prohibit this practice.

The action does not discriminate against scallop fishermen because this practice (targeting a species both on and off a DAS clock for commercial purposes) is allowed in no other federally-managed fishery. When the Council developed and adopted the general category permit in 1993 within Amendment 4, it was meant to serve a dual role: to allow vessels that opportunistically fished near-shore concentrations of sea scallops to continue to do so and to allow vessels on long trips catching other species to land the small amount of daily scallop bycatch. Many vessels that day-fished nearshore concentrations of scallops (like those in Maine or near Cape Cod) continued fishing under a general category permit and did not apply for a limited access scallop permit. When DAS allocations were higher and scallops less abundant, few limited access scallop vessels day-fished when not on a scallop DAS. During the last few years, more limited access vessels have been doing so because the DAS allocations have declined and scallop abundance has correspondingly increased.

Ultimately, the action is not meant to discriminate agains fishermen, but to enhance the yield and economic value of the resource to fishermen.

29. ***General category provisions should not be changed. Others commented that the Council should adopt additional measures for general category vessels including VMS requirements and increased possession limits.***

Official data reports suggest that scallop fishing by vessels with general category permits has declined recently, possibly in response to declining scallop prices. For the time being, the Council decided to adopt the status quo for scallop fishing by vessels with a general category permit, but this situation will be closely monitored and future actions may be possible.

30. Requiring VMS on vessels with general category permits is not feasible – the cost is too high.

The Council decided not to require vessels that target sea scallops under general category rules to obtain and operate VMS equipment. Future framework actions that allow vessels with general category permits to fish in controlled access areas may require VMS, however. The benefits and costs of doing so will be assessed if and when such an action is proposed.

31. ***Vessels with general category permits should be able to participate in controlled access programs, especially if they were unable to fish for scallops during a rotation closure.***

The Council agreed with this policy and Amendment 10 includes a provision to allow vessels with general category scallop permits to retain and land the scallop possession limit when fishing under a special access program – for scallops or another species. Special reporting requirements and/or a scallop TAC may be needed in future actions allowing controlled access, however.

32. ***There should be a moratorium on general category vessels.***

The Council determined that a moratorium on general category vessels was not appropriate for consideration in Amendment 10. The original purpose of the general category was to provide for open access opportunity for vessels that depend on catching a variety of species and to accommodate the ability for vessels to land customary scallop bycatch when targeting other species on long trips. Boats that opportunistically target scallops while participating in a variety of other fisheries include but are not limited to small boats and vessels that historically fished scallops before the limited access program was implemented in 1994, but that did not qualify for a limited access permit. This fishery provides a variety of economic and social benefits to fishing-dependent coastal communities.

19.4.4 Protected species

33. ***The Council did not consider any management actions that are designed to protect the barndoor skate from being captured/injured/killed during scallop fishing, nor does it discuss equipment modifications, if any, being considered that may prevent skate capture. The DSEIS did not indicate if any fishery data existed showing skate fatality following capture in a scallop dredge, or if there are survival estimates.***

Due to the following considerations and the fact that no gear modifications are available to prevent skate capture, besides the ones that are in place, the Council was unable to develop and analyze measures to specifically address barndoor skate. Nonetheless, skate conservation is very important and the Council considered many alternatives in Section 5.3.5 to minimize bycatch of finfish and some may help conserve barndoor and other skate. The measure that is probably the most effective is keeping total fishing time and area swept down, which can be achieved by fishing on large scallops in controlled access areas and the DAS tradeoff. Also important is an approved measure that will increase sea sampling, allowing a better determination of the distribution and amount of barndoor skate bycatch in all areas.

Barndoor skate is a candidate species for listing as a threatened or endangered species under the Endangered Species Act, but recent survey data indicate that there are far more barndoor skate than previously thought and there may be data that indicate such a listing is unnecessary. Following a petition to list barndoor skate as a threatened or endangered species, analysis of the population found it was neither threatened or endangered.

Barndoor skate bycatch estimates (Section 8.3.1) suggest that Georges Bank area access contributes a very small amount of mortality on the barndoor skate population. Furthermore on short tows that are characteristic of the commercial fishery in the controlled access areas (especially those on Georges Bank), barndoor skate appear to survive capture in good condition better than most species (personal observation). Barndoor skate may, however, experience post-release mortality from injuries encountered in the dredge or on deck that isn't obvious on release.

34. ***The Council did not consider management alternatives to protect sea turtles from death or injury during scallop fishing, such as the development of experimental sea turtle exclusion devices.***

The amendment promotes additional sea sampling, funded by scallop set asides, that will allow for more observation and better estimates of the amount and distribution of sea turtle interactions with scallop dredges. Also, the amendment also promotes scallop-related research, funded by scallop set-asides that may be used to develop new fishing methods or gear modifications to protect sea turtles from death or injury during scallop fishing. One of the primary research priorities for the use of scallop research set aside funding is for investigating the potential causes of and solutions for sea turtle interactions with scallop fishing.

In fact, some of these funds have already been used to investigate why sea turtle interactions are occurring and explore gear modifications that will reduce encounters. Perhaps this new research could have been identified in the document better, but the research is in the initial stages and has not been completed or analyzed at this time.

Also important is the ability to adapt and react in a pro-active way when new protected species issues arise and/or new methods to minimize interactions become available. Rather than rely solely on a Biological Opinion and further analysis to address the issue, the amendment includes a protected species proactive adjustment process (Section 5.1.7) to allow the Council to react quickly and adjust fishery regulations by framework action when the need arises.

35. ***The Hudson Canyon Area might be a possible venue for test implementation of turtle exclusion devices.***

The Council agrees and has allocated Hudson Canyon Area set-aside funding for this purpose. The turtle interactions may however happen in other areas in the future. Both set-aside programs to fund more observers and scallop research (including those related to protected species interactions) have been expanded in Amendment 10 and would allow for research over a broader area where problems may exist.

19.4.5 Finfish bycatch

36. ***The DSEIS fails to adequeately assess the potential adverse impacts to overfishied groundfish stocks from accessing groundfish closed areas***

This assessment has been augmented in the FSEIS using data and analysis from sea sampling during a previous access program, originally included in the FSEIS for Framework Adjustment 15. These data suggest that except for monkfish and some species of skates, the finfish bycatch was a very small proportion of standing finfish biomass. The rules in place for access during the 2000 fishing year were very successful in keeping finfish bycatch down to insignificant levels.

Amendment 10 includes a rather broad range of alternatives for minimizing bycatch, either in controlled access areas or in regular, open fishing areas (Section 5.3.5). Some of the alternatives (for example area-specific finfish possession limits, TACs, and seasons) were very broad and could encompass a wide range of options and/or specifications. Much analysis is hampered by a lack of adequate data, so in some cases pooling over years (i.e. the 28,000 tows) was done to evaluate spatial and seasonal patterns, rather than trends across time. In other cases, more detailed analyses were included using sea sampling from a shorter time frame (for example in controlled access areas having enhanced sea sampling from a scallop TAC set-aside). Based on these data and analyses, candidate options that could have a potential beneficial effect by avoidance of high levels of bycatch were identified.

In the end, after public hearings, the Council decided that specific area and seasonal closures to avoid bycatch were too draconian. Instead, the Council approved a proposed action to increase the twine top mesh, increase ring size, and allocate DAS in ways the minimized bottom contact and therefore bycatch. All are expected to have a positive, but difficult to quantify, effect on many species of overfished groundfish (at least ones vulnerable to capture by scallop dredges).

Sections 7.2.4.1 and 8.3 evaluate past and potential future impacts on groundfish stocks, from fishing in groundfish areas. These analyses were brought forward and updated in the FSEIS based on the analyses in the SEIS for Scallop Framework Adjustment 15, using sea sampling data from enhanced observer coverage in controlled access areas funded by the scallop TAC set-aside. Although these estimates indicate that the direct impacts on most species of groundfish are minor during the time when fishing occurred during previous access programs, the Council will consider additional measures to minimize bycatch and bycatch mortality for finfish within Framework Adjustment 39.

37. ***Access to the groundfish closed areas cannot be granted through an amendment to the Scallop FMP.***

Such an action would require an amendment or framework to the Multispecies FMP, under current regulations. Although the Council is considering a special access program in Amendment 13, it has initiated Framework Adjustment 39 to consider alternatives and analyze the effect of access on beleaguered groundfish stocks. To the extent possible, Amendment 10 has analyzed the environmental effects with and without access of the closed groundfish areas, but a framework action will be required to allow access to these groundfish areas, since it was not deemed practical to add a companion groundfish framework to the scallop amendment, nor has it been possible to develop a separate groundfish framework action in time for Amendment 10 approval and implementation. Instead, the Council has initiated Framework Adjustment 16/39 in November 2003, with a final meeting expected in late Feburary and implementation in late summer or early fall of 2004.

Even though the Council adopted measures in Amendment 10 to minimize bycatch and bycatch mortality, other alternatives may be used in controlled access programs to further limit the impact. Such measures in Amendment 10 include area-specific finfish TACs, gear restrictions and modifications, seasons for access to avoid times when bycatch would be high, and finfish possession limits. As planned for Framework Adjustment 16/39, the Council will consider and evaluate new alternatives for access to the Georges Bank closed groundfish areas to minimize this bycatch during a scallop controlled access program.

19.4.6 General comments on the documents or procedures

38. ***The documents describing the fishery industry are complex technical assessments and are difficult to read. The dependent and independent variable which impact this complex interaction are numerous, difficult to describe, and even harder for the public to comprehend. The DSEIS might also be shortened with technical material being place in an appendix***

Amendment 10 addresses complex issues via a broad range of alternatives, leading to a more complex document than those for previous actions. Nonetheless some improvements have been made in the FSEIS to summarize these complex interactions and describe the mechanisms that cause adverse impacts. A new cumulative effects section has been added (Section 8.1) that summarizes the pathways causing impacts on valuable environmental components in the area being managed. It also includes a table that summarizes these impacts over time and effect. Although much technical material remains, more technical material has been relegated to the appendices to reduce the complexity of the document.

39. ***Several comments were submitted in response to the DSEIS that are outside of the scope of Amendment 10, and no specific response is included in this FSEIS.***

Commenters are reminded that Amendment 10 contains measures to achieve the specific goals and objectives specified in Section 4, "Purpose and Need." In addition, some comments suggested that the analyses included in Amendment 10 are not based on the best available science. The Council disagrees that Amendment 10 is based on insufficient, inadequate, or outdated science.. A description of how the Council complies with National Standard 2 to use the best available sciene and with the new Data Quality Act is found in Sections 6.1.2 and 11.0, respectively.

40. ***The Council was urged to keep Amendment 10 simple.***

The Council faces complex and sometimes competing issues when it manages a resource and the effects of the fishery on the environment. Often, alternatives to address these complex issues have interactive effects which are hard to analyze and explain in simple terms, while providing the necessary detail to tranparently explain how analyses were done and report on the results. Since Amendment 10 introduces a new adaptive management strategy, there will be a wide range of outcomes depending on future conditions.

Since Amendment 10 introduces and adaptive strategy and addresses many issues ranging from changes in allocations, impacts on bycatch species, and effects on EFH, as well as scallop research and monitoring, the Council recommended a suite of management measures to NMFS that includes some complex management schemes.

Packaging these alternatives for the DSEIS would have been impractical, because doing so would have either caused the Council to preclude certain combinations, or make the number of potential combinations horrendously long. Much of the complexity of the measures included in the DSEIS, that might have been combined in numerous final actions, however, has been eliminated with the Council's final selection of alternatives. Nevertheless, in order to ensure that area rotation and new management measures combine to make an effective management plan, some complexity remains.

41. ***Access to groundfish areas cannot be implemented through scallop plan amendment.***

The Council agrees and is proceeding with the joint Framework 16 to the Scallop FMP and Framework 39 to the Multispecies FMP to address this issue. Future access actions might be processed as a new special access program (SAP) through specifications approved by the Council for Amendment 13 to the Multispecies FMP.

19.4.7 Comments on EFH alternatives or analysis

42. ***The analysis and estimated benefits are insufficient to justify using closures to minimize impacts on habitat. The benefits to the resources from the proposed closures have not been adequately estimated or described. On the other hand, habitat closures are one of the least practicable choices compared with other ways (effort reduction and gear modification) to minimize impacts, much of which has been achieved through existing or planned management measures. Gear substitution is totally impracticable for the sea scallop fishery; because no other scallop gear is available that doesn't cause greater habitat impacts.***

The Council agrees that it is difficult to quantify the benefits of using closures through habitat closures, but the evidence and expert opinion suggests that area closures for certain fishing gears, primarily bottom-tending mobile gear, is the most effective way to conserve EFH for vulnerable, benthic species. Other management strategies such as reducing the quality and amount of bottom contact can help minimize impacts, but area closures are more effective because most of the adverse habitat impacts occur from the first passage of gear over the bottom. In areas with complex, hard bottom habitat it sometimes takes years or even decades to recover, making effort reduction a less effective choice

The Council took a careful look at the practicality of the various area closure alternatives. Although important scallop resources appear within the boundaries of Habitat Alternative 6, this alternative appears to be the most effective because it continues the habitat recovery there that began in 1994 with the year-around groundfish area closures that overlap this alternative. It also appears to be practicable because these areas are presently closed and will be closed in Amendment 13 to gears capable of catching groundfish, unless partially re-opened in a future special access program in the Multispecies FMP or a controlled access program in the Scallop FMP. Therefore the costs of classifying these areas as habitat closures is very low relative to the benefits of continuing habitat recovery in them.

The Council also aggress that gear substitution is impracticable, because there are only two gears that catch commercial quantities of sea scallops: dredges and bottom trawls. Both have adverse impacts on sensitive habitat and trawls are very likely to increase bycatch and bycatch mortality, because they fish like a flatfish net used to catch yellowtail and other flounders.

43. There is insufficient analysis and discussion of the adverse habitat impacts of the status quo and the potential positive impacts of scallop management alternatives in the document.

The adverse habitat impacts of the status quo are described in the Gear Effects Evaluation, Section 7.2.6.2 . Moreover, status quo management is also analyzed in Section 8.5.7.1. Much of the information in these sections has been revised and clarified.

44. ***There is insufficient analysis of human, i.e. non-fishing, impacts on essential fish habitat.***

The SEIS identifies the type of non-fishing impacts that would have an adverse effect on scallop EFH, primarily activities that degrade water quality or clarity in offshore continental shelf areas where scallops reside. It would be more appropriate to assess the non-fishing impacts on finfish EFH under the plans that regulate finfish species.

45. ***The SEIS does not analyze the relationship between habitat effects and the distribution of scallop fishing effort.***

This is not at all true. The document analyses the distribution of scallop fishing effort relative to substrate categories associated with habitats that are deemed to be adversely impacted by dredges and trawls as well as EFH designations for species that are characterized as being moderately or highly impacted by dredges and trawls. Moreover, the Habitat Technical Team received an analysis that showed the statistical association of juvenile and adult EFH designation data with the Poppe et al. (1989) habitat types. This analysis was not included in the SEIS because it encompassed a broader region than the NAAA, and it did not collapse the Poppe et al. (1989) sediment classifications in the same way that the EFH metrics analysis did.

The FSEIS furthermore analyses the probable distribution of fishing effort under area rotation, with and without access to the Georges Bank areas, in comparison with the factors used in the EFH metrics analysis. This new analysis was included in the final document to address this issue.

46. ***Amendment 10 does not consider or contain reasonable alternatives to minimize habitat impacts that were recommended during scoping.***

Two strategies were recommended during scoping that the Council developed based upon available substrate, EFH designation, and scallop effort distribution data. These analyses were performed in response to scoping comments and recommended strategies to evaluate EFH importance and balance that with fishery productivity, to determine where habitat closures would be most effective, taking into account the cost of preventing fishing in identified areas. These analyses led the Council to adopt in the DSEIS, habitat alternatives 5a to 5d and 7. As another option, only one concrete proposal with boundaries and specifications was offered by the public during scoping while the Council was developing these alternatives. This proposal, developed jointly by the Council advisors, came very late in the process, which prevented analysis in the Amendment 10 DSEIS but is under consideration in Amendment 13 to the Multispecies FMP.

19.4.7.1 Process/Legal Comments

47. ***Habitat alternatives represent a reasonable range of alternatives under NEPA***

The Council and NMFS concur.

48. Amendment 10 fails to include a number of alternatives that were recommended through the scoping process.

NMFS published a Notice of Intent (NOI) to prepare a supplemental EIS for the EFH components of the Northeast Multispecies and Atlantic Sea Scallop Fishery Management Plans on February 1, 2001 (66 FR 8568). The public comment period was open until April 4, 2001. Based on the original Amendment 13 and Amendment 10 scoping a letter, dated April 13, 2001, the following proposals were recommended to protect EFH:

- Develop a precautionary management approach to protecting EFH
- Establishment of Habitat Research Areas
- Creation of a systematic and effective HAPC designation process

The Council received another letter from the same group dated March 4, 2002; almost a year later and outside the scoping period that summarized the proposals identified through scoping. The second letter contains the original three proposals included during the scoping period and an additional six (6) proposals, which include:

- Make a primary goal of rotational management minimizing the effects of scallop dredging on habitat by: (1) excluding dredging from gravel “hard bottom” areas and (2) restricting scallop dredging to those areas that are the most productive and leaving other less-productive areas inaccessible to the scallop fishery.
- Establish area-based gear restrictions prohibiting dredging and trawling in sensitive habitats, including known-hard bottom on Jeffrey’s Ledge, Stellwagen and George’s Bank (in juvenile cod EFH).

- Establish harvest incentives for fixed gear (i.e. access to mobile gear restriction zones). The incentives should try to protect sensitive hard-bottom cod EFH, protect benthic invertebrates (major groundfish food source) and protect the complexity of these habitats to promote recruitment.
- Create spawning sanctuaries to improve scallop recruitment.
- Prohibit scallop dredging in areas containing sensitive EFH for overfished species.
- Create a rotational-area management system that keeps areas closed for six (6) years.

All of the above-proposed alternatives submitted within or outside of the scoping period have been considered in the development of the Amendment 13 and/or Amendment 10 DSEISs. If the proposals were considered but rejected for full analysis in the DSEIS, a rationale is provided in the Alternatives Considered But Rejected Section of the DSEIS. Moreover, the Council's technical staff and scientists made a good-faith effort to try to develop the vague recommendations into viable alternatives, which resulted in four (4) separate habitat closed area alternatives in the document.

49. DEIS fails to demonstrate that any potential adverse effects of fishing in New England reach the legal standard of being "identified" and "adverse."

We disagree. The NMFS technical guidance on the implementation of the essential fish habitat components of the Magunuson-Steven Act states that, "for the identification and description of adverse effects on EFH, FMPs should provide a scientific basis for concluding that the potential or known adverse effects are a result of the identified activities. Examples of scientific justification include, but are not limited to: peer-reviewed articles and reports; resource agency publications that have been subjected to internal agency review; agency data products, such as research findings, on-going evaluations and scientific knowledge of species, ecosystems, or watershed systems; ocean temperature, dissolved oxygen and salinity logs; fish landings reports; satellite and aerial imagery data products; and testimonies of individuals with a demonstrated expertise regarding the appropriate resources." This guidance is followed and implemented successfully in the FSEIS through the thorough Gear Effects Evaluation and Adverse Impact Determinations.

50. Amendment 10 is not an appropriate vehicle for creating year-round habitat closed areas

The Council and NMFS agree that creating year-round habitat closed areas within individual FMPs when concurrent action is not taken in other Council managed FMPs is problematic. However, because the scallop fishery is adversely impacting EFH for several species and life stages, the Amendment 10 action must implement measures to minimize those effects to the extent practicable in order to meet the requirements of the Sustainable Fisheries Act. Amendment 10 does implement year-round indefinite closures to scallop dredge gear within the existing year-round groundfish closed areas with the exception of the Framework 13 Scallop Access Areas. Finally, the Council will be initiating an omnibus habitat amendment that will seek to, among other things, integrate habitat protection measures across all Council managed FMPs.

51. ***The DSEIS ignores extensive legal guidance regarding the significant environmental issues and how to best reduce adverse impacts of scallop dredging on EFH.***

We disagree. The FSEIS contains a detailed account of the effect of fishing and non-fishing related impacts on EFH and other environmental and natural resources as required by the Magnuson-Stevens Act and the National Environmental Policy Act. The Council and NMFS feel confident that the FSEIS and related SFA actions taken in Amendment 10 will reduce the impacts of scallop dredging on EFH to the extent practicable.

19.4.7.2 General Recommendations

52. Measures to protect deep water corals should be included.

Due to the timing of Amendment 10, measures to protect deep-water corals are not included in the FSEIS. However, measures to protect deep-water coral from monkfish trawl gear, a fishery that prosecutes in deeper water where corals may be present, are included in the DSEIS for Amendment 2 to the Monkfish FMP. A copy of the Monkfish FMP Amendment 2 DSEIS will be posted to the Council's website once the document is submitted to the Agency in the coming weeks (www.nefmc.org).

53. None of the habitat closure alternatives are acceptable (not designed for the purpose of minimizing adverse impacts of fishing on EFH, none [of the alternatives] would do much to protect the most vulnerable habitats, it is possible that the net effect on EFH will be negative, proposed closures are inefficient since they would large areas of valuable fishing grounds with sandy seabeds in order to prevent fishing on small areas of mud, cobble, boulder, and bedrock, some closures are unenforceable, and some closures include areas in the Mid-Atlantic, which will cause conflict with the MAFMC).

To minimize the adverse effects of fishing on EFH from the scallop fishery, the Council has chosen to implement Habitat Alternative 6 which will close the portions of the current year-round closed area not included in the Scallop Framework 13 Access Areas to scallop dredge gear indefinitely. This closure will assign the extra protection of a habitat closure to areas described as only 2.3% gravel, but that is a significant portion of the total amount of gravel in the region (17%). Critical and sensitive habitats occur within these area boundaries and protection of these areas from fishing with scallop gear will allow continued habitat recovery in these areas, particularly when other bottom tending mobile gear are prohibited to promote groundfish rebuilding and to protect groundfish spawning activities. Under the present management circumstances, selection of these closures for habitat protection carries little cost as long as the groundfish closed areas apply to scallop fishing. In terms of EFH protection, the percent of total vulnerable EFH in Alternative 6 ranks higher than most of the other alternatives, excluding habitat alternatives 7 and 9, which were not deemed to be practicable. Additionally, Alternative 6 contains high amounts of biomass for three bottom-feeding trophic guilds which is an important indication of what species live in this area, and how many. For example, more benthivore biomass (species that eat from the ocean bottom) is contained in Alternative 6 than any of the other alternatives, except for habitat alternatives 7 and 9.

54. No Habitat closures should be part of Amendment 10.

The Council considered this alternative but decided, with advice from NMFS, that this approach would not meet the requirements of the Magnuson-Stevens Act to minimize adverse effects of fishing on EFH.

55. Offshore closures, Georges Bank, are impracticable because the cost of the lost scallop harvest outweighs any potential habitat benefits

This was considered in the Amendment 10 analysis of the alternatives. Because it is extremely difficult to assign a market value to "any potential habitat benefits", the Council made its decision to close offshore areas on eastern George's Bank (northern portion of Closed Area II) based on a trade off between potentially allowing access to the more sandy areas in the southern portion and protecting the more complex bottoms known to exist in the northern portion.

56. ***Need to defer additional consideration of more refined habitat closure options to a new Omnibus measure***

The Council and NMFS agree that creating year-round habitat closed areas within individual FMPs when concurrent action is not taken in other Council managed FMPs is problematic. However, because the scallop fishery is adversely impacting EFH for several species and life stages, the Amendment 10 action must implement measures to minimize those effects to the extent practicable in order to meet the requirements of the Sustainable Fisheries Act. Amendment 10 does implement year-round indefinite closures to scallop dredge gear within the existing year-round groundfish closed areas with the exception of the Framework 13 Scallop Access Areas. Finally, the Council will be initiating an omnibus habitat amendment that will seek to, among other things, integrate habitat protection measures across all Council managed FMPs.

57. ***There is no reason to close EFH for scallops since it is the belief of most industry that scalloping improves habitat for scallops.***

While some in the industry may believe this to be true, the gear effects evaluation and adverse impacts determination in the Amendment 10 FSEIS concluded that scallop fishing does not adversely impact scallop EFH. However, scallop fishing was found to adversely impact EFH for several other species and life stages. The Magnuson-Stevens Act requires the Council to approve measures that minimize the effect the scallop fishery has on the EFH of other federally-managed species. As such, there is ample reason for the Council to close areas to protect EFH for species which are adversely impacted by the use of scallop gear.

58. ***Areas closed for EFH for other species including MPAs should be developed through a comprehensive amendment affecting all species and gear types.***

The Council and NMFS agree that creating year-round habitat closed areas within individual FMPs when concurrent action is not taken in other Council managed FMPs is problematic. However, because the scallop fishery is adversely impacting EFH for several species and life stages, the Amendment 10 action must implement measures to minimize those effects to the extent practicable in order to meet the requirements of the Sustainable Fisheries Act. Amendment 10 does implement year-round indefinite closures to scallop dredge gear within the existing year-round groundfish closed areas with the exception of the Framework 13 Scallop Access Areas. The Council will be initiating an omnibus habitat amendment that will seek to, among other things, integrate habitat protection measures across all Council managed FMPs. Additionally, the Council is currently working to develop a Council policy on Marine Protected Areas through its Habitat/Marine Protected Areas Committee.

19.4.7.3 Specific Alternatives

59. ***Supports Alternative 2 as long as Council states that they are not habitat management measures, but rather measures with ancillary benefits to habitat***

The Council chose to implement Habitat Alternative 2 (Benefits of Other Amendment 10 Measures) in order to partially meet its requirement to minimize adverse effects of scallop fishing on EFH. In doing so, the Council recognizes that the measures to reduce days-at-sea, and implementing broken trip DAS and trip adjustments, four-inch rings and ten-inch twine tops, reduced possession limit for limited access vessels outside of scallop DAS and a 2% set-aside from TAC and/or DAS allocation to fund research and surveys will result in positive direct and indirect protection for EFH from scallop gear. As such, the Council acknowledges these measures as habitat management measures.

60. ***Joint Advisor's approach is preferred.***

The Joint Advisor's approach is not included as an alternative under consideration in Amendment 10 due to timing. It is, however, included in Amendment 13 to the Multispecies FMP as Habitat Alternative 10 and is a preferred alternative in the DSEIS.

61. Of the habitat alternatives adequately analyzed by the Council, Alternative 3a comes closest to fulfilling [the habitat responsibilities].

Alternative 3 includes the closure of the Great South Channel, which is impracticable due to the dramatic social and economic impacts. Further, the equity of impacts is uneven and is focused mainly in the New Bedford, MA port.

62. ***Reject the DSEIS (1,497 comments)***

Due to the requirements of both the Magnuson-Stevens Act and the settlement agreement in the AOC vs. Daley EFH Lawsuit, the Council is unable to reject the DSEIS as suggested.

63. ***Habitat Alternatives 2 and 9 are virtually identical to the No Action/Status Quo***

Response: The difference between Alternative 2 (Status Quo/No Action) and Alternative 9 (Existing management boundaries for area closures would be used to protect habitat from harm by scallop fishing gear) is the inclusion of the Cashes Ledge closure year round in Alternative 9. Additionally, Alternative 9 would afford the existing year-round groundfish closed areas the added protection of a "habitat closure." As such, it would not be subject to automatic opening or access during a rebuilt groundfish complex condition.

64. ***The JAR alternative will damage sensitive habitats and should not be included in the DSEIS.***

The "JAR" alternative is not included in the DSEIS due to timing issues with Amendment 10. It is, however, included in Amendment 13 to the Multispecies FMP as Habitat Alternative 10 and is a preferred alternative in the DSEIS.

65. ***Vessel Monitoring Systems seem to be a burden with little benefit.***

Implementing a Vessel Monitoring System throughout the fleet will enable the Council to better evaluate the effect of the fishery on EFH in the future by producing more accurate estimates of extent, duration and intensity of impacts on EFH.

66. ***Opposes restrictions on rock chains because of safety issues***

The Council agrees that safety risk associated with limiting rock chains outweighs the habitat benefits that might be realized. Furthermore, the intent of limiting rock chains is to change fishing behavior such that less fishing activity occurs over hard bottoms. This may or may not occur and if it does not, removal of rock chains may increase adverse impacts on habitat because more rocks and hard bottom would be hauled to the surface in dredges.

67. Amendment 10 should reject the requirement of 4"rings because it may result in the inability to catch a reasonable number of scallops and in certain weather conditions it would mean more tows and effect the habitat more adversely. However, more escapement of fish and small scallops are a tremendous benefit.

The Council has chosen to implement the requirement of 4-inch rings everywhere for the scallop fishery. Particularly in areas having predominately large scallops, like a re-opened controlled access scallop rotation area, this measure will decrease bottom contact time to take the same number of scallops and achieve the fishing mortality targets. This result can help reduce habitat benefits, particularly when it reduces the 'footprint' of the fishing activity by reducing effort in areas that are fished infrequently. With vessel DAS at a premium, scallop fishing vessels are unlikely to spend time targeting smaller scallops in marginal areas with a dredge that is designed to allow more escapement of smaller scallops. Since the distributional effects of this measure are difficult to quantify, it could reduce fishing in areas that are infrequently fished or it could simply reduce fishing intensity in areas that would continue be dredged. In the latter case, the habitat benefits would be lower than if the measure eliminated fishing in some areas that are infrequently fished.

68. Supports alternative for TAC set-aside for habitat research

The Council has chosen to implement this measure (Habitat Alternative 12) in Amendment 10. Up to 2% of the TAC set-aside would be used to conduct both scallop and habitat-related scallop research, including cooperative industry surveys to monitor the resource and rotation area management.

69. Supports recognition of benefits of rotation on seafloor

The FSEIS recognizes that a well-constructed rotational area management program, which takes into account the need to minimize adverse effect of scallop fishing on EFH, does benefit EFH.

70. Should reconsider the use of some of the considered but rejected alternatives such as alternatives to create more shelter or an alternative to increase and enhance growth of dense epifauna and related communities by active intervention.

As is stated in the FSEIS, these alternatives within the context of Amendment 10 are not possible. It is likely that the Council will re-visit these suggestions during the development of the upcoming Omnibus Habitat Amendment #2.

71. ***The DSEIS should include measures to protect known areas of deep-water corals in New England.***

Because scallops filter-feed on phytoplankton, very little scallop fishing occurs in areas where deep-water corals are likely to be found. Most scallop fishing occurs from 20-35 fathoms, with occasional fishing in deeper areas down to 50 fathoms. In contrast, most deepwater corals are found near the heads of canyons in depths over 100 fathoms. Including alternatives in Amendment 10 to protect deepwater corals would therefore be superfluous.

19.4.7.4 Other

72. The DSEIS does not contain alternatives specifically designed consistent with the EFH Technical Team's recommendation to protect all known hard-bottom habitats or to protect sensitive juvenile cod EFH in any comprehensive way.

The measures approved in Amendment 10 to protect habitat specifically close hard-bottom and sensitive juvenile cod EFH indefinitely from the impacts of scallop dredging. It is not practicable to protect all known hard-bottom habitats or all juvenile cod EFH within Scallop Amendment 10.

73. ***The DSEIS fails to include an adequate range of alternatives to minimize the adverse impacts of scallop dredging on EFH for a number of key groundfish species (2)***

This is not true. The groundfish species that are adversely impacted and their level of protection (percent-of-total) are listed in Section 7 in the FSEIS and represent a wide range of alternatives that adequately protect EFH from scallop dredging for groundfish species that are adversely impacted. For the proposed action that includes Habitat Alternative 6, the protected for the life stages that are adversely effected, as illustrated using "percent-of-total" statistic and are American plaice (8.0-8.63%), cod (17.4%), halibut (15.3%), haddock (12.1-14.9%), ocean pout (7.7-11.1%), pollock (8.58%), red hake (6.56%), redfish (6.56-7.7%), silver hake (7.1%), white hake (8.3%), winter flounder (12.2%), witch flounder (2.8-7.28%), and yellowtail flounder (9.6-12.3%).

Within the 13 habitat alternatives that involve the use of closed areas to minimize adverse effects to EFH and using juvenile cod as an example, total juvenile cod EFH protection ranges from 1.4% for Habitat Alternative 8a to 67.1% for Habitat Alternative 7 (see Table 203 in Section 8.5.2.2). This clearly represents a wide rangfe of alternatives.

19.4.7.5 Analysis Comments

74. The only EFH-designated ten minute squares that are included in analyses are those based on survey data – thus, analyses exclude inshore areas.

This was an analytical error. This is an accurate comment and excluding the inshore areas with EFH was an oversight that was not discovered until the end of the public comment period for Amendment 10. Unfortunately, the EFH metric analysis could not be redone to incorporate inshore areas in the time permitted. Thus, the square nautical miles of EFH in an alternative presented in the analysis is accurate, but the percent of EFH values are overestimated in most cases. For example, if one alternative contains 330 square nautical miles of haddock EFH, or 12% of the total haddock EFH in the region, that 12% may be an overestimate because the square nautical miles of inshore ten minute squares are not included in the analysis calculations. Of all the revisions that had to occur in the time between approval and submission of this document, this issue raised during public comment was not considered as high a priority as some of the others because the overall rank of alternatives were not going to be impacted by including internal waters. Since the area of inshore waters was excluded from the EFH analysis of all the alternatives, the oversight was consistent across all alternatives. For example, it is possible that the percent of haddock EFH contained in the same alternative described above may change from 12% to 11% when the inshore areas are included, but that change in percent will be reflected in all the other alternatives under consideration since none of the alternatives contain inshore closures. Therefore, from a NEPA perspective, this oversight does not change the way the alternatives should have been analyzed or how they compare to each other.

75. ***There is no reason to believe that scallop EFH is adversely affected by scallop fishing gear (dredges or trawls), therefore closed areas should only be evaluated (and designed) according to how well they would protect EFH of other species from scallop fishing.***

The determination that scallop EFH is adversely impacted by bottom-tending mobile gear has been re-evaluated and removed from the adverse impacts determination section of the FSEIS. As such, closed areas are evaluated according to how well they would protect EFH of other species EFH from scallop fishing.

76. ***Amendment 10 should consider effects of scallop otter trawls, not all bottom otter trawls, on scallop EFH and EFH of other species; as a result, tilefish and witch flounder should be deleted from list of species with EFH that is vulnerable to mobile, bottom-tending gear because they do not inhabit depths/substrates where scallop dredges or trawls are used.***

Differential effects of scallop trawls and other types of bottom trawls will be spelled out in FSEIS, but EFH evaluations of closed area alternatives will likely not be changed by dropping two species from list of 24 species with vulnerable EFH.

77. ***EFH metric analyses in A10 are crude, not as good as in A13, and should not be used.***

The EFH analyses in Amendment 10 FSEIS have been refined and corrected and are now consistent with the analyses included in the Amendment 13 DSEIS.

78. ***Species and life stages identified as "adversely impacted" in Table 119 were used in analyses instead of those identified in vulnerability tables (Tables 79-117).***

The species and life stages included in the Adverse Impacts Determinations (DSEIS Table 119) are the same in other tables in the DSEIS and the FSEIS. DSEIS Table 119 was derived from the analyses in DSEIS Tables 15-56 as well as DSEIS Table 57.

79. ***Methods used to determine which species/life stages are adversely impacted by mobile gear are too subjective and results are not credible.***

These determinations are inferences based on available published information. The evidence of a link between habitat alterations and resource productivity was not possible at the time and, therefore, this link was not used as a criterion. Instead, only indications that habitat function or value (e.g., in providing shelter or food) would potentially be impaired by fishing effects were used.

80. ***Need to clarify that analyses only show how much EFH occurs within the closed area alternatives, not the net change in gear impacts on EFH that would result from such closures.***

This has been clarified in FSEIS.

81. ***Need to total the EFH values for all species/life stages in each alternative in Tables 161 and 162 since it is the aggregate value that is important.***

This analysis has been completed and is included in the FSEIS.

82. ***There are some errors in EFH area values in Tables 161 and 162: values can't be lower in alternative 9 than in alternative 6.***

EFH area values have been re-calculated in square miles from decimal degrees and the errors have been corrected.

83. ***Analyses of EFH distribution, habitat features of proposed closures, gear effects, and the distribution of fishing activity by different gears needs to be integrated into a determination of what fishing is doing to benthic habitats and how these impacts would be minimized under various closed area alternatives.***

This improved analysis has been completed and is included in the FSEIS.

84. ***Use of EFH – which already incorporates substrate – makes sediment analysis repetitive.***

Substrate features are not applied in EFH designations on a spatial basis.

85. ***Method used to scale sediment data for area is biased for "rare events."***

The "area-scaled" sediment values have been removed from the analysis.

86. ***Biomass metrics don't address EFH protection objectives of MSA, and don't differ in any consistent way among alternatives, so they should be discarded.***

There is some variation in biomass components among alternatives that help to describe environmental impacts of alternatives for NEPA purposes. As the Amendment 10 document marries the SFA documentation and analyses requirements with that of NEPA, it is appropriate to include biomass metrics in the FSEIS.

87. ***In the absence of "hard" evidence needed to evaluate benefits of closed areas, A10 could have identified alternatives that fall within acceptable economic cost boundaries.***

This is another possible alternative to identifying reasonable and practicable alternatives to minimize adverse impacts of fishing on EFH.

88. ***There is no mention of habitat closed areas in enforcement analysis.***

This information has been incorporated into the FSEIS.

89. ***Negative effects of fishing gears are qualitative and are not set in any quantitative context, without any mention of effects that were not seen.***

This is not true. Any effect that was tested for and found to be non-significant is reported in the gear effects tables.

90. ***Identification of "potential" adverse effects in Section 3.3.2 are not relevant to EFH management objectives of MSA.***

Yes, they are relevant. The EFH Final Rule makes it clear that EFH protection measures can be evaluated in terms of "potential" effects.

91. ***Habitat vulnerability ranks were assigned in a "risk-averse" manner (when uncertain, the higher rank was used): this approach is biased and produces misleading information.***

NMFS and the Council believe that the use of a precautionary approach is justified in this situation.

92. ***The No Action alternative applies to the entire DEIS, not the habitat section, since it does not describe what would happen if the Council rejects all proposed habitat alternatives, but accepts other alternatives.***

If the Council rejected all proposed habitat alternatives, but accepts other alternatives, they will essentially be selecting habitat alternative 2. However, the Council has selected a number of Habitat Alternatives for implementation including: Alternative 2, 6, 11 and 12.

93. ***Evaluation of habitat impacts of non-habitat-related management alternatives (Alternative 2) are vague: a better evaluation of the habitat benefits of rotational area closures should have been possible.***

It is difficult to produce more than a qualitative evaluation of rotational area closures unless it is known what specific areas (habitats) will be closed, for how long, and to what gears (if any) besides scallop gear. However, a quantitative analysis has been attempted and is included in the FSEIS.

19.4.7.6 Scientific Comments

94. ***All conclusions in DEIS are based on hypothesis that the first pass of the gear is the primary concern: if that hypothesis is incorrect, conclusions are invalidated.***

This is not accurate. The FSEIS assumes that the level of disturbance diminishes by about 50% with each tow, but only in undisturbed areas and in a specific tow path. Habitat protection is reduced as fishing intensity throughout an area increases.

95. ***Concept of recovery is invoked without sufficient explanation of what it means.***

This explanation has been improved in the FSEIS. Recovery of EFH is defined as a condition that supports production of MSY.

96. ***Sediment data are not sufficiently detailed (low spatial resolution) to support analyses of sediment composition within closed area alternatives.***

Poppe et al. (1989) maps are inaccurate at small scales, but represent best available information on sediments for whole region. Problems with data were recognized in analysis and conclusions drawn regarding sediment composition of proposed closures.

97. ***More attention needs to be given to mud as a vulnerable bottom type.***

This is probably true. However, EFH in mud habitats are not as vulnerable as gravel/rocky habitats as shown by the Gear Effects Evaluation and the Vulnerability Analysis.

98. ***Bedrock is the most important bottom type to protect, but none of the closed area options contain any significant amount of bedrock (except #7, which is unreasonably large).***

Bedrock is poorly represented in sediment database because it is rare in offshore areas and poorly sampled. None of the alternative under consideration contain a large amount of bedrock because there is not a large amount of bedrock in the region. Only 150 square nautical miles of bedrock have been mapped based upon the Poppe et al (1989) sampling. This does not necessarily represent all bedrock that is contained within the Northeast, the majority of which is located in coastal waters. The fishing gear effects workshop (NREFHSC, 2002) reported that gravel/cobble/boulder habitat with emergent epifauna had the greatest habitat complexity and is the most susceptible to adverse effects from certain types of fishing gear.

Alternatives 3a, 3b, 4 and 9 contain between 10 and 13 percent of all the bedrock in the total region, 19, 19 15, and 15 square nautical miles respectively. It is true that Alternative 7 contains 139 of the total 150 square nautical miles of bedrock (93%), but this FSEIS contains a broad range of habitat closed area alternatives that vary in size.

Alternative 7 was developed specifically to redirect scallop dredging into highly productive scallop beds and out of productive EFH (as recommended by scoping comments). As such, this represents a large geographic area that would be prohibited to scallop dredges and therefore provides the greatest degree of EFH protection from scallop gear, protecting 67.1% of the juvenile cod EFH. However, the Council rejected this alternative because it would need to apply to fisheries using other bottom-tending mobile gear to be effective.

99. Gravel is also important, but is defined to include gravel (less important) and cobbles and boulders (more important); closed areas are not designed to protect most vulnerable substrates.

While the gravel substrate classification in Poppe et al. (1989) includes less important small gravel, it also includes large gravel, cobbles, and boulders that have been shown to have important characteristics for EFH. The DSEIS identifies many of the substrates falling in this classification as being adversely impacted by scallop dredging, hence its importance as an EFH metric to evaluate different habitat closure alternatives and the percent of gravel substrate within it classified by Poppe et al. (1989).

100. Species metric is inappropriate for evaluating alternatives.

There is some variation in biomass components among alternatives that help to describe environmental impacts of alternatives for NEPA purposes. As the Amendment 10 document marries the SFA documentation and analyses requirements with that of NEPA, it is appropriate to include biomass metrics in the FSEIS.

101. Some details in gear descriptions need to be corrected.

Corrections have been made in the FSEIS.

102. Summaries in gear effects tables (literature review) mis-represent conclusions of some studies.

The analyses were conducted very deliberately and carefully and only report conclusions/methods of each study that were reported in the publication.

103. Some of the rationales cited in species vulnerability tables are flawed: some are not substantiated and others are based on incorrect assumptions or interpretations of published information.

Technical experts based on specific criteria, identified in the DSEIS, reviewed and determined the classification of a species being vulnerable to adverse impacts from dredge and trawl fishing gear. The Council believes that the expert consensus on vulnerability represents the best scientific information available at this time. For some species, an internal review has modified the vulnerability classification and the EFH analyses have been modified to reflect these changes.

19.4.7.7 Additional Comments

104. **Comment A**: ***The DSEIS ignored extensive legal and scientific guidance regarding the significant environmental issues and how to best reduce adverse impacts of scallop dredging on EFH.***

We disagree with this commentator's general characterization of the DSEIS, although we note that the present FSEIS is an improvement over the DSEIS and further note that we have and will continue to consider the comments submitted during the NEPA comment periods for this document. The FSEIS was developed using the best available legal and scientific guidance. The NMFS believes that the document will serve the agency in its decisions to uphold national environmental policies and goals, including the minimization of adverse impacts of scallop dredging on EFH, to the extent practicable. These issues have been and will continue to be considered in the Amendment 10 decision-making process. For more specific responses to this comment and related comments, see responses to Comment C.

105. **Comment B**: ***The DSEIS fails to fully analyze the environmental impacts of the No Action and Status Quo Alternatives and the analysis of Habitat Alternative 2 focuses only on the benefits of other measures in Amendment 10.***

Although the DSEIS did contain an analysis of impacts, analysis in the FSEIS has been revised, improved and clarified. The habitat impacts of the Status Quo and No Action alternatives are described in Section 8.5.4 - Environmental Consequences of Habitat Alternatives Under Consideration. Section 8.5.4.1 describes the differences between the No Action and Status Quo alternatives. Section 8.5.4.2 provides an analysis of Habitat Alternative 2 and describes impacts in terms of both the positive and negative effects to habitat.

106. **Comment C**: ***The range of habitat alternatives is inadequate.***

The Amendment 10 FSEIS is a tool designed to assist the NMFS in making informed decisions regarding scallop management based on the environmental consequences of the proposed management actions. The Council, acting on advice and recommendations made by the Habitat Technical Team and the NEFMC Habitat Committee, and input received from the public during the scoping process and during the preparation of the amendment, considered a number of habitat management alternatives for inclusion in the Amendment 10 DSEIS. Thirteen alternatives (several of which have multiple options) were eventually included in the document. In selecting the habitat management measures that were included in Amendment 10, the Council made sure that they represented a wide range of "reasonable" alternatives. In order to be "reasonable," an alternative had to be feasible and had to meet the purpose and need of the amendment. As explained in more detail below, the NMFS presently believes that the FSEIS includes an appropriately wide range of reasonable alternatives and notes that the NEPA process is ongoing with further ability for public comment and agency review.

The habitat management alternatives in Amendment 10 were developed in accordance with the most up-to-date scientific knowledge as presented in recent reports by a National Research Council Committee on the Ecosystem Effects of Fishing and by a panel of experts convened for a Northeast US Fishing Gear Effects Workshop. Both groups recognized that there are three fishery management tools available to mitigate the effects of trawls and dredges on seafloor habitats: fishing effort reduction, gear modifications, and area closures.

Relative to effort reductions, the FSEIS contains six strategies/alternatives described for rotational management in Amendment 10 (FSEIS Section 5.3.2.2 - 5.3.2.8). In addition to temporarily closing certain areas to allow for the recovery of exploited scallop beds, other alternatives restrict the use of days-at-sea in re-opened areas. These measures are incorporated into Habitat Alternative 2 (FSEIS Section 5.3.4.2).

As for gear modifications, several alternatives have been developed that mitigate impacts of scallop dredging to seafloor habitats. Two alternatives included increasing the minimum dredge ring size to 4 inches in all or select areas (Habitat Alternative 11). Increasing the dredge ring size allows more small scallops to escape capture and improves the gear's efficiency for catching larger scallops. This improved efficiency would benefit habitat by reducing the amount of area swept by scallop dredging (FSEIS Section 5.3.4.11). Another gear modification included in the DSEIS was a measure to restrict the use of rock chains on dredges (Habitat Alternative 10). It is thought that controlling the use of rock chains has the potential to reduce fishing in hard-bottom or rocky habitats that are more sensitive to disturbance (FSEIS Section 5.3.4.10).

Finally, relating to area closures, the majority of the alternatives developed solely to minimize or mitigate the adverse impacts of fishing on habitat utilize closed areas. Twelve distinct closed area options have been developed and analyzed. Three of them were developed specifically to protect hard-bottom areas (Habitat Alternative 3A, 3B, and 4). Four were developed to balance EFH protection with fishery productivity (Habitat Alternative 5A, 5B, 5C, and 5D) and one was developed to prohibit scalloping in low production scallop areas as well as highly productive EFH (Habitat Alternative 7). Two closed area options were developed to utilized existing groundfish closure areas to gain additional habitat protections (Habitat alternative 6 and 9), and two were developed to specifically provide habitat protection in and adjacent to the Habitat Area of Particular Concern for juvenile cod on eastern Georges Bank. (See FSEIS Section 5.3.4.3 - 5.3.4.9).

In sum, the Amendment 10 FSEIS considered alternatives that utilize each management tool (effort reduction, gear modification, and closed areas). The twelve closed area options range from the use of existing area closures, to expansion of those areas, to development of new closed areas that are not related to any previous area closures. In terms of the two most relevant habitat characterization metrics that were analyzed (percent EFH and percent hard bottom substrate in the Northeast region), these twelve closed area options provide a wide range of EFH protection. They contain, for example, 0-72% of total EFH area for species and life stages that were determined to be vulnerable to the adverse impacts of mobile, bottom-tending gear (trawls and dredges) and 0-72% of the hard bottom substrate in the region. For overfished groundfish species, the ranges of EFH protection (from scallop dredging) provided by the 12 habitat closed area measures are 1-76% for cod, 0-90% for American plaice, 0-82% for white hake, 1-63% for winter flounder, and 0-52% for yellowtail flounder. Accordingly, NMFS believes that the range of alternatives included in the Amendment 10 DSEIS is adequate and robust and will be of undoubted assistance to the agency as it considers the environmental consequences of its decisions in this matter.

107. **Comment C1**. ***Many habitat closure alternatives are not tailored to address the significant impacts of scallop dredging in a comprehensive way.***

This is not true. All 12 habitat closed area options are comprehensive since they eliminate all the potential adverse effects of scallop dredging on all EFH and habitat types within the boundaries of each proposed closed area. These effects are identified in Section 7.2.6.3.4 of the FSEIS. Since scallop dredging affects benthic habitats for a number of federally-managed species in the Northeast region (but not for scallops), the closed areas were not designed to eliminate scallop fishing in essential habitat areas occupied by any particular species. Such an approach would be at odds with the MSA requirement to minimize adverse impacts on EFH for all species affected by the scallop fishery. Likewise, it would have made no sense to design closed area alternatives that only address specific impacts (but not all impacts) of scallop dredging. However, as specified in the response to C above, each closed area alternative was designed differently according to the goal of the closure.

108. **<u>Comment C2</u>**: ***Habitat alternatives 2 and 9 are virtually identical to the No Action/Status Quo.***

There are significant differences between Alternatives 2 and 9 and the No Action/Status Quo Alternative. Alternative 2 relies on the incidental habitat benefits of all the other scallop resource management alternatives in Amendment 10 to minimize the adverse impacts of scallop fishing. Several resource management measures considered in Amendment 10 have habitat benefits that will be realized even if no habitat-specific management measures are adopted. These benefits will be in addition to those associated with the No Action/Status Quo Alternative, which would simply maintain the existing groundfish closures.

The difference between Alternative 1 (Status Quo/No Action) and Alternative 9 is that Alternative 9 would afford the existing year-round groundfish closed areas the added protection of "habitat closures." Unlike the groundfish closures, which would be utilized to minimize the habitat impacts of fishing under the No Action/Status Quo Alternative, habitat closures would remain closed indefinitely. Groundfish closures are, by their very nature, temporary since they can be modified or eliminated completely once groundfish stocks recover and the closures are no longer needed to limit fishing effort or to protect spawning fish. Also, some gear types that adversely impact bottom habitats but do not capture groundfish (*e.g.*, shrimp trawls and clam dredges) are allowed in groundfish closed areas, and portions of the groundfish closures on Georges Bank have been opened on a limited basis to scallop dredging. In addition, Alternative 9 includes a year round closure around Cashes Ledge (in the Gulf of Maine) that is not included in Alternative 1.

109. **<u>Comment C3</u>**: ***Many habitat closure alternatives are only slight variations of the No/Action status quo.***

As stated in the response to C2 above, the status quo/no action alternative does not close any areas to fishing for habitat protection purposes, meaning that some types of mobile, bottom-tending gear (*e.g.*, clam dredges and shrimp trawls) can be used in them, and they are only closed temporarily to limit groundfish mortality or as spawning closures, until groundfish stocks have recovered from the effects of overfishing. In addition, most of the habitat closed area alternatives close areas both inside and outside of existing groundfish closure areas, thus providing a significant increase in habitat protection as described in Section 8.5 of the FSEIS.

110. **<u>Comment C4</u>**: ***The Councils Preferred Alternatives to reopen portions of the groundfish closed area will exacerbate environmental impacts, contrary to statements made in the DSEIS.***

Amendment 10 adopts a rotational, limited access strategy for portions of the groundfish closed areas that will be implemented in subsequent framework adjustments. The Council acknowledges that there will be negative habitat impacts of scallop dredging within the controlled access areas because they have not been disturbed by mobile, bottom-tending gear since 1999 and 2000 (see

Section 8.5.4.2 in the DSEIS), but also points out that these negative impacts may be offset by the positive effects of shifting fishing effort out of open access areas that are currently being heavily fished (Section 5.1.6.2 in the FSEIS). The other factor that may reduce overall habitat impacts is the reduced bottom time for dredge tows in the controlled access areas because of the large number and size of the scallops that accumulate in these areas after several years of no fishing.

111. **Comment C5**: ***Alternative 5 is not scientifically supported and has been repeatedly criticized by the Habitat Tech team and others.***

The four closed area options in Alternative 5 were developed using the best scientific methodologies and information available. The above comment seems mistakenly to judge the scientific utility of an alternative against a standard of unquestioned scientific certainty. In other words, a lack of dispositive scientific evidence does not necessarily render an alternative arbitrary, nor does it create an obligation to conduct further experiments, or to gather additional information, or to design new scientific models. Additionally, an agency cannot sit idly by waiting for complete unanimity, particularly in the field of science where conflicting facts or opinions are a necessary part of the scientific process.

The closed area scenarios depicted in Alternative 5 were derived utilizing a model developed by NEFMC staff and many members of the Scallop PDT, Groundfish PDT, and Habitat Technical Team to evaluate optimal area closure configurations to optimize the tradeoff between EFH protection and losses in resource productivity associated. The Working Group model is based upon accepted mathematical treatment of spatial population dynamics for marine fish populations and incorporates widely accepted and published ecological theory of density-dependent habitat suitability (See Appendix IV for a full description of the methods used to develop the model, model assumptions, uncertainties and sensitivity analyses).

The Habitat Technical Team and the Habitat Committee raised some questions related to the weights assigned to the input parameters of the model (*i.e.*, assumptions regarding the relative importance of individual species) and the combination of productivity values used to optimize the tradeoff between habitat benefits and fishery costs. Neither group, however, criticized the model's use as being improper. Specifically, prior to using the model to generate closed area options, the Habitat Technical Team and the Habitat Committee recommended that various sensitivity analyses (changes in various model parameters) be conducted to see how the proposed closed areas would change based upon changes to the model parameters. Once these analyses were completed, the model was used to develop four habitat closed area options (Alternatives 5A, 5B, 5C, and 5D). The concerns of some Technical Team and Committee members were thereby addressed, while other individuals, although less concerned than before, remained uncertain. But a comfort level was reached and, despite the opinion of some that the correct parameters were not being used, the model was accepted as being the best available.

The Working Group model could have been used to develop habitat closures to protect just one or a few species, but the Council's joint working group did not do that. Instead it gave more weight to the input parameters and abundance distribution data for species whose bottom habitat was likely to be adversely affected by scallop dredging, as specified by the joint PDT/Technical Team working group. These weights and factors are described in Appendix IV for the five sensitivity analyses.

The Working Group Model has also been compared to a preliminary model (MARXAN) under development by the University of Connecticut for application to the design of multi-species habitat closed areas in the Northeast region. The Habitat Technical Team raised similar issues with the MARXAN model as with the Working Group Model. Therefore the MARXAN model was subjected to similar sensitivity analyses as the Working Group Model. Although the Habitat Technical Team and the Habitat Committee were interested in utilizing both models to generate habitat closed area scenarios, the MARXAN model needed further development for use by the Council and additional financial resources were required to complete it.

Since the Working Group Model was the only model available at the time for use by the Council, they selected all four model outputs (Alternatives 5A - 5D) for full analysis and inclusion in Amendment 10. These five options contrast nicely with the other seven closed area options that were developed more qualitatively. The Council's decision to include all the closed area scenarios derived from this model adds credibility to the Working Group's approach and supports the Council's decision to rely on the model as a scientific tool.

112. **Comment C6**: ***Alternative 7 shares similar flaws as Alternative 5.***

This alternative was developed based upon a scoping comment from an environmental organization that suggested restricting scallop dredging to areas that are the most productive (for scallops) and leaving other less-productive areas inaccessible to the scallop fishery. Alternative 7 specifically prohibits scallop dredging in ten-minute squares that have low scallop productivity and high EFH value. Confining the fishery to this area closes about 78% of the total region to scallop dredging. This alternative was considered to be a reasonable alternative and was included in Amendment 10 with a full environmental analysis. It was developed independently of the working group, but using the same model (see response to Comment C5) with some additional scallop distribution data that were not used to develop Alternative 5.

113. **Comment C7**: ***Alternative 12 and 13 have not been developed, nor adequately analyzed in the DSEIS.***

Habitat Alternative 12 is to provide a scallop TAC set-aside to fund habitat research with a goal of improving our scientific knowledge of the habitats of the region. The Council selected this alternative for implementation in the FSEIS. The alternative was analyzed in Section 8.5.

Habitat Alternative 13 would further integrate habitat management with area rotation. This concept is outlined in Section 5.3.2.7, which is one of the scallop area rotation alternatives. Under this alternative, the frequency, duration, and intensity of scallop fishing in rotation management areas would be modified to minimize adverse habitat impacts. However, specific criteria for controlling the frequency, duration, and intensity of scallop fishing were not defined, because of a lack of scientific consensus about how these criteria should be specified. Specifically, there was considerable uncertainty about the effects of varying the amount of effort as a means to limit adverse impacts in small areas, and uncertainty about habitat recovery rates that would be needed to determine access frequency under this strategy. For this reason, the environmental consequences of this alternative were not analyzed and it was determined to be impracticable.

114. Comment C8: ***The Councils preferred alternative - Addendum Alternatives 1-9 as prepared by the Joint Industry Advisors - will damage sensitive habitats and should not be included in this DSEIS.***

The Joint Industry Advisors alternatives 1-9 are not included for consideration as part of Amendment 10 or the FSEIS. These are alternatives under consideration in Amendment 13 to the Northeast Multispecies FMP and are contained in Addendum I for informational purposes only. These alternatives were developed too late in the process for inclusion in Amendment 10.

115. **<u>Comment C9</u>**: ***The DSEIS does not contain alternatives proposed during the scoping meeting or in later comments.***

NMFS published a Notice of Intent (NOI) to prepare a supplemental EIS for the EFH components of the Northeast Multispecies and Atlantic Sea Scallop Fishery Management Plans on February 1, 2001 (66 FR 8568). The public comment period was open until April 4, 2001. Based on the original Amendment 13 and Amendment 10 scoping letter, dated April 13, 2001, the following proposals were recommended to protect EFH:

- Develop a precautionary management approach to protecting EFH
- Establishment of Habitat Research Areas
- Creation of a systematic and effective HAPC designation process

The Council received another letter from the same group dated March 4, 2002; almost a year later and outside the scoping period that summarized the proposals identified through scoping. The second letter contains the original three proposals included during the scoping period and an additional six (6) proposals, which include:

- Make a primary goal of rotational management minimizing the effects of scallop dredging on habitat by: (1) excluding dredging from gravel "hard bottom" areas and (2) restricting scallop dredging to those areas that are the most productive and leaving other less-productive areas inaccessible to the scallop fishery.
- Establish area-based gear restrictions prohibiting dredging and trawling in sensitive habitats, including known-hard bottom on Jeffreys Ledge, Stellwagen and Georges Bank (in juvenile cod EFH).
- Establish harvest incentives for fixed gear (i.e., access to mobile gear restriction zones). The incentives should try to protect sensitive hard-bottom cod EFH, protect benthic invertebrates (major groundfish food source) and protect the complexity of these habitats to promote recruitment.
- Create spawning sanctuaries to improve scallop recruitment.
- Prohibit scallop dredging in areas containing sensitive EFH for overfished species.
- Create a rotational-area management system that keeps areas closed for six (6) years.

All of the above-proposed alternatives submitted within or outside of the scoping period have been considered in the development of the Amendment 10 DSEIS/FSEIS .

- The precautionary approach is an approach to decision-making, not a specific management alternative that can be implemented through regulation. After discussion, this recommendation was eliminated from further consideration (See Appendix II).
- Recommendation #2 is Alternative #14 in Amendment 10 and was considered but rejected (see Section 5.4.4).
- Recommendation #3 (HAPC designations) is being reviewed for all species as part of an Omnibus EFH Amendment (See Section 6.2.6 and 7.2.6.9). It is anticipated that a request for HAPC proposals will be published in the Federal Register in early 2004 following the process the Council adopted in 2000. The Omnibus approach is the most effective way to fully integrate HAPC and EFH designation issues across all FMPs.
- Recommendation #4 was developed into Habitat Alternative #7 (see Section 5.3.4.7 and response to comment 6 above).
- The concept of Recommendation #5 is a component of Habitat Alternatives 3a, 3b, 4, 6, 8a and 8b.
- Recommendation #6 is Alternative #16 in Amendment 10 and was considered but rejected.

- Recommendation #7 (spawning sanctuaries) is a component of rotational management, which is a major objective of Amendment 10.
- The concept of Recommendation #8 is a component of all of the habitat closed area alternatives.

19.4.8 Comments on economic analyses

116. Analyses do not account for displacement of effort into areas of higher habitat value and sensitivity: consequences are 1) economic input analyses are misleading, and 2) vessels would be forced out of sandy bottom areas into higher value hard-bottom habitats.

Many analyses in the DSEIS used the proposed overfishing definition as the basis for expected scallop effort in areas that remain open to fishing. The target fishing mortality in areas that are available to fishing remains constant and effort by area is expected to be nearly the same in open areas, no matter the size or location of habitat closures. This analysis is not misleading for the proposed overfishing definition, but does not account for the effort shift and higher amount of fishing effort that would occur in open fishing areas if the status quo overfishing definition were applied.

Section 7.2.3.2 in the DSEIS analyzes the performance of the fishery and its impacts when using the status quo overfishing definition and compares it to the performance and impacts when using the proposed overfishing definition, using habitat alternative 6. As the commenter points out, the status quo overfishing definition coupled with long-term area closures to protect habitat increases fishing effort and total area swept in areas that remain open to fishing.

A more complete analysis of the final alternative was prepared for the FSEIS, comparing the performance and impacts of the two overfishing definitions using Habitat Alternative 6, with and without access to the Georges Bank areas. The status quo overfishing definition would allow considerably more fishing effort in open areas, possibly increasing effort surrounding hard bottom habitats not included in the habitat closure.

The effect of this effort shift using the status quo overfishing definition and habitat alternative 6 on habitats (measured by EFH designations and substrate types) were analyzed in Section 8.5.7.2.1.1. Although rotation area management and Habitat Alternative 6 with the status quo overfishing definition increases effort in areas that remain open, the analysis estimates a reduction in the percent of effort over gravelly sand areas and an increase in effort over areas with greater amounts of EFH designations for juvenile species that are vulnerable to fishing with dredges and trawls.

Economic analysis shows only the impacts of habitat closures on scallop revenues, costs and overall economic benefits based on the biological projections of scallop landings from all areas open to fishing. These impacts on scallop fishery are independent of the impacts on habitat value and sensitivity.

117. There is confusion over what access scenario was used to evaluate the economic impacts of habitat closure alternatives; can't apply results of economic analysis without knowing what "area access scenario 1" (the preferred area rotation option) is referred to.

Area access alternative 1 was defined in the DSEIS and includes a mechanical rotation area management system with access to the parts of the Georges Bank closed areas that were open to scallop fishing during the 2000 fishing year, including parts of Closed Area I, Closed Area II, and the Nantucket Lightship Area. The impacts of the habitat closure options were analyzed, however, for all area access options, including access option 2 which provides access to Framework 11 areas, option 3 which provides access to Framework 13 areas, and option 4 which provide access to all groundfish areas not otherwise included in a level 1-4 habitat closure. The impacts of the habitat closures were compared to "no habitat closures" but with access to groundfish areas according to these four access options.

118. The estimated cost of habitat closures during 2004-2007 of $4 million is not believable (too low).

The cost of habitat closures could be estimated in terms of the reduction in scallop revenues, producer or consumer surpluses, or economic benefits relative to no habitat closures. All of these economic values were estimated from the biological projections of scallop landings under alternative habitat closures. Table 316 shows these impacts for area access alternative 1 only. According to this Table, the impacts of the habitat closures range from a $5 million reduction to a $245 million reduction on total economic benefits depending on the specific habitat alternative. Table 331, Table 333, Table 335 and Table 341, however, show impacts of the alternative habitat closures on net economic benefits, producer and consumer surpluses and fleet revenues with all the area access options. In short, the cost of habitat closures change with the scallop biomass included in each particular area, and estimated yield from the biological if access were given to these areas.

Only habitat closures alternatives 3a and 6 had a reduction in total revenue of $4 million. This is an annual estimate over 2004 – 2007 and the actual total estimate for all four years is $16 million in 1996 dollars. In nominal terms, the loss in revenue is actually 15% higher than in 1996 dollars shown in Table 316.

119. Comparisons of habitat benefits (percent gains in EFH) are not equivalent to economic losses (percent loss in revenue compared to 2001): a 20% increase in EFH area is not balanced by a 20% loss in revenue. What is the economic benefit of EFH protection?

The positive economic effect from conservation of EFH through specific closures cannot be quantified, because of the difficulty in predicting habitat recovery rates and estimating how preserving habitat will translate into future yield. Qualitatively, there is plenty of research showing that preserving quality habitat improves yield by increasing effective nursery areas and boosting spawning capacity, however. The Council therefore believes that preserving EFH will have a measurable benefit to enhancing rebuilding of depleted finfish stocks, which has been estimated to have positive net benefits from higher landings when stocks are near target biomass levels.

Although costs to the scallop industry from the various closures, combined with rotation area management alternatives and area access options have been estimated, they cannot be quantitatively compared with the benefits of habitat conservation.

120. Use of retrospective analysis of the impact that proposed habitat closures would have had on scallop revenue during 1995-2001 is misleading because scallop vessels were excluded from most of groundfish closed areas in those years; if scallop vessels are given access to portions of these areas in A10, but prevented from using them because of habitat closures, costs will be much greater than indicated by the analysis.

This retrospective analysis only estimates the effect that the proposed habitat closures would have had on historic scallop fishing effort and revenue. This may or may not be the same as future impacts, but provides another useful perspective on the potential costs. As the commenter points out, this analysis underestimates the total potential impact had the Georges Bank closed areas been fully open to scallop fishing, a point recognized in the analysis. Other analyses with various area access options were also analyzed based on future biological projections, which include the effects that habitat closures would have on future access to scallop resources within the Georges Bank closed areas.

121. ***Economic impact analysis only considers effects of habitat closures on scallop fishery even though they will prohibit gears used in other fisheries as well.***

The costs to other fisheries from habitat closures are not addressed because Amendment 10 actions would only affect the scallop fishery. Actions in other FMPs that limit access in habitat closed areas to other fisheries would be analyzed in those documents.

122. ***There are problems in Table 201: not all habitat closed area alternatives are shown and there are errors in scallop production estimates, e.g., estimate for all of 3a has been estimated by scallop PDT to reside in much smaller cod HAPC.***

Table 201 (now Table 223) was developed early in the process and therefore did not include some alternatives that were developed later. As section 8.5.4.14.1 explains, the productivity estimates in Table 201 were derived from the proportion of historic recruitment by area that fell within the proposed habitat closures.

This analysis of the amount of productivity lost does not take into account the potential for migration to make species in the habitat closures available to the fishery. It also does not factor in other scallop management measures that may apply in the future. On the other hand, it provides an approximation of the proportion of productivity from scallop, groundfish, and monkfish recruitment that has been observed within the various habitat closure alternatives. For sedentary species, like scallops, the Council believes that this fairly estimates the relative costs to the fishery, irrespective of management and fishery effects.

The full biological and economic analysis estimates the cost of various habitat closures on the biological projections, which include potential management alternatives that would require 4” rings, apply rotation area management, and/or allow access to parts or all of the Georges Bank closed areas, using the proportion of scallop productivity estimated to be in each rotation management area within the boundaries of a closed area alternative (see Table 224).

123. ***Estimate intended to show effects of closed areas on landings and DAS use in 2004 (Tables 203-205) are underestimated because TACs in areas that are likely to be re-opened are underestimated (by a large margin)...the PDT is currently revising them.***

The projections are based on the 2002 resource survey, using random tows that are consistent with the survey design and give a best estimate of resource biomass. During 2002, NMFS made some additional non-random tows that when included to estimate the TACs, were higher than the projected estimates in the DSEIS using the random tows alone. Also, SMAST video survey was used for Nantucket Lightship Area TAC estimation and the video survey density estimates were slightly higher than for the annual NMFS dredge survey alone.

Although the projection estimates for Georges Bank closed areas were less than the final TAC estimates, a consistent method across alternatives to evaluate the effect that various habitat closure alternatives might have. This process provides a robust estimate of effects relative to status quo and no action that also use random survey tows from the projection data.

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