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1.0 ENVIRONMENTAL IMPACTS

1.1 IMPACTS ON SCALLOP RESOURCE

1.1.1 No Action

If No Action is taken under Amendment 11 there are not expected to be substantial impacts on the scallop resource in either direction. The alternatives under consideration for ACLs are expected to have some beneficial impacts on the scallop resource from increased accountability and payback type of measures if catch limits are exceeded. In general, the stacking and leasing alternatives under consideration are expected to have neutral impacts on the resource if adjustments are included to reduce risks of increased catch. But if no action is taken for these alternatives there are no direct impacts on the scallop resource.

The alternative to revise the overfishing definition is expected to have positive impacts on the resource. The current overfishing definition (No Action) and overfishing reference points are based on the assumption that fishing mortality (F) is spatially uniform. But, in the scallop fishery this assumption is inaccurate because of unfished biomass in closed areas, variable Fs in access areas, and spatially variable fishing mortality in open areas that potentially leads to growth overfishing in these areas. Under the current OFD, closed and access areas protect the scallop stock from recruitment overfishing, but growth overfishing may occur in the open areas because the current OFD averages spatially across open and closed areas, i.e. F is higher in open areas to compensate for the zero fishing mortality in closed areas. Therefore, No Action on this measure will not have negative consequences on the resource because closed areas help prevent recruitment overfishing, but growth overfishing would be a concern.

None of the measures under consideration for adjustments to the general category management program are expected to have impacts on the resource, so if No Action is taken related to these there would be no impacts on the resource.

No Action on the measure to address EFH closed areas could have impacts on the scallop resource. Having both Amendment 10 and Amendment 13 EFH boundaries apply to the scallop fishery prevents allocating scallop access into areas with the highest catch rates and reduces the benefits of area rotation. If no action is taken for this alternative, effort is shifted into areas with lower scallop catch rates, increasing area swept and potentially having negative impacts on the environment.

If no action is taken on the measures to improve the research set-aside program, the scallop resource would not be impacted.

If no action is taken on changing the scallop fishing year there may be negative impacts on the scallop resource. Keeping the start date at March 1 (No Action) may have negative indirect impacts on the scallop resource because it does not enable the Council to integrate the most recent scallop survey results into analyses used to make decisions for scallop management. Overall, a March 1 start date increases uncertainty and risk because future management decisions are based on older data, which could have indirect impacts on the scallop resource. This could also mean that the Council decides to use more up to date information, and as a result frameworks are implemented late.

1.1.2 Compliance with re-authorized Magnuson-Stevens conservation and management act (MSA)

The MSA was reauthorized in 2007. Section 104(a) (10) of the Act established new requirements to end and prevent overfishing, including annual catch limits (ACLs) and accountability measures (AMs). Overall this section includes a summary of new definitions and clarifies how these will be integrated with current scallop reference points. One new requirement is to have an ABC control rule recommended by the SSC. The Act now requires that the specific sources of scientific uncertainty in the fishery be factored in when setting ABC below OFL – the catch associated with the overfishing threshold. Because the Council is not permitted to set catch above ABC, having an ABC control rule should help prevent overfishing, having beneficial impacts on the scallop resource.

The Act also requires the Council set annual catch limits (ACL) equal to or less than ABC. In setting catch levels the Council is required to describe specific sources of management uncertainty in the fishery and account for them when setting the ACL below ABC, or if ACTs are used management uncertainty is explained as the difference between ACL and ACT. The Act also requires that each FMP implement accountability measures if the fishery exceeds the ACL. This action includes several alternatives for AMs, and in theory these measures should help prevent overfishing and hold the fishery more accountable for any overages if they occur. Therefore, AMs are expected to have beneficial impacts on the resource.

This action also considers accountability measures for a sub-ACL of YT flounder. This is the only sub-ACL this fishery has been allocated. Catch and discards of all other species in the scallop fishery have been accounted for before ACLs are set for those directed fisheries. The AMs under consideration for YT flounder may have impacts on the scallop resource depending on which one is selected. Effort shifts are expected with all of the YT AMs under consideration, and effort shifts can have negative consequences on the scallop resource if effort is shifted to less optimal areas and into seasons with lower meat weights. Some of the in-season YT AMs could cause derby fishing, which can also have negative consequences on the scallop resource if effort is merged into a smaller window of time when scallop meat weights are not optimal.

1.1.3 Measures to address excess capacity in the limited access scallop fishery and provide more flexibility for efficient utilization of the resource

1.1.3.1 No Action

If this alternative is selected, then no additional measures would be implemented to reduce capacity in the limited access scallop fishery. All current restrictions would remain in place. No impacts on scallop resource expected from no action. The fishery has sufficient measures to prevent overfishing, and if not corrective measures can be taken in a framework action to reduce effort.

1.1.3.2 Permit Stacking

This group of alternatives would allow a single limited access vessel to have two limited access scallop permits on one vessel.

1.1.3.2.1 Fishing power adjustment for stacking permits

In order to address the concern that stacking could move effort from less powerful or lower-performing vessels to more powerful or higher-performing vessels, potentially increasing capacity and fishing mortality, the Council is considering alternatives for adjusting stacked permits. If the fishing power adjustments are sufficient to prevent potential increases in catch, then there are no impacts expected on the scallop resource. Selecting a higher percentage for the mortality adjustment would reduce potential risks of increased catch, but would have more impacts on the vessels that stack.

It is possible that the alternative that restricts stacking between vessels that meet the replacement criteria could increase catch and F because analyses support that even when vessels are the same length and horsepower catch on one can be greater. Vessel age and fishing behavior in terms of trip length can have impacts on catch that would not be accounted for with this alternative. A third alternative is under consideration that is somewhat of a combination alternative; like permits have no adjustment and permits from different categories can stack but subject to an adjustment. This alternative has similar risks of increased catch for vessels with the same replacement criteria described above. The alternative that puts restrictions on trawl vessels that stack with dredge permits would reduce potential future increases of F if that vessel converted back to a trawl permit and fished both permits with trawl gear. Trawl gear is capable of catching smaller scallops, so more animals are killed for the same weight, leading to a higher F.

Two options are under consideration for de-stacking: allow it and prohibit it. De-stacking provides more flexibility to the industry to make business decisions. It does remove the possibility to permanently eliminate capacity in the fishery, because permits could later be de-stacked and put back on two separate boats. However, excess capacity does not directly impact the resource so long as there are sufficient measure in place to limit catch and mortality. There are other impacts of excess capacity, but they are not direct impacts on the scallop resource.

1.1.3.3 Leasing

This group of alternatives would allow a limited access scallop vessel to lease fishing effort from another limited access permit. There is one option for DAS leasing and one for leasing of access area trips. There are various options being considered in terms of who can lease and other restrictions. There are also several alternatives for fishing power adjustments that would be applied to leased open area DAS in order to prevent increases in fishing capability. Similar to the discussion above for stacking, if the fishing power adjustments are sufficient to prevent potential increases in catch, then there are no impacts expected on the scallop resource. Selecting a higher percentage for the mortality adjustment would reduce potential risks of increased catch, but would have more impacts on the vessels that lease.

One option under leasing that could increase catch is the allowance of leasing from CPH. However, the amount of effort currently in CPH is minimal – actually zero permits are in CPH as of 2009. If there were permits in CPH this could increase effort levels beyond what is seen today, but that is not the case. If vessels decide to put their permits in CPH in the future and lease that effort out, overall impacts on the resource should be similar to current levels, provided the effort is not moved to more efficient vessels with no adjustment applied.

There are many other alternatives under consideration related to leasing that are not expected to have impacts on the scallop resource such as history of leased effort, restrictions on who can lease, ownership cap provisions, and application requirements.

1.1.4 Measures to adjust specific aspects of FMP to make overall program more effective

This section contains alternatives for various measures that are already in place. The topics include adjustments to the overfishing definition, modifications to the limited access general category program, revision of the EFH closed areas if Phase II to the Habitat Omnibus Amendment is delayed, improvements to the research set-aside program, and changing the fishing year.

1.1.4.1 Measures to adjust the current overfishing definition (OFD) to be more compatible with area rotation

The SQ OFD underestimates the effects of fishing mortality because F is averaged across closed, access, and open areas, which all receive different amounts of fishing pressure. Yield-per-recruit is reduced with a spatially averaged OFD (current) because the yield is far lower in open areas. Additionally, the biomass-per-recruit is higher because of rotational management and the long-term closures.

The A10-proposed OFD has been slightly modified to average F over time within particular areas, thus considering spatial variation and allowing optimal yield to be harvested from both open and access areas. This alternative would also remove the influence of the un-harvested biomass from closed areas (EFH) from the mortality estimate in the open areas, which is the primary cause for currently setting such a low F_{target}. An argument that has been presented against altering the OFD is that we already have a low F_{target}, a precautionary measure to help mitigate open area overfishing. However, the optimal spatially-averaged fishing mortality target varies from year to year, depending on the fraction of scallops in closed areas, and currently there is no systematic way of setting the target.

A third alternative was developed after the PDT presented the second alternative to the SSC in October 2008; a "hybrid" alternative, combining aspects of the alternative proposed in A10 and the existing overfishing definition. The A10-proposed overfishing definition would be difficult to assess since the area used to calculate fishing mortality would change year to year as areas open and close. On the other hand, the greatest difficulty with the status quo OFD is that the fishing mortality target is set in an *ad hoc* manner. In the hybrid alternative, the threshold would be kept as in the status quo OFD (currently, a spatially averaged F of 0.29), whereas the target would be set using the proposed overfishing definition with the additional restriction that the spatially averaged fishing mortality shall be no higher that 80% of the threshold. Under the hybrid definition, the targets for the open and access areas would be set at the level appropriate for each area (e.g., using current information somewhere between 0.23 and 0.26 in open areas, and using the time-averaging principle in the access areas), thus preventing growth overfishing in the open areas while keeping the current simple overfishing threshold.

Amendment 10 explained that in the near term (2004-2008), the current overfishing definition would produce higher landings and DAS allocations, but over the long-term, landings would be reduced. Amendment 10 explained that the A10-modified definition had favorable characteristics like reducing potential impacts on bycatch and habitat by reducing area swept, increasing catch by 10% with larger average scallop size, and in the long-term producing higher stock biomass. The proposed hybrid OFD encounters the same short-term issues and provides the same long-term benefits.

1.1.4.2 Minor adjustments to the limited access general category management program

These alternatives include several potential modifications to the limited entry program recently implemented for the general category fishery. Amendment 11 to the Scallop FMP limited access in the general category fishery and implemented an IFQ program for qualifying vessels. Several specific ideas were raised during that process but were delayed for consideration because they would require more time for development and analysis. This action is currently considering alternatives to address the following specific issues: rollover of IFQ, consideration of a community fishing association that could buy and lease general category IFQ, modification of the general category possession limit, and modification of the maximum quota restriction one vessel can harvest. Other modifications related to Amendment 11 will not be considered in this action.

1.1.4.2.1 Provision to allow IFQ rollover

The Council is considering a rollover allowance for general category IFQ permit holders. If for some reason a vessel is unable to harvest their full IFQ in a given fishing year, a rollover allowance authorizes a vessel to carry forward unused quota for use in the following fishing year. This should not pose any impacts on the resource because the rollover catch is accounted for in year 1, but may be caught in year 2. This could cause issues with annual catch limits, but in terms of impacts on the resource it should be neutral.

1.1.4.2.2 Modify the general category possession limit

The Council is considering a modification to the general category possession limit in response to requests from some of the industry that the current possession limit is not economically feasible. Since the fishery is managed under an IFQ increasing the possession limit or removing it should not have direct impacts on the scallop resource, provided the size composition of catch does not decrease. If more small scallops are caught F would increase.

1.1.4.2.3 Modify the maximum quota one general category vessel can fish

The Council is considering this alternative to respond to input from the industry that the current ownership restrictions are not consistent. There are currently two ownership restrictions in place: 1) a restriction on the maximum amount of quota an individual can own (5%); and 2) a restriction on the maximum amount of quota that can be harvested from one platform (2%). The alternative under consideration would modify the maximum quota one vessel can fish from 2% to 2.5% of the total general category allocation. This should have no direct impacts on the scallop resource.

1.1.4.2.4 Allow LAGC IFQ permit owners to permanently transfer some or all quota allocation to another IFQ permit holder or community-based trust or permit bank

The intent of this alternative is to allow LAGC IFQ permit owners to permanently transfer some or all of their quota allocation independent of their IFQ permit to another LAGC IFQ permit holder or CFA holder while retaining the permit itself. Since this fishery is managed by IFQ this should not have direct impacts on the scallop resource because the total amount of catch is limited. It may move IFQ from vessels that would not have necessarily harvested their full IFQ, but projections are based on all general category IFQ being fished, there is no assumed level of non-harvest.

1.1.4.2.5 Implementation of Community Fishing Associations (CFAs)

Because this fishery is managed by IFQ this is not expected to have direct impacts on the resource.

1.1.4.3 Measures to address EFH closed areas if the EFH Omnibus Amendment 2 is delayed

This alternative would consider making the EFH closed areas consistent under both FMPs if the EFH Omnibus Amendment 2 timeline is delayed. If selected, only the areas closed for EFH under Amendment 13 would be closed to scallop gear; the areas closed for EFH under Amendment 10 would be eliminated.

Having both sets of EFH areas closed to scallop gear for the last several years has affected the scallop resource by allocating more open area effort than access area effort, primarily because the boundaries in Closed Area I have prevented allocating scallop access in that area. The scallop resource available in the remaining “sliver” has not been sufficient to allocate an access area trip to Closed Area I. As a result, additional open area DAS have been allocated to meet fishing targets, which puts effort in areas with lower catch rates. This increases impacts on the scallop resource if fishing is in suboptimal areas, and increases bottom time which has impacts on bycatch and EFH.

If this boundary issue is resolved, there is sufficient scallop resource within Closed Area I to provide access. This configuration would reduce effort in other less optimal areas. Closed Area I has not been open to the fishery since 2005, so the scallops are large within that area and should be harvested before they reach maximum growth potential. Fishing larger scallops reduces overall F compared to equal catch of smaller scallops.

1.1.4.4 Measures to improve research set-aside program

The measures to improve the research set-aside program are designed to improve the timing and administration of the program. Arguably, if the program can be more streamlined and worthwhile projects can occur with less obstacles, better and more timely research will result. This will have indirect benefits on the scallop resource.

There is one alternative that would remove additional TAC specifically for scallop survey work in areas scheduled to open for scallop access. A total of 3% would be removed for research compared to 2%. Having dedicated resource for funding research to survey access areas will improve our ability to allocate the appropriate amount of effort to prevent overfishing and optimize yield.

Lastly, there is an alternative that would include a list of the measures from which research projects may be exempt. A researcher would not need to apply for an experimental fishing permit if the project wished to be exempt from the following restrictions:

- Crew restrictions
- Seasonal closure in Elephant Trunk
- Requirement to return to port if fishing in more than one area

Eliminating the crew restriction on research trips is not expected to have impacts on the scallop resource provided compensation does not involve harvesting smaller scallops with additional crew. The intent of eliminating the crew restriction on research trips is to enable more researchers onboard, so the likelihood of researchers shucking scallops to be landed as compensation is minimal. Therefore, the impacts of eliminating the crew restriction for research trips and research compensation trips is not expected to have impacts on the scallop resource. In fact, if more research can be conducted on a single trip by allowing more researchers on board, this measure could have indirect benefits for scallop-related research overall.

Allowing research trips access in Elephant Trunk during the seasonal closure of September 1-October 31 is not expected to have major impacts on the scallop resource that would not be outweighed by the potential benefits of conducting research in that area during that season. Scallop meat weights are lower in September and October compared to other times of the year and quality is not optimal, so overall F from compensation fishing may be higher during that time compared to other seasons. However, the purpose of the closure is to reduce potential interactions with sea turtles, and these two months are expected to have greater probability of interaction than other times of year. If research projects are focused on researching these interactions it would be advantageous to gain access to the area during this time of year.

Eliminating the requirement to return to port if fishing in more than one area on a research trip should not have any impacts on the resource provided the vessel only fishes the allowed amount of catch in the specified areas. Even if 100% of all compensation fishing takes place in suboptimal areas and seasons, there are still no overall impacts on the scallop resource because this research makes up such a small percentage of the overall fishery.

1.1.4.5 Measures to change the scallop fishing year

The scallop fishing year is out of sync with the framework adjustment process and the timing of when the scallop survey data become available for analysis. As a result, actions have not been implemented at the start of the fishing year, TACs have been misestimated due to reliance on older data, and extra actions have been required to compensate. The Council has considered changing the scallop fishing year several times in the past, but each time the Council decided to maintain the status quo of March 1. One reason the Council is again considering modifying the scallop fishing year is in response to new requirements for ACLs. If the Council decides to allocate ACLs across various FMPs, it may be useful for FMPs to be on the same fishing year to the extent practicable (i.e., May 1 to be consistent with the Groundfish FMP).

The alternative that would modify the fishing year to May 1 would improve integration of best available science into the management process. Moving the start of the fishing year back even two months allows for needed time to process, analyze, and integrate survey data from the current year into management decisions for fishery specifications the following year. This alternative would be most effective if the federal survey can be moved to earlier in the year and data were available earlier in the summer (June rather than September).

1.2 IMPACTS ON PHYSICAL ENVIRONMENT AND ESSENTIAL FISH HABITAT

The following sections discuss the potential adverse impacts of the proposed action on EFH. Section 1.2.1 describes the Council's general approach to EFH impacts analysis, Section 1.2.2 summarizes the fishing impacts literature relevant to the scallop dredge fishery, and Section 1.2.3 describes the potential impacts, if any, of each of the proposed alternatives.

1.2.1 Methods for assessing the impacts of fishing on EFH

Beginning in early 2008, NEFMC habitat staff, committee members, and plan development team members commenced work on Phase 2 of the EFH Omnibus Amendment 2. The purpose of Phase 2 is to identify fishing impacts to EFH and develop management alternatives to minimize those impacts. Although analyses and alternatives development for Phase 2 are ongoing, the EFH impacts assessment for Amendment 15 is intended to be broadly consistent with the Phase 2 approach.

The primary goal of Phase 2 was to develop a tool (hereafter referred to as the Swept Area Seabed Impact (SASI) model) that will allow for objective, rigorous comparisons of impacts across fisheries and gear types. Benthic habitats were characterized by their dominant substrate and energy environment, and based on this characterization, the structural benthic features likely to be present in each habitat type were listed. Next, the vulnerability of each feature to bottom-tending fishing gears was evaluated, using the fishing impacts literature relevant to regional gears and habitat types whenever possible. Vulnerability incorporates both the susceptibility of seabed habitat components to fishing gears, and the ability of those habitat components to recover from impact. These habitat vulnerability parameters were then combined with fishing effort information in a spatially-referenced, GIS-compatible environment. Because fishing effort, substrate, and seabed energy can be mapped, the results of SASI can be used to compare the EFH impacts of various spatial management scenarios.

Fishing effort, for all gear types, is represented in a common area swept currency, which facilitates comparisons between gears and/or fisheries. **Broadly speaking, the Phase 2 analyses assume that area of seabed swept by a particular fishery or subcomponent of a fishery is a proxy for seabed impact, and that seabed impact is a proxy for impacts to EFH.** Thus, although SASI is not fully operational and is pending final approval by the Council's Scientific and Statistical Committee, in order to be consistent with the SASI approach, most the alternatives described below are presented in terms of whether they would be likely to increase or decrease area swept.

SASI allows habitat vulnerability to vary based on the dominant substrate and energy environment of a particular area of the seabed. Thus, dominant substrate and energy characteristics can be used, in combination with information on actualized or likely future fishing effort and the vulnerability assessment described above, to determine whether habitats are at particular risk and should therefore be protected by EFH closures. Phase 2 will review the EFH closures established by Northeast Multispecies Amendment 13 and Atlantic Sea Scallop Amendment 10. The scallop fishery is currently restricted by both sets of closures. In advance of this full review, this document will characterize and compare the EFH closure areas qualitatively.

1.2.2 General information on the impacts scallop gear on fish habitats

The sea scallop fishery is primarily prosecuted with New Bedford-style dredges. Sixteen studies have examined the effects of New Bedford-style scallop dredge gear on seafloor habitat components (Table 1)[1]. Many of these studies compare fished and unfished areas fairly broadly, making them difficult to relate to a tow based assessment. These included Asch and Collie (2007), Auster et al. (1996), Collie et al. (1997), Collie et al. (2000), Collie et al. (2005), Hermsen et al. (2003), Knight (2003), Langton and Robinson (1990), Lindholm et al. (2004), Link et al. (2005), and Stokesbury and Harris (2006). Furthermore, because many grounds are fished by both scallop dredges and otter trawls, a number of these studies confound the effects of these various gears. The exception to this is Stokesbury and Harris (2006), which was conducted entirely within the Georges Bank closed areas, which have been closed to trawling since 1994[2], but have been opened to scalloping at various intervals beginning in 1999. This study compared the same areas before and after fishing to estimate the impacts of fishing as compared to changes due to natural disturbance at the scale of the fishery.

Langton and Robinson (1990) conducted a before/after fishing comparison of the abundance and distribution of three species on Fippenies Ledge, but the possible effects of trawling were not evaluated. Five studies assessed the direct impacts of experimental tows and are thus more closely aligned with the tow-based assessment of impacts to features: Caddy (1968), Caddy (1973), Murawski and Serchuk (1989), Sullivan et al. (2003), and Watling et al. (2006). Of these, Sullivan et al. (2003) and Watling et al. (2001) returned later to assess recovery at the experimental sites. Most studies were conducted on sand or sand/gravel habitats; although Auster et al. (1996), Caddy (1968), and Mayer et al. (1991) examined the effects of dredging on mud substrates. The studies were conducted primarily in U.S. waters in the Gulf of Maine, on Georges Bank, or in the Mid-Atlantic Bight, generally in high energy areas; two were conducted in the Gulf of St. Lawrence. The following table summarizes the methods and results of these studies.

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[1] In other parts of the world, toothed scallop dredges are used. The NEFMC Habitat Plan Development Team determined that toothed dredges were sufficiently different from New Bedford-style dredges such that they were not included in the Phase 2 gear impacts literature review. The literature on otter trawl impacts is much more extensive, and will ultimately be used to help inform habitat feature recovery values in the SASI vulnerability assessment.

[2] One notable exception is the yellowtail flounder Special Access Program that occurred in Closed Area II during 2004.

Table 1 - Impacts of New Bedford-style scallop dredges on geological, biological, and prey habitat components. Where multiple field studies are included in one publication, or where multiple publications are summarized together, individual components are denoted as (A), (B), (C), etc. 'S' indicates statistical significance.

Study information	***Study approach***	***Effects***	***Recovery***
Ref #: 404 **Citation**: Asch and Collie (2007) **Location**: Northern edge, eastern Georges Bank, U.S. and Canada **Depth**: 40-50, 80-90 m **Substrate**: Gravel (pebble and cobble pavements with some overlying sand) **Energy**: High, author defined **Evaluated**: Biological, prey	Comparative. Multiple gear types fished in study area. Still photographs (N=386) analyzed for percent cover of colonial epifauna and the abundance of non-colonial organisms at shallow and deep disturbed and undisturbed sites in and around Georges Bank Closed Area II.	At shallow sites, cover of all epifauna except hydroids S differed by disturbance regime. Sponges and bushy bryozoans showed S higher % cover at undisturbed sites, encrusting bryozoans and *Filograna implexa* showed S higher % cover at disturbed sites. Also at shallow sites, generally S between year variations. At deep sites, % cover of *F. implexa* and hydroids is S higher in undisturbed areas; other taxa showed no differences by disturbance regime. For non-colonial epifauna, depth contributed more to differences in species composition than disturbance. Higher spp. richness at undisturbed sites (S at shallow sites).	At shallow sites, several taxa showed changes in abundance beginning 2 years after closed area established. Increase in abundance of *P. magellanicus*, *Pagurus* spp., *S. droebachiensis*, *Asterias* spp. between closure (1994) and 2000.
Ref #: 11 **Citation**: Auster et al. 1996 **Location**: 3 sites, Gulf of Maine, USA **Depth**: See study approach **Substrate:** See study approach **Energy**: See study approach **Evaluated**: Geological (B), biological (A,B,C)	Comparative. Amount of fishing effort and types of mobile gear used in study areas not well defined. **See otter trawl.** Three sites: (A) Swans Island: closed 10 yr, sand and cobble, depth not specified, comparative: inside-outside video transects, high energy inferred (B) Jeffreys Bank: boulders prevented fishing, then fishing, gravel and mud, depth 94m, comparative: one pair of before/6 years after submersible dives, low energy inferred (C) Stellwagen Bank: daily fishing evidenced by trawl/dredge tracks, gravel and sand, depth 32-43m, observational: n=4 (?) video transects over 2 years, high energy inferred	(A) In cobble habitat (N=12-13 transects per treatment), S lower cover of emergent epifauna, sea cucumbers in fished area; in sand habitat (N=17-18 transects per treatment), S lower cover of sea cucumbers and biogenic depressions in fished area. (B) Qualitative; loss of mud veneer, reduction in epifaunal species, incl. sponges (quantified but no statistical tests), movement of boulders (C) Positive relationship between hydrozoan *Corymorpha penduala* and shrimp in 1993, fewer areas with hydrozoans and wide distribution of tunicate *Molgula arenata* in 1994	Not addressed
Ref #: 42 **Citation**: Caddy 1968 **Location**: Northumberland Strait, Gulf of St. Lawrence, Canada **Depth**: 20 m **Substrate:** Mud, sand **Energy**: High, inferred **Evaluated**: Geological	Observed impacts during a scallop dredge efficiency study. Divers examined physical effects of two tows.	Drag tracks (3 cm deep) produced by skids; smooth ridges between them produced by rings in drag belly; dislodged shells in dredge tracks.	Not addressed

Study information	***Study approach***	***Effects***	***Recovery***
Ref #: 43 **Citation**: Caddy 1973 **Location**: Chaleur Bay, Gulf of St. Lawrence, Canada **Depth**: 40-50 m **Substrate**: Sand, gravel (gravel over sand, with occasional boulders) **Energy**: High, inferred **Evaluated**: Geological, Biological	Submersible observations of tow tracks made <1 hr after single dredge tows.	Suspended sediment; flat track, marks left by skids, rings, and tow bar; gravel fragments less frequent (many overturned); boulders dislodged or plowed along bottom.	Not addressed
Ref #: 69, 70, 71, 158 **Citation**: (A) Collie et al. 1997, (B) Collie et al. 2000, (C) Collie et al. 2005 (D) Hermsen et al. 2003 **Location**: Eastern Georges Bank (Northern edge), U.S. and Canada **Depth**: 42-90 m **Substrate**: Sand, gravel (pebble-cobble "pavement" with some overlying sand) **Energy**: High, inferred **Evaluated**: (A, C) Geological, (A,B,C) biological, prey (D) Geological, biological, prey	Comparative. Multiple gear types fished in study area. Benthic sampling, video, and still photos in 2 shallow (42-47 m) and 4 deep (80-90 m) sites disturbed (D) and undisturbed (U) by trawls and scallop dredges. Hermsen et al.: Benthic macrofauna sampled at deep and shallow sites disturbed and undisturbed (by fishing) using Naturalists dredge with a 6.4 mm liner 8 times over 7 yr period, 2 yrs prior to closure, just after closure, and 5 yrs after closure.	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; percent cover of tube-dwelling polychaetes, hydroids, and bryozoans S higher in deepwater, but no disturbance effect. Hermsen et al.: Production remained markedly lower at shallow disturbed site over course of study than at nearby recovering site, where it increased over 12-fold from before closure to 5 yrs after closure; at deep sites, production remained S higher at undisturbed sites. Sea scallops and sea urchins dominated production at shallow recovering site; a soft-bodied tube-building polychaete dominated production at the deep, undisturbed site.	C) 5 years after fishing eliminated from area (Closed Area II), observed S shifts in species composition and S increases in abundance, biomass, production, and epifaunal cover.
Ref #: 217 **Citation**: Langton and Robinson 1990 **Location:** Jeffreys and Fippennies Ledges, Gulf of Maine, USA **Depth:** 80-100 m **Substrate:** Sand, gravel (gravelly sand with some gravel, shell hash, and small rocks) **Energy:** Low, inferred **Evaluated:** Biological, prey	Submersible observations made 1 yr apart, before and after commercial dredging of Fippennies Ledge. Jeffreys Ledge observed once, after dredging.	Three species dominated both sites – *Placopecten magellanicus, Myxicola infundibulum, Cerianthus borealis*. After dredging at Fippennies Ledge, densities of all three are reduced. Authors observed that Jeffreys Ledge site was similar to post-fishing Fippennies Ledge.	Not addressed

Study information	***Study approach***	***Effects***	***Recovery***
Ref #: 225 **Citation**: Lindholm et al. (2004) **Location**: Eastern Georges Bank **Depth**: 50-100 m **Substrate**: Sand **Energy**: High, inferred **Evaluated**: Geological, biological, prey	Comparative. Multiple gear types fished in study area (**see otter trawl**). Compared relative abundance of 7 microhabitats at 32 stations located inside and outside an area closed for 4.5 yrs to bottom trawls and dredges (Closed Area II) using video and still photos taken along transects.	S higher incidence of rare sponge and shell fragment habitats inside closed area, NS differences for 6 more common habitat types in fished and unfished areas in mobile (<60m) or immobile (>60m) sand habitats, sponges and biogenic depressions numerically more abundant in immobile sand habitats inside closed area.	Not addressed
Ref #: 228 **Citation**: Link et al. (2005) **Location**: Georges Bank **Depth**: 35-90 m **Substrate**: Sand, gravel **Energy**: High, inferred **Evaluated**: Biological, prey	Comparative. Multiple gear types fished in study area. Fished inside and outside of Closed Areas I and II with a #36 Yankee otter trawl to sample nekton and benthic community.	Benthic macroinvertebrate species richness did not vary by inside/outside closure, but did vary by habitat type.	After 5 years of closure, generally did not see a notable increase in biomass and abundance inside the closed area for most species.
Ref #: 236 **Citation**: Mayer et al. (1991) **Location**: Gulf of Maine, Maine coast, USA **Depth**: 20 m **Substrate**: Mud **Energy:** High, inferred **Evaluated**: Geological	The effect of commercial dragging on sedimentary organic matter is examined in two field experiments using different gear types.	A heavy scallop dredge caused two types of organic matter translocation – some of the surficial organic matter is exported from the drag site and the remaining material is mixed into subsurface sediments. Phospholipid analysis indicated decreases in various classes of microbiota, with relative increases in the contribution of anaerobic bacteria to the microbial community.	Not addressed.
Ref #: 256 **Citation**: Murawski and Serchuk (1989) **Location**: Mid-Atlantic Bight, USA **Depth**: Not given **Substrate**: Sand, mud and coarse gravel **Energy**: High, inferred **Evaluated**: Biological.	Immediately after dredging, examined tow path visually using a submersible.	Lack of damaged scallops in tow path indicated low incidental mortalility (<5%).	Not addressed.

Study information	*Study approach*	*Effects*	*Recovery*
Ref #: 352 **Citation**: Stokesbury and Harris 2006 **Location**: Georges Bank **Depth**: 52-70 m (means at 4 sites) **Substrate:** Sand, gravel (Sand, shell debris, granule/pebbles, cobbles and boulders) **Energy**: High, inferred **Evaluated**: Geological, biological, prey	Experimental BACI study (counts of fish and marcoinvertebrates > 40 mm in video images) in areas that were opened to scallop fishing in 2000/01 and control areas that have remained closed since 1994; exp 1 compared northern portion of CAII (closed) with NLCA (open), exp 2 compared open and closed portions of CAI; both sites in each experiment had similar tidal current velocities, impact areas in both experiments deeper with more sand than control areas.	Changes in density in areas impacted by limited fishing are similar to changes in control areas; in both experiments bryozoans/hydrozoans increased S after fishing, while sponges decreased in impact and control areas (S so in exp1), and sand dollars decreased NS in impact portion of CAI, with NS increases in closed area. Temporal changes in open and closed areas (before-before and after-after) and shifts in sediment composition between surveys indicate that fishing affected the epibenthic community less than natural environmental conditions.	Not addressed
Ref #: 359 **Citation**: Sullivan et al. 2003 **Location**: New York Bight **Depth**: 45-88 m **Substrate:** Sand **Energy**: Unknown **Evaluated**: Geological, biological, prey	Experimental. Effects of experimental dredging on habitat structure for YOY yellowtail flounder evaluated using a submersible to conduct pre-dredge and post-dredge surveys (2d, 3mo, 1yr after impact) at 3 sites (2 within Hudson Canyon closed area), with multiple control and dredge treatments at each site.	Dredging reduced physical heterogeneity such that the frequency of sand waves, tube mats, and biogenic depressions decreased relative to control plots; typical post-dredge landscapes (<2d) consisted of extensive patches of clean, silty sand, interspersed with regular striations of shell hash; abundant mobile epifauna such as sand dollars typically dislodged or buried under a thin layer of silt. Despite the vigorous reworking of surficial sediments, the overall impact of the dredge appeared to extend no deeper than 2-6 cm below the sediment surface. A significant decrease in available benthic prey is observed at 3 months following a series of major natural perturbations (Hurricanes Dennis, Floyd, and Gert).	No evidence of a dredging impact of any kind apparent after 3 months and 1 year; however, major disturbance of seabed at two shallower sites caused by hurricanes 2 months after experimental dredging.
Ref #: 391 **Citation:** Watling et al. 2001 **Location**: Damariscotta River, Maine, USA **Depth**: 15 m **Substrate:** Sand (Silty sand) **Energy**: High, inferred **Evaluated**: Geological, prey	Experimental study (23 tows in 1 day); effects on macrofauna (mostly infauna) evaluated 1 day and 4 and 6 months after dredging in an unexploited area.	Loss of fine surficial sediments; lowered food quality of sediment; reduced abundance of some taxa; no changes in number of taxa; S reductions in total number of individuals 4 months after dredging.	Within 6 months, no recovery of fine sediments, full recovery of benthic fauna and food value.

1.2.3 Impacts of specific alternatives

The EFH final rule requires that changes made to FMPs through Amendments and Framework actions must ensure that the FMP continues to minimize to the extent practicable adverse effects on EFH caused by fishing. Most of the alternatives in this Amendment are procedural and/or administrative in nature and are unlikely to affect EFH, just as they are unlikely to have substantial impacts on the sea scallop resource that differ from the status quo. However, three management measures under consideration in this action could have direct impacts to EFH.

These include the modification of habitat closed area boundaries that were originally adopted in Amendment 10 to the Scallop FMP and changes to the scallop overfishing definition.

1.2.3.1 Compliance with re-authorized Magnuson-Stevens Fishery Conservation and Management Act (MSA) (Section 3.2)

1.2.3.1.1 Definition and integration of new terms with existing scallop reference points (Section 3.2.1)

This alternative would relate the terms used in the reauthorized MSA to those used in the scallop FMP. None of these changes are related to the impacts of the scallop fishery on designated EFH.

1.2.3.1.2 Summary of old and new terms and how they will be integrated in Scallop FMP (Section 3.2.2)

Similar to above, this alternative would relate the terms used in the reauthorized MSA to those used in the scallop FMP. None of these changes are related to the impacts of the scallop fishery on designated EFH.

1.2.3.1.3 Alternatives under consideration for implementing ACLs in the Scallop FMP (Section 3.2.3)

The alternatives presented in Section 3.2.3 relate to the implementation of an Annual Catch Limit (ACL) for the sea scallop fishery. In addition to a no action alternative (Section 3.2.3.1), these alternatives include:

- ACL structure (Section 3.2.3.2)
- Northern Gulf of Maine ACL (Section 3.2.3.3)
- Other sources of scallop fishing mortality (Section 3.2.3.4)
- ACL sub-components (Section 3.2.3.5)
- Placement of terms and buffers for uncertainty (Section 3.2.3.6)
- Description of scientific uncertainty (Section 3.2.3.7)
- Description of management uncertainty (Section 3.2.3.8)
- Accountability measures for scallop ACLs (Section 3.2.3.9)
- Scallop ACL for other fisheries (Section 3.2.3.10)
- ACLs set in other FMPs for the scallop fishery (Section 3.2.3.11)
- Administrative process for setting ACLs in the Scallop FMP (Section 3.2.3.12)
- Monitoring ACLs (Section 3.2.3.13)
- Timing of ACL monitoring and triggering AMs (Section 3.2.3.14)

These alternatives are procedural/administrative in nature, and their implementation in whole or in part is not expected to have significant impacts on designated EFH.

1.2.3.2 Measures to address excess capacity in the limited access scallop fishery and provide more flexibility for efficient utilization of the resource (Section 3.3)

If implemented, these alternatives would create permit stacking and/or leasing programs for the sea scallop fishery. In addition to the no action alternative (Section 3.3.1), there are alternatives related to permit stacking (Section 3.3.2):

- Restrict stacking to two permits only (Section 3.3.2.1)
- Fishing power adjustment for stacking permits (Section 3.3.2.2)
  - Permits can be stacked provided there is a fishing power adjustment (Section 3.3.2.2.1)
  - Permits can only be stacked which meet replacement criteria (Section 3.3.2.2.2)
  - Permits in same replacement criteria have no adjustment applied and permits from different categories would be subject to fishing power adjustment (Section 3.3.2.2.3)
  - Restriction on stacking for trawl permits (Section 3.3.2.2.4)
- Status of stacked permits (Section 3.3.2.3)

The alternatives related to fishing power are intended to ensure that permit stacking would be conservation neutral, or in other words, that scallop harvest would be similar regardless of stacking. Broadly, if scallop harvests under stacking are similar to the status quo alternative, similar impacts to EFH would be expected.

Additional alternatives are related to permit leasing (Section 3.3.3):

- Leasing of open area DAS (Section 3.3.3.1)
  - Fishing power adjustment for leasing open area DAS (Section 3.3.3.1.1)
  - Maximum DAS that can be leased (Section 3.3.3.1.2)
  - DAS and landings history (Section 3.3.3.1.3)
- Leasing of access area trips (Section 3.3.3.2)
- Ownership cap provisions (Section 3.3.3.3)
- Leasing restrictions options (Section 3.3.3.4)
- Application Requirements (Section 3.3.3.5)
- Leasing from vessels in CPH (Section 3.3.3.6)
- Sub-leasing (Section 3.3.3.7)
- Other Provisions for vessels that lease DAS and/or access area trips (Section 3.3.3.8)

Similar to the stacking alternatives, the alternatives related to fishing power are intended to ensure that permit leasing would be conservation neutral. Again, if scallop harvests under leasing are similar to the status quo alternative, similar impacts to EFH would be expected.

The Swept Area Seabed Impact (SASI) model currently being developed for Phase 2 of Omnibus EFH Amendment 2 would allow for the estimation of change in seabed impacts related to stacking and leasing-related adjustments to the way the scallop resource is harvested. The EFH impacts assessment methods developed for EFH Omnibus Amendment 2 (see Appendix) assume that area swept is a proxy for seabed impact. A secondary assumption is that given a particular gear type (for this fishery, mostly New Bedford-style scallop dredges), seabed impact may vary by location based on the habitat features assumed to occur based on the dominant substrate and energy environment of the area being fished. Either the stacking of permits or the leasing of open area days at sea could potentially shift scallop fishing effort spatially, and thus could increase or decrease impacts to EFH if fishing then occurs in areas that are more or less susceptible to scallop fishing gear, and/or if those areas recover more slowly or quickly following impact. In access areas, because trip limits are fixed, transfers of access trips between vessels that capture scallops more or less efficiently per area swept, seabed impacts would be expected to decline or increase, respectively.

The particular transfers of fishing effort between vessels that might occur under stacking or leasing are very difficult to predict, as are any spatial shifts in fishing effort that might result from these transfers. Therefore, it is assumed that because the alternatives are designed to be conservation neutral that any additional EFH impacts beyond the status quo alternative would be negligible.

1.2.3.3 Measures to adjust specific aspects of FMP to make overall program more effective (Section 3.4)

1.2.3.3.1 Measures to adjust the current overfishing definition (OFD) to be more compatible with area rotation (Section 3.4.1)

Two alternative overfishing definitions are being considered, in addition to the status quo (Section 3.4.1.1):

- Amendment 10 Overfishing Definition – Time-Averaged within Specific Areas (Section 3.4.1.2)
- Hybrid Overfishing Definition Alternative (Section 3.4.1.3)

Each of the alternative overfishing definitions would improve the ability of the scallop fishery to harvest dense aggregations of scallops in rotational management and access areas, and would also reduce the potential for overly high fishing mortality rates in open areas. Assuming that these changes would increase catch per unit of effort, the selection of either alternative over the status quo could potentially reduce area swept and thus impacts to seabed habitats/EFH.

Given specific area rotation scenarios and scallop assessment data, more detailed area-swept estimates could be generated.

1.2.3.3.2 Minor adjustments to the limited access general category management program (Section 3.4.2)

1.2.3.3.2.1 Provision to allow IFQ rollover (Section 3.4.2.1)

IFQ rollover of up to 15% (Section 3.4.2.1.2) is being considered in addition to the no action alternative (Section 3.4.2.1.1). Because this alternative would not increase or decrease scallop allocations, but just shift fishing effort between years, impacts to EFH would not be expected to increase as compared to the status quo alternative.

1.2.3.3.2.2 Consideration of a general category sector application (Section 3.4.2.2)

A single LAGC scallop section is being considered under this amendment. Similar to the IFQ rollover alternative, implementation of this section would not increase or decrease scallop allocations, but would shift effort slightly, in this case between vessels rather than between fishing years. Again, impacts to EFH would not be expected to increase as compared to the status quo alternative.

1.2.3.3.2.3 Modify the general category possession limit (Section 3.4.2.3)

A modification of the possession limit up to 1,000 pounds (Section 3.4.2.3.2) and an elimination of the possession limit (Section 3.4.2.3.3) are being considered in addition to the status quo possession limit of 400 lb (Section 3.4.2.3.1). An increase in or elimination of the possession limit would not increase or decrease scallop allocations, but allow those allocations to be caught on fewer trips. Impacts to EFH would not be expected to increase as compared to the status quo alternative.

1.2.3.3.2.4 Modify the maximum quota one general category vessel can fish (Section 3.4.2.4)

A modification of the maximum quota one vessel can fish from 2% to 2.5% of total general category allocation (Section 3.4.2.4.2) is being considered in addition to the no action alternative (Section 3.4.2.4.1). This alternative is primarily administrative in nature and impacts to EFH would not be expected to increase as compared to the status quo alternative.

1.2.3.3.2.5 Allow LAGC quota to be transferred from IFQ permits (Section 3.4.2.5)

Two alternatives are being considered to allow for transfer of LAGC quota:

- Allow LAGC IFQ permit owners to permanently transfer some or all quota allocation to another IFQ permit holder (Section 3.4.2.5.1)
- Allow LAGC IFQ permits owners to permanently transfer some or all allocation to a community-based trust or permit bank (Section 3.4.2.5.2)

These alternatives would not increase the overall allocation of scallop quota to the LAGC permit category, so impacts to EFH would not be expected to increase as compared to the status quo alternative.

1.2.3.3.2.6 Implementation of Community Fishing Associations (CFAs) (Section 3.4.2.6)

This alternative is primarily administrative in nature and impacts to EFH would not be expected to increase as compared to the status quo alternative.

1.2.3.3.3 Measures to address EFH closed areas if EFH Omnibus Amendment 2 is delayed (Section 3.4.3)

This action proposes to eliminate the habitat closed areas implemented under Amendment 10 to the Scallop FMP in Closed Area I, Closed Area II, and the Nantucket Lightship Closed Area. If this alternative is adopted, the habitat closed areas implemented under Amendment 13 to the Multispecies FMP would be the only habitat closures applicable to the scallop fishery. The elimination of the Amendment 10 closures would improve the practicability of the habitat closed areas and eliminate conflicts between the two FMPs. Reconciliation of the two sets of habitat closures was proposed in a joint framework to the Scallop and Multispecies FMPs (Framework 16/39, 2004). However, the closures were ultimately not reconciled under this action. In response to Oceana v. Evans, et al., (Civil Action No. 04-810, D.D.C., August 2, 2005, and October 6, 2005), the court determined that EFH closure boundaries could not be changed via framework action and that such changes would require a full FMP amendment, and the closures established by Amendment 10 were reinstated.

The current scallop access areas that comply with both the Amendment 13 and Amendment 10 EFH closures are shown below (Figure 1). Having both Amendment 10 and Amendment 13 EFH boundaries apply to the scallop fishery prevents allocating scallop access into areas with the highest catch rates and reduces the benefits of area rotation. If no action is taken for this alternative, effort is shifted into areas with lower scallop catch rates, increasing area swept and potentially having negative impacts on the seabed habitats. To the extent that this alternative would allow for the harvest of dense aggregations of scallops in the groundfish mortality closures, choosing this alternative over the status quo could potentially reduce area swept and thus impacts to seabed habitats/EFH.

Elimination of the Amendment 10 closures does not automatically grant scallop access to the portions of the groundfish mortality closed areas that are not habitat closures under Amendment 13; sea scallop access areas would need to be re-specified via a joint framework action between the two plans. In particular, if the proposed action were approved, a foreseeable future action would be to extend the CAI scallop access area southward to the CAI groundfish EFH closure. When considering joint Frameworks 16/39 to the Atlantic Sea Scallop and Northeast Multispecies FMPs, the Council concluded that the potential habitat gain from protecting the southern part of the access area in Closed Area I that has not been part of a previous access program did not outweigh the economic costs of preventing the scallop fleet from accessing this area. However, this future change, as well as any other scallop access area changes, would be analyzed in a joint framework action (likely Framework 22, 2011-2012 fishing year) in light of their potential positive impacts on the scallop fishery, and considering potential negative impacts on the finfish bycatch and on EFH. At this time, it is anticipated that the Swept Area Seabed Impact Model will be available for comparing the vulnerability of particular areas to scallop dredge gear. This model would be used in conjunction with scallop survey data and various area rotation scenarios to determine the optimum areas for scallop fishery access.

Figure 1 – EFH closures currently in effect under Scallop Amendment 10 (pink) and Multispecies (Groundfish) Amendment 13 (hatched blue). The year round mortality closures are outlined in black. Scallop access areas currently in effect under Framework 19 are shown in green. The 50 and 100 m depth contours are plotted for reference. Under the proposed alternative, areas in pink without any hatching would be candidate areas for scallop access, although they would need to be analyzed and approved in a joint Multispecies/Scallop framework action. A likely candidate for future scallop access is the pink area just south of the current CAI scallop access area.

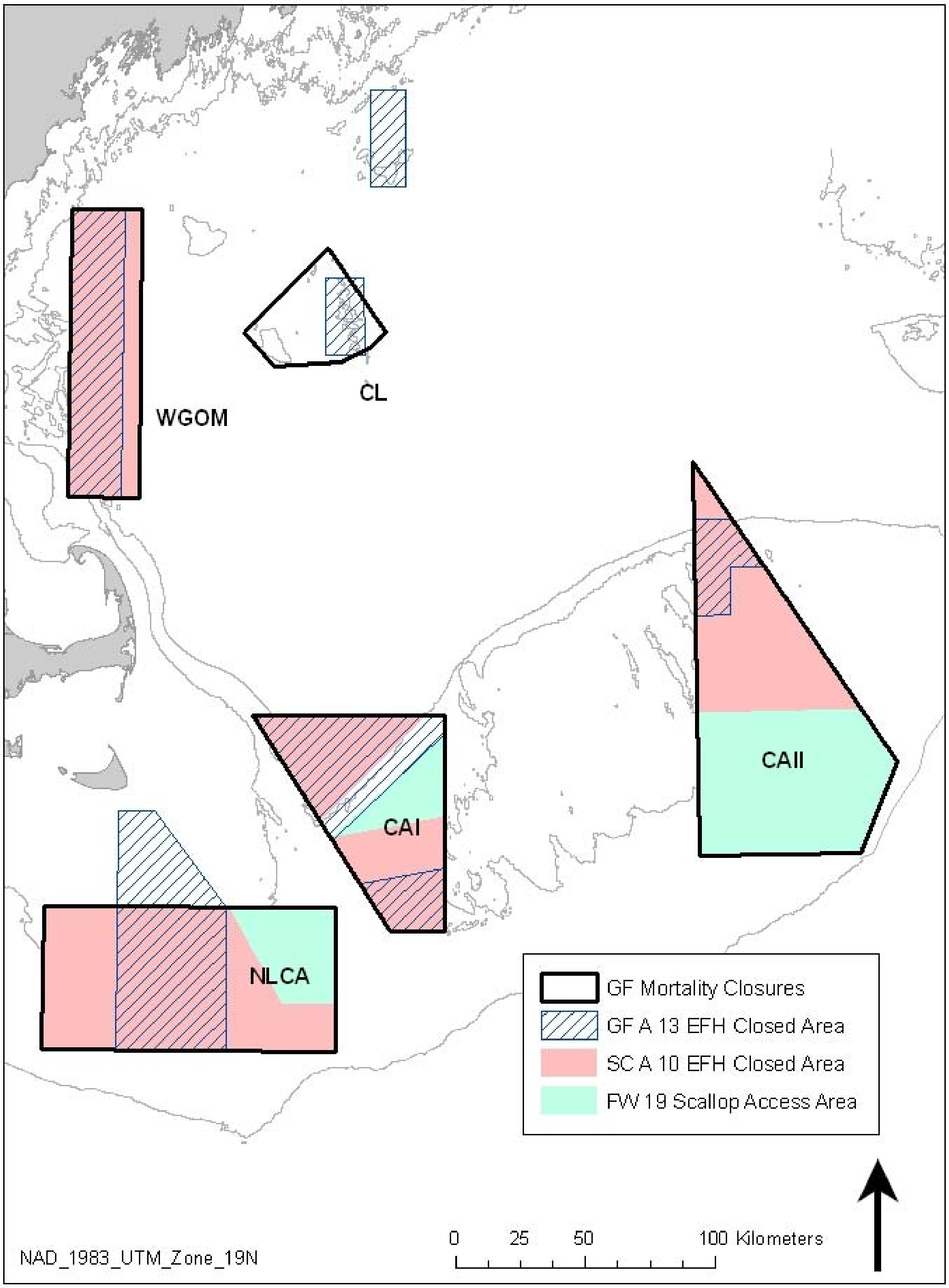

Table 2 shows the area of the various EFH closures, and compares the total amount of seabed closed to fishing under the status quo and the proposed alternative. It is important to bear in mind that some of the EFH closures that would be eliminated under this proposal would be unlikely to be reopened to scalloping under future framework action. The total area of seabed that would remain closed under this alternative is just under 10,000 km^2.

Table 2 – Size of various EFH closed areas.

Groundfish closures only	
Name of area	***Size of area (km^2)***
CAI_GF_north	1937
CAI_GF_south	584
CAII_GF	641
CL_GF	443
JB_GF	499
WGOM_GF	2272
NLCA_GF	3387
Total area of groundfish EFH closures	**9764**
Scallop closures only	
Name of area	***Size of area (km^2)***
CAI_SC_north	1361
CAI_SC_south	1351
CAII_SC	3027
NLCA_SC	5106
WGOM_SC	3030
Total area of scallop EFH closures	**13875**
Total area closed under both A 13 and A 10	
Name of area	***Size of area (km^2)***
WGOM	3030
CAII	3027
CL	443
JB	499
CAI	3289
NLCA	6142
Total area closed for EFH, considering spatial overlap	**16429**
Loss of EFH closed areas under proposed action	
Name of area	***Size of area (km^2)***
CAII (scallop closure minus groundfish closure)	2385
WGOM (scallop closure minus groundfish closure)	757
CAI (southern part of scallop closure minus southern part of groundfish closure)	768
NLCA (overlapping closure minus groundfish closure)	2755
EFH closed areas that would be eliminated, considering spatial overlap	**6666**
% loss of EFH closures	**41%**
EFH closed areas remaining	**9764 km^2**

1.2.3.3.4 Measures to improve research set-aside program (Section 3.4.4)

Proposed changes to the research set-aside program include (in addition to a no action alternative):

- Publish federal funding opportunity as early as possible (Section 3.4.4.2)
- Extend the RSA program to be multi-year (Section 3.4.4.3)
- Modify open area RSA allocation from DAS to pounds (Section 3.4.4.4)
- Modify entire RSA allocation to a fixed poundage rather than a percent (Section 3.4.4.5)
- Separate RSA TAC into 2 subsets (survey and other) (Section 3.4.4.6)
- Remove additional TAC specific for survey work in addition to 2% set-aside (Section 3.4.4.7)
- Rollover of RSA TAC (Section 3.4.4.8)
    - Rollover of unused RSA TAC to the next fishing year
    - Rollover of unused RSA TAC to second solicitation in same fishing year
    - Rollover of unused RSA TAC to same individuals for program development funds
    - Rollover of unused TAC to help fund observer program
    - Rollover of unused TAC to compensate awarded projects
- Extension for harvesting compensation TAC (Section 3.4.4.9)
- Increase public input of RSA review process (Section 3.4.4.10)
- Regulations from which RSA projects are exempt (Section 3.4.4.11)

None of these changes are expected to impact designated EFH.

1.2.3.3.5 Measures to change the scallop fishing year (Section 3.4.5)

Amendment 15 proposes a change in the scallop fishing year from March 1 (the no action alternative, Section 3.4.5.1) to May 1 (Section 3.4.5.2). Although it is possible that this change would lead to a temporal shift in fishing effort and thus differences in area swept due to changes in shell-height meat-weight ratios, the magnitude of these changes is unknown and therefore the possible impacts of this alternative are very difficult to assess quantitatively. A benefit of this measure is the potential to use more current survey data in scallop allocation decisions, which would hopefully result in more efficient harvest of large scallops in rotational management areas, thus reducing area swept and EFH impacts.

1.2.3.4 Items to be added to the list of frameworkable items in the FMP (Section 3.5)

This action proposes to add three items to the list of management measures that may be implemented via framework action rather than via FMP amendment. They include:

- Modify the general category possession limit (Section 3.5.1)
- Adjustment to aspects of ACL management (Section 3.5.2)
- Fishing power adjustments (Section 3.5.3)

Whether these changes are implemented via framework or amendment has no bearing on their potential impacts to designated EFH.

1.3 IMPACTS ON PROTECTED RESOURCES

1.3.1 Background

The Amendment 15 alternatives are evaluated below for their impacts on protected resources with a focus on threatened and endangered sea turtles, as noted in the Affected Environment Section. As with the analyses provided in the last scallop management action, the species considered here are loggerhead, leatherback, Kemp's ridley and green sea turtles.

Both scallop dredge and scallop trawl gear will be addressed in this section, generally collectively, given they are the most commonly used gears by general category and limited access vessels in this fishery. To evaluate impacts it may be helpful to note that the majority of fishing effort is attributed to the dredge fishery. Most of the approximately 325 active limited access vessels use dredge gear. There are about 350 general category vessels that are expected to be allowed to land 5 percent of the total projected scallop landings once the transition to the IFQ program implemented under Amendment 11 is effective. The vast majority of scallop landings by limited access and general category vessels is with dredge gear (Table ???).

To briefly summarize the sea scallop fishery management program, it employs a limited access permit system and controls DAS use in scallop open areas. Limited numbers of trips with trip limits also are allowed in designated rotational access areas. Major harvest areas include Georges Bank with less activity in the Gulf of Maine. Both are regions in which turtles are far less likely to be found relative to Mid-Atlantic waters, where effort and scallop catch levels have increased in recent years. In addition, directed general category scallop fishing effort has increased overall since 1994, including new effort in the Mid-Atlantic, but this trend is being addressed by measures implemented in Amendment 11.

Although scallop fishing is a year-round activity, takes of sea turtles potentially may occur from May through November given the overlap of the sea turtle distribution (Shoop and Kenney 1992; Braun-McNeill and Epperly 2002) and fishery effort (NEFMC 2003, 2005).

With respect to sea turtle interactions with the fishery overall, it is noteworthy that there were very low levels of observer coverage throughout the fishery up to 2003. Since that time, bycatch rates, with a focus on the Mid-Atlantic, have been analyzed in a number of publications that are discussed in the Affected Environment section.

Beginning in September 2006, federally permitted scallop dredge gear must be modified by adding an arrangement of horizontal and vertical chains, referred to as "chain mats", between the sweep and the cutting bar when fishing in an area that extends south of 41° 9.0 N from the shoreline to the outer boundary of the EEZ during the period May 1 through November 30 each year (71 FR 50361). The requirement is expected to reduce the severity of some turtle interactions with scallop dredge gear.

On March 14, 2008, NMFS completed an Endangered Species Act (ESA) Section 7 Consultation on the Atlantic Sea Scallop Fishery Management Plan.[3] Under the ESA, each Federal agency is

[3] The full biological opinion can be found at http://www.nero.noaa.gov/prot_res/section7/.

required to ensure its actions are not likely to jeopardize the continued existence of any listed species or critical habitat. If a Federal action is likely to adversely affect a listed species, formal consultation is necessary. Five formal Section 7 consultations, with resulting biological opinions, have been completed on the Atlantic sea scallop fishery to date. All five have had the same conclusion: the continued authorization of the scallop fishery may adversely affect, but is not likely to jeopardize the continued existence of four sea turtles (loggerheads, green, Kemp's ridley, and leatherback).

With respect to Amendment 15, there will not be major changes in the amount or areas that scallop vessels fish from most of the alternatives under consideration. Specific measures that impact scallop fishing patterns directly are generally implemented by framework action. Discussions regarding sea turtle interactions with the fishery are largely qualitative and based on whether alternatives under consideration are expected to shift effort to the Mid-Atlantic. Sea turtles migrate through and forage within certain parts of the Mid-Atlantic primarily during the summer and fall. Sea turtles also occur in Northeastern waters, but to a lesser extent, and interactions with scallop gear may occur, but the potential is less than in the Mid-Atlantic. The alternatives under consideration are evaluated below in terms of whether they are expected to shift scallop effort from other areas or seasons that have lower potential interactions with sea turtles.

1.3.2 No Action

If No Action is taken under Amendment 15 there are not expected to be any additional impacts on protected resources with no action. The alternatives under consideration for ACLs are expected to have no impacts since they are related to increased accountability and payback type of measures for the fishery if catch limits are exceeded. In general, the stacking and leasing alternatives under consideration are expected to have neutral impacts on the protect resources so long as more effort is not shifted to the Mid-Atlantic as a result of stacking and leasing. Overall effort shifts are not expected from stacking and leasing alone since the level of stacking and leasing is expected to occur within businesses that are in multi-vessel businesses already. It is impossible to predict exactly which vessel will decide to participate in stacking and leasing, but overall there is no reason to believe that overall effort levels in the Mid-Atlantic would be impacted as a result.

Taking no action on the alternative to revise the overfishing definition is not expected to have direct impacts on protected resources.

None of the measures under consideration for adjustments to the general category management program are expected to have direct impacts on protected resources, so if No Action is taken related to these there would be no impacts on protected resources.

No Action on the measure to address EFH closed areas would not have direct impacts on protected resources; however, having both Amendment 10 and Amendment 13 EFH boundaries apply to the scallop fishery prevents allocating scallop access into areas with the highest catch rates and reduces the benefits of area rotation. If no action is taken for this alternative, effort is shifted into areas with lower scallop catch rates, increasing area swept and potentially having negative impacts on the environment including protected resource. If more open area DAS are allocated to compensate for losses of yield in Closed Area I for example, some of those days could be fished in the Mid-Atlantic with higher potential interactions with sea turtles compared to fishing within Closed Area I.

If no action is taken on the measures to improve the research set-aside program, protected resources would not be impacted.

Lastly, if no action is taken on changing the scallop fishing year there are no expected impacts on protected resources.

1.3.3 Compliance with re-authorized Magnuson-Stevens conservation and management act (MSA)

The majority of measures under consideration for this section have no direct impacts on protected resources. Within this section there are alternatives for accountability measures (AMs) for the scallop fishery and for a sub-ACL of YT flounder. The AMs under consideration for YT flounder may have impacts on protected resources depending on which one is selected. Effort shifts are expected with all of the YT AMs under consideration, and effort shifts can have negative consequences on the protected resources if effort shifts to the Mid-Atlantic. For example, the YT stock area with higher catch rates in GB, and if the scallop fishery is not allocated enough YT flounder on GB to provide sufficient access in that YT stock area, more effort may be allocated within the SNE/MA YT stock area. Some of the AM alternatives suggest that if one YT stock area reaches the YT quota then effort will shift to other YT stock areas. Others include a maximum DAS that can be used in a particular YT stock area, and if this occurs in GB or CC/GOM stock areas, more effort could be used in the SNE/MA stock areas, which includes all waters south of Long Island.

1.3.4 Measures to address excess capacity in the limited access scallop fishery and provide more flexibility for efficient utilization of the resource

1.3.4.1 No Action

If this alternative is selected, then no additional measures would be implemented to reduce capacity in the limited access scallop fishery. All current restrictions would remain in place. No impacts on protected resources are expected from no action.

1.3.4.2 Permit Stacking and leasing

This group of alternatives would allow a single limited access vessel to have two limited access scallop permits on one vessel. In general, the stacking and leasing alternatives under consideration are expected to have neutral impacts on the protected resources so long as more effort is not shifted to the Mid-Atlantic as a result of stacking and leasing. Overall effort shifts are not expected from stacking and leasing alone since the level of stacking and leasing is expected to occur within businesses that are in multi-vessel businesses already. Specifically, some vessels are expected to stack within businesses currently in the Mid-Atlantic and some vessels are expected to stack with vessels that are from New England. It is impossible to predict exactly which vessel will decide to participate in stacking and leasing, but overall there is no reason to believe that overall effort levels in the Mid-Atlantic would be impacted as a result.

There are fishing power adjustment alternatives under consideration that would reduce the DAS allocated to a permit that is stacked onto another vessel. This reduction will decrease the total amount of DAS allocated to the fishery, but effort on vessels that stack is expected to be more efficient. So while fewer DAS will be available to the fishery, the overall level of effort or time gear is on the bottom is expected to be similar. With more DAS on one platform the vessels will have more flexibility and it is expected they will be more efficient – so overall catch per DAS will be higher. Overall LPUE will be higher per DAS, but that platform will have fewer DAS than 2 separate vessels, so potential impacts on protected resources from these measures alone are expected to be neutral.

In terms of access area effort, if stacking and leasing leads to more efficient fishing in access areas, less time gear is on the bottom, there could be potentially beneficial impacts on protected resources. More efficient fishing in access areas with a possession limit reduces bottom time overall, but more efficient fishing in open areas does not necessarily reduce bottom time because those vessels are not limited by a possession limit. Specifically, larger, more powerful vessels can pull gear through the water faster and more efficient crews can shuck faster, so with no possession limit those factors could increase time gear is on the bottom. Overall, if the fishing power adjustments are sufficient to prevent potential increases in catch (or bottom time), then there are no impacts expected on protected resources. Selecting a higher percentage for the mortality adjustment would reduce potential risks of increased catch (and increased bottom time), but would have more impacts on the vessels that lease/stack.

The other alternatives related to stacking and leasing are not expected to have impacts on protected resources.

1.3.5 Measures to adjust specific aspects of FMP to make overall program more effective

This section contains alternatives for various measures that are already in place. The topics include adjustments to the overfishing definition, modifications to the limited access general category program, revision of the EFH closed areas if Phase II to the Habitat Omnibus Amendment is delayed, improvements to the research set-aside program, and changing the fishing year.

1.3.5.1 Measures to adjust the current overfishing definition (OFD)

The alternatives to revise the overfishing definition are not expected to have direct impacts on protected resources.

1.3.5.2 Minor adjustments to the limited access general category management program

These alternatives include several potential modifications to the limited entry program recently implemented for the general category fishery. The IFQ rollover provision should not have any impacts on protected resources. As for the possession limit alternatives, since the fishery is managed under an IFQ increasing the possession limit or removing it should not have direct impacts on protected resources. The alternative under consideration to increase the maximum quota one vessel can fish from 2% to 2.5% of the total general category allocation is not expected to have direct impacts on the scallop resource.

The alternative that would allow LAGC IFQ permit owners to permanently transfer some or all of their quota allocation independent of their IFQ permit to another LAGC IFQ permit holder or CFA holder while retaining the permit itself should not have direct impacts on protected resources. These vessels were not likely to use their scallop IFQ so transferring it to another vessel is for economic reasons, and should not affect fishing behavior. If small amounts of quota from many vessels is pooled together into one new operation in the Mid-Atlantic that could increase directed LAGC fishing in that area, but since this fishery is managed by IFQ this should not have direct impacts on protected resources because the total amount of catch is limited. It may move IFQ from vessels that would not have necessarily harvested their full IFQ, but projections are based on all general category IFQ being fished, there is no assumed level of non-harvest.

The alternative that would implement community fishing associations is not expected to have direct impacts on protected resources because the fishery is managed by an overall IFQ. It is possible that CFAs from the Mid-Atlantic could pool effort from other areas and lease quota to vessels in the Mid-Atlantic increasing fishing effort near those ports, but the total amount of IFQ one group or community can hold is limited.

1.3.5.3 Measures to address EFH closed areas if the EFH Omnibus Amendment 2 is delayed

This alternative would consider making the EFH closed areas consistent under both FMPs if the EFH Omnibus Amendment 2 timeline is delayed. If selected, only the areas closed for EFH under Amendment 13 would be closed to scallop gear; the areas closed for EFH under Amendment 10 would be eliminated.

Having both sets of EFH areas closed to scallop gear for the last several years has affected where scallop effort is allocated. Overall, more open area DAS have been allocated than the plan would have done if there were not constraints on access areas within GB closed areas (primarily because the boundaries in Closed Area I have prevented allocating scallop access in that area). The scallop resource available in the remaining “sliver” of Closed Area I has not been sufficient to allocate an access area trip in that area. As a result, additional open area DAS have been allocated to meet fishing targets, which puts effort in areas with lower catch rates. Some of these open area DAS are likely fished in the Mid-Atlantic, particularly on vessels that are from those ports. If the access area boundaries are modified, more effort will likely be allocated within GB closed areas in the future, which may reduce fishing time in open areas in the Mid-Atlantic.

1.3.5.4 Measures to improve research set-aside program

The measures to improve the research set-aside program are designed to improve the timing and administration of the program. Arguably, if the program can be more streamlined and worth projects can occur with fewer obstacles, better and more timely research will result, having indirect benefits on protected resources since research on that topic is a high priority.

There is an alternative that would include a list of the measures from which research projects may be exempt. A researcher would not need to apply for an experimental fishing permit if the project wanted to be exempt from the following restrictions:

- Crew restrictions

- Seasonal closure in Elephant Trunk
- Requirement to return to port if fishing in more than one area

Eliminating the crew restriction on research trips is not expected to have impacts on protected resources so long as compensation for research trips does not harvest smaller scallops with additional crew (more bottom time for same poundage if scallops are smaller). The intent of eliminating the crew restriction on research trips is to enable more researchers onboard, so the likelihood of researchers shucking scallops to be landed as compensation is minimal. Therefore, the impacts of eliminating the crew restriction for research trips and research compensation trips is not expected to have impacts on protected resources.

Allowing research trips access in Elephant Trunk during the seasonal closure of September 1-October 31 would likely have impacts on protected resources. It is not clear if the potential impacts would be outweighed by the potential benefits of conducting research in that area during that season when interaction rates are expected to be highest so that we could learn the most about reducing impacts of the fishery on turtles. It is unlikely that all the RSA set aside for ETA would be harvested during this seasonal closure because this time of year has lower meat weights and quality is not optimal. However, there is demand for Elephant Trunk scallops and if the rest of the fishery is closed out of the area, prices may be higher for pounds from that area during the seasonal closure. If all 2% of the set aside for ETA was used during the months of September and October in 2011 (when this action would be effective) that would equate to about 120,000 pounds (1 trip is expected in 2011, so 2% of 6.0 million). If catch rates are about 2,500 pounds a day (similar to average LPUE for access area trips in recent years) that would equal roughly 48 DAS. For comparison, the scallop fishery will likely be allocated about ??? DAS for open areas in 2011. The fishery tends to fish about ½ the allocated DAS in the Mid-Atlantic, and about X% of those are during the month of September and October. [*update with FW21 analyses*].

Eliminating the requirement to return to port if fishing in more than one area on a research trip should not have any impacts on protected resources.

1.3.5.5 Measures to change the scallop fishing year

The scallop fishing year is out of sync with the framework adjustment process and the timing of when the scallop survey data become available for analysis. This alternative should not have any direct impacts on protected resources.

1.4 ECONOMIC IMPACTS

1.4.1 No Action

If No Action is taken there are not expected to be substantial impacts on scallop landings, revenues, producer and consumer surpluses and net economic benefits from the scallop fishery. There are always risks of overfishing of the resource however, due to the scientific and management uncertainty since the current measures do not have well defined accountability and payback type of measures if catch limits are exceeded due to these sources of uncertainty. These risks could result in less than optimal economic benefits from the sea scallop resource,

If no action is taken, Sea Scallop Fishery will continue to have an excess harvesting capacity and the economic benefits from the scallop resource will fall short of the optimum levels. On the on the other hand, no action would result in higher employment in the harvesting sector compared to the permit stacking/leasing measures proposed under Amendment 15. The permit stacking/leasing alternatives will also increase management uncertainty in the short-term and could lead to increased fishing mortality in the open areas if proper adjustments for fishing power and increased efficiency are not implemented.

With the current overfishing definition under no action there will be always a concern for growth overfishing in the open areas. Under the current OFD, closed and access areas protect the scallop stock from recruitment overfishing, but growth overfishing may occur in the open areas because the current OFD averages spatially across open and closed areas, i.e. F is higher in open areas to compensate for the zero fishing mortality in closed areas.

If no action is taken in regard to the general category management program, the overall economic impacts on the sea scallop fishery will be small, but there will be always a risk of not fishing the general category TAC in full and the fishing costs for this fishery will be higher than optimal due to the constraints from 400 lb. trip limit.

No Action on the measure to address EFH closed areas could result in less than optimal yield and economic benefits materialized from the scallop fishery. Having both Amendment 10 and Amendment 13 EFH boundaries apply to the scallop fishery prevents allocating scallop access into areas with the highest catch rates and reduces the benefits of area rotation. If no action is taken for this alternative, effort is shifted into areas with lower scallop catch rates, increasing the fishing costs and reducing economic benefits from the fishery.

If no action is taken on the measures to improve the research set-aside program, the problems associated with delays in research would continue. If no action is taken on changing the scallop fishing year there may be some negative indirect impacts on the economic benefits because the current fishing year does not enable the Council to integrate the most recent scallop survey results into analyses used to make decisions for scallop management. On the other hand, no action would require no change in the business plans of the scallop fishermen and reduce the risks associated putting off the major fishing decisions to a date later than March 1.

1.4.2 Compliance with re-authorized Magnuson-Stevens conservation and management ACT

Amendment 15 measures will change the process of managing the scallop fishery by setting annual ACLs instead of determining effort levels consistent with the target fishing mortality rate. The MSA established new requirements to end and prevent overfishing, including annual catch limits (ACLs) and accountability measures (AMs). The sources of scientific uncertainty in the fishery would be factored out when setting ABC below OFL – the catch associated with the overfishing threshold. Because the Council is not permitted to set catch above ABC, having an ABC control rule should help prevent overfishing and have beneficial impacts on the scallop resource, on the scallop yield, and positive impacts on revenues, producer and consumer surpluses and net benefits from the fishery.

The Act also requires the Council set annual catch limits (ACL) equal to or less than ABC. In setting catch levels the Council is required to describe specific sources of management uncertainty in the fishery and account for them when setting the ACL below ABC, or if ACTs are used, management uncertainty is explained as the difference between ACL and ACT. The alternatives under consideration for ACLs are expected to have some beneficial impacts on the scallop resource from increased accountability and payback type of measures if catch limits are exceeded. The short-term and long-term economic benefits of the setting ACTs will depend on the difference of annual ACTs from the landing streams that would be projected to materialize without the change in management process, i.e., under the status quo scenario. Under the present system, DAS and the access area trip allocations are determined from the levels of landings corresponding to the target F levels, which is 20% of $F_{threshold}$ (or F_{max}). If the new system results in a similar landings stream as expected, there would be no change in economic benefits from the status quo levels. Even if the landing streams changed as a result of the new measures, the risk to the resource from overfishing either due to the scientific or management uncertainty would be minimized with the proposed measures due to the better accounting of sources of uncertainty.

The Act requires that each FMP implement accountability measures if the fishery exceeds the ACL. The primary AMs for the limited access and the limited access general category fisheries is the use of an ACT. The buffer between ACL and ACT would act as a proactive in-season AM. These measures should help prevent overfishing and hold the fishery more accountable for any overages if they occur. Option 1 would set LA ACT set at F rate with 25% probability of exceeding LA portion of total ACL (after removing incidental catch, general category ACL, and set asides from the overall ABC=ACL) to account for the management uncertainty. Option 2 would identify a specific buffer based on results of new analyses of variability in estimate of LPUE, or projected LPUE compared to actual estimates from open area DAS. The buffer set for both options would be deducted to determine the ACT for each fishery. The second option would allow more flexibility and adjust the buffers according to the current conditions in the fishery with positive economic benefits for the fishery.

Since general category fishery is managed by IFQs, one alternative would set the buffer to zero and another option would include up to 5% buffer to account for potential monitoring concerns, IFQ carryover provision and other implementation errors. The first measure would be economically more beneficial to the general category fishery by allowing a larger TAC. In addition, if an individual vessel exceeds their IFQ or leased IFQ in a given fishing year, their

IFQ the following fishing year would be reduced the following fishing year by the same amount, reducing the risks of overfishing over the medium to long-term period. On the other hand, a 5% buffer could some economic benefits only is a large percentage of qualifiers exceed their IFQ, which is unlikely. This option would have adverse economic impacts, however, on the vessels that do not exceed their allocations.

In general, the overall results on the scallop fishery will depend on how the ACTs and proposed buffers will affect the total scallop landings compared to no action landings. In general, the differences in the long-term yield streams are not expected to be significant and the AMs (i.e., use of ACTs) are expected to have beneficial impacts on the resource by minimizing the risks due to the scientific and management uncertainty. This in turn is expected to have positive impacts on the scallop landings and overall positive impacts on revenues, producer and consumer surpluses and net economic benefits from the fishery in the long-term.

This action also considers accountability measures for a sub-ACL of YT flounder. The AMs under consideration for YT flounder may have impacts on the scallop resource and yield depending on which one is selected. Effort shifts are expected with all of the YT AMs under consideration, and effort shifts can have negative economic impacts if effort is shifted to less optimal areas and into seasons with lower meat weights. Some of the in-season YT AMs, especially one that proposes the closure of the entire yellowtail stock area, could cause derby fishing, which can have negative impacts on prices and revenues if effort is merged into a smaller window of time when scallop meat weights are not optimal. The options which would be based on identification of areas that have higher bycatch rates within a YT stock area and closing only these portions, or the options that would remove the overages in the next year or in year 3, for example, from individual DAS would not have the negative impacts associated with in-season Yellowtail AMs. Alternative 4 would institute an individual maximum number of DAS that can be used in a stock area for year three to account for an overage of the YTF sub-ACL in year one. An estimate would be made in terms of how many DAS would be expected to catch the total YT remaining, and an individual maximum number of DAS would be instituted per vessel for that stock area for year 3. Similarly, for the general category vessels, an individual maximum percent (or poundage?) of IFQ that can be used in that stock area will be instituted in year 3. Individually based allocation of DAS will prevent derby fishing and allowing vessels to trade area specific DAS/IFQ would reduce distributional impacts with positive economic impacts on the participants. Revising the opening of the GB access areas could have positive economic impacts as well if that reduces the yellowtail bycatch.

1.4.3 Measures to address excess capacity in the limited access scallop fishery and provide more flexibility for efficient utilization of the resource

Amendment 15 alternatives include permit stacking and DAS and access area trip leasing in order to address excess capacity in the sea scallop fishery. Capacity could be defined in several ways relative to the technical efficiency or taking into account the costs of production, economic aspects, or social constraints. From a technical perspective, capacity may be defined as the maximum output that could be obtained by the fixed inputs (vessel this case), using the variable factors of production, such as DAS and crew size when the availability of these factors are not restricted. Capacity in the fisheries would also vary with the level of resource biomass and could be evaluated in relation to the sustainable scallop harvest.

A historical examination of the trends in terms of the number of vessels, DAS-used, and vessel characteristics of full-time limited access vessels that participated in the sea scallop fishery since 1994 indicates the existence of excess capacity in the fishery from a technical efficiency perspective at the current scallop stock harvest and biomass levels.

It must be cautioned, however, that this is a straightforward scenario analysis and is not intended to estimate a technically efficient level of DAS-used for the scallop fleet. There are several models which estimated technical inefficiency in the sea scallop fishery by data envelopment (DEA) and stochastic production frontier (SPF) models (John Walden (2006) and Jim Kirkley et al. (2004). According to 2008 Report to Congress by NMFS, Sea Scallop Fishery is placed among the fisheries with an excess harvesting capacity from 38 to 67% according to the measure used.

Table 3 shows that there has been a steady decline in the DAS-used per full-time limited access vessel since 1994 due to the effort-reduction and area-rotation policies implemented by the various Scallop Amendments and Frameworks. The DAS-allocation per full-time vessel declined from 204 days-at-sea in 1994 (Amendment 4) to less than 110 days-at-sea (Framework 18) for the 2006-2007 fishing years. As a result, average DAS-used declined from 161 days in 1994 to 95 days in 2007, while at the same time the number of full-time vessels participating in the fishery increased from about 210 in 1994 to 315 vessels in 2007. The reduction in effort was even greater, from an average of 180 days in 1994 to 93 days in 2007, for 124 relatively larger vessels that fished every year during the last 14 years from 1994 to 2007 (Table 3). If there were no restrictions on effort, it is evident that most vessels would use more DAS than they did in the past when DAS allocations were higher, rather than operating two or more vessels with smaller DAS allocations and incurring overhead costs such as insurance for each vessel. This would reduce the costs per pound of scallops and increase profits per vessel. The fact that a smaller number of vessels could harvest the same amount of scallops at a given level of scallop biomass by using more days-at-sea than they are currently allocated is indicative of excess technical capacity in the scallop fishery.

It must be cautioned, however, that this is a straightforward scenario analysis and is not intended to estimate a technically efficient level of DAS-used for the scallop fleet. There are several models which estimated technical inefficiency in the sea scallop fishery by data envelopment (DEA) and stochastic production frontier (SPF) models (John Walden (2006) and Jim Kirkley et al. (2004). According to 2008 Report to Congress by NMFS, Sea Scallop Fishery is placed among the fisheries with an excess harvesting capacity from 38 to 67% according to the measure used.

Table 3. Vessel size, DAS-used and LPUE by years fished by full-time limited access vessels

FISHYEAR	Years Fished	Number of vessels	Average GRT	Average HP	Average DAS-used	Average LPUE
1994	Less than 14 Years	86	143	727	135	591
	14 years	124	168	899	180	519
1994 Total		210	158	829	161	543
1999	Less than 14 Years	92	141	706	88	917
	14 years	124	168	905	109	994
1999 Total		216	157	820	100	963
2003	Less than 14 Years	155	136	678	105	1,588
	14 years	124	167	905	117	1,867
2003 Total		279	150	779	110	1,713
2004	Less than 14 Years	171	135	690	95	1,941
	14 years	124	167	904	97	2,371
2004 Total		295	149	780	96	2,124
2005	Less than 14 Years	188	133	702	77	1,775
	14 years	124	166	907	83	2,004
2005 Total		312	146	783	79	1,866
2006	Less than 14 Years	190	133	709	78	1,804
	14 years	124	166	907	86	2,087
2006 Total		314	146	787	81	1,918
2007	Less than 14 Years	191	134	716	97	1,602
	14 years	124	166	907	93	1,884
2007 Total		315	147	791	95	1,714

*Excluding outliers and LPUE data <400 lb.

Reducing excess capacity by having a smaller number of vessels harvesting ACT would increase the technical efficiency, reduce fishing costs, and increase profits and producer surplus. This would also help to reduce congestion at the docks, and reduce the waste of fuel, electricity and lower maintenance costs. Permit stacking and leasing options could lead to increased safety if the open area DAS and access area trips are fished on newer boats. On the other hand, permit stacking and/or DAS leasing could have adverse economic impacts on vessels that are not involved with DAS transfers if no adjustments to transferred DAS to keep the fishing mortality constant. Permit stacking and/or DAS leasing could also have negative impacts on employment and these impacts are estimated by the IMPLAN model and discussed in Social Impact Analysis. No action alternative would not implement any additional measures to reduce capacity in the limited access scallop fishery. All current restrictions on effort transfers would remain in place. If this alternative is selected the excess capacity in the scallop fishery will prevail and the economic benefits derived from the scallop fishery will be less than it could be if the vessels are operated at technically efficient levels. On the other hand, under no action the employment levels will probably be higher and some of the distributional impacts of stacking would be prevented. The economic impacts of the no action and of the permit stacking and leasing alternatives on the harvesting sector are analyzed below in Sections from 1.4.3.1 to 1.4.3.4.3. The impacts of the proposed options are compared with the impacts of no action (status quo).

1.4.3.1 Overview of Permit Stacking/Leasing Alternatives

This group of alternatives would allow a single limited access vessel to have up to two limited access permits (3.3.2.1) subject to fishing power and mortality adjustments. Specifically, the vessel would be permitted to fish the allocations for both permits. This alternative is expected to reduce the size of the scallop fleet by allowing a limited level of permit stacking. Idled vessels could be sold or scrapped and future investments could be put into one vessel instead of two. Stacking of two permits on one vessel will improve technical efficiency, reduce fishing costs, increase profits and producer surplus. Limiting stacking to two limited access permits would prevent excessive consolidation in the fishery, compared to unrestricted permit stacking. Similarly, leasing alternatives restrict leasing of open area DAS and access area trips to the twice of the allocation.

Although permit stacking and leasing alternatives will provide flexibility of the vessels to adjust their effort to changes in the scallop biomass and/or in management measures, they could lead to an increase in fishing effort if DAS is transferred from a small vessel to a larger vessel with higher fishing power. The historical data on LPUE's for the full-time limited access fleet by vessel by horsepower, length and gross tonnage indicate that average open area trip landings and LPUE is higher and the trip length is longer for the group of vessels with a higher horsepower, length and gross tonnage compared to the smaller vessels (Table 3). Thus, if a transfer of DAS took place from small full-time scallop boats to the larger boats either through permit stacking or DAS leasing, the scallop landings, mortality, and the capacity in the fishery could in fact increase. As a result, the DAS allocations may have to be reduced during the next management cycle to prevent fishing mortality exceeding target levels. This could have adverse economic impacts on vessels that are not involved with DAS transfers if no adjustments are made to DAS.

Table 4. Average annual LPUE of the FT vessels including small dredge and trawls

AREAGRP	FISHING_YEAR	200-599	600-850	851-999	>=1000	Grand Total
ACCESS AREAS	1999	1,040	1,419	1,518	1,564	1,416
	2000	1,501	1,709	1,737	1,874	1,721
	2001	1,665	1,886	1,871	1,886	1,827
	2002	1,475	1,880	1,694	1,901	1,764
	2003	1,601	1,960	1,898	1,977	1,858
	2004	1,706	2,070	2,130	2,355	2,036
	2005	1,621	1,787	1,704	2,026	1,781
	2006	2,233	2,509	2,785	2,903	2,522
	2007	2,028	2,412	2,672	2,600	2,362
OPEN AREAS	1999	858	928	924	1,123	962
	2000	1,200	1,419	1,385	1,581	1,402
	2001	1,418	1,750	1,724	1,877	1,679
	2002	1,540	1,838	1,832	1,985	1,774
	2003	1,561	1,903	1,934	2,009	1,823
	2004	1,852	2,359	2,376	2,521	2,237
	2005	1,692	2,279	2,387	2,654	2,169
	2006	1,282	1,681	2,015	2,139	1,698
	2007	1,090	1,475	1,565	1,663	1,423

Table 5. Number of FT vessels including small dredge and trawls

AREAGRP	FISHING_YEAR	200-599	600-850	851-999	>=1000	Grand Total
ACCESS	1999	20	71	15	39	145
	2000	19	56	9	31	115
	2001	40	67	11	35	153
	2002	24	39	4	20	87
	2003	27	40	3	23	93
	2004	78	107	18	64	267
	2005	74	103	18	52	247
	2006	64	91	17	40	212
	2007	78	110	22	58	268
OPEN	1999	45	77	17	50	189
	2000	51	86	18	51	206
	2001	66	93	20	49	228
	2002	78	95	20	52	245
	2003	83	102	19	61	265
	2004	84	108	17	59	268
	2005	85	110	21	49	265
	2006	77	109	22	61	269
	2007	68	116	23	56	263

In order to address the concern that stacking could move effort from less powerful or lower-performing vessels to more powerful or higher-performing vessels, potentially increasing capacity and fishing mortality, the Council is considering alternatives for adjusting stacked permits or leased DAS for fishing power (**Alternative 3.3.2.2.1**) and also by a second mortality adjustment that would be applied to all transactions within a range of 5% to 11%. Another alternative (**3.3.2.2.2**) would allow vessels to stack permits with no power adjustment if the baseline specifications of the permits involved meet the current vessel replacement criteria of 20/10/10/10 (HP/GT/NT/LOA) and a hybrid alternative (3.3.2.2.3) would require no adjustment if vessels are from the same upgrade restriction category, but would also allow vessels from different categories as long as the same power adjustment described in Section?? is applied to stacked permit. If a trawl permit converts to a dredge vessel (through annual declaration) and stacks with another dredge permit it would not be permitted to convert back to a trawl permit and fish both permits with trawl gear (3.3.2.2.4). These adjustments will only be for DAS only and would not adjust access area trips since that activity is controlled by output controls (possession limit). So if a full-time permit was stacked with an occasional permit, that vessel would be permitted to take multiple access area trips, but would be bound to the possession limit associated with each trip. Alternative 3.3.2.2 would restrict a vessel so that stacking a second permit could only occur once. A vessel could not stack two permits one year and than stack a third permit in the future. The Committee included two options for de-stacking: Option 1 would allow de-stacking and Option B would prohibit de-stacking. In addition, individual permits will count toward the 5% ownership restriction. One vessel with two permits would count as two permits in terms of the ownership maximum.

1.4.3.2 Development of fishing power and overall mortality adjustment alternatives

Section 1.4.3.2.1 presents a production model that is developed to derive a formula for adjusting DAS for fishing power adjustment (FPA) that is specific to the vessels involved in the stack/lease. The model estimates landings per vessel as a function of DAS used (annual), horsepower, length, LPUE and two dummy variables for dredge size. Information gathered from the advisory panel indicated that it was easy to change the GRT of the vessels, so the production model was revised to include length instead. In addition, different dummy variables for dredge and trawl were added to capture differences in efficiency from these gear types. The production model is described in detail in Section 1.4.3.2.1 and an analysis of the impact of vessel's age on LPUE is provided in Section 1.4.3.2.2 below. The adjustment factors are shown in Table 8 for vessels grouped by horsepower and length.

In addition to the adjustment described above that would account for differences in fishing power based on various horsepower and length characteristics, the PDT also recommends an additional "mortality" adjustment. Based on the production model estimates, on the impact of vessel's age on efficiency, and on factors that *are not taken into account* in the model but are expected to increase LPUE when effort is stacked/leased, the PDT also recommended that an additional overall adjustment of 9% (Overall DAS or Mortality Adjustment) should be applied to the number of *days that are transferred*. This adjustment would be applied to all transactions regardless of HP and length class and would only apply to the permit or DAS that are transferred. The initial permit (and the DAS associated with the first permit) would not be affected by this adjustment. The rationale for this Mortality Adjustment is discussed in Section 1.4.3.2.3 and summarized below as follows:

a) The simulation results based on the production model coefficients indicated that the LPUE (landings per days-absent) is estimated to increase by about 5% if open area days-at-sea used is doubled as result of stacking or leasing. For example, consider a vessel that had an open area LPUE of 2000 lb. per days absent while fishing with 42 open area days-at-sea. The model results suggested that if this vessel doubles it open area days from 42 to 84 days through leasing/stacking, its LPUE could increase to 2100 per day-at-sea, increasing the total catch by 5%. Therefore, in order to keep the total catch constant, total days should be reduced by 5% from 84 days to approximately 80 days. To be consistent with the fishing power adjustment which is applied only to the transferred days, the same result could be obtained by reducing the transferred days, that is, 42 days-at-sea by about double of 5%. The reason why the adjustment is less than 10% (5%*2) has to do with the decline in LPUE as the number of transferred days is reduced (as a result of the adjustment). Taking this into account, the simulation model indicated that the transferred days-at-sea, i.e., 42 days, should be reduced approximately by about 9%, by about 4 days, to 38 days, in order to keep the fishing mortality constant.

b) Although 9% mortality adjustment is derived from the production model coefficient, there are several reasons why an overall mortality adjustment would be needed ***even if*** the production model estimates resulted in a ***<u>constant</u>*** instead of a 5% increase in LPUE as open area DAS doubled. [4] In fact, LPUE could increase even more than 5% under some circumstances and due to factors that could not be taken into account by the

[4] This would happen if the coefficient of DAS variable is unitary instead of 1.07 in Table 6 below.

production model.[5] In other words, scallop fishing mortality could increase even after the transferred days-at-sea are reduced by 9% for the reasons summarized below:

a. Increase in vessel's flexibility in determining the trip length could lead to savings in steam time and increase landings per days-at-sea (including the steam time). Several examples provided in Table 12 to Table 14, show how this flexibility could help to increase LPUE and landings by 3% to 14% assuming a given level of DAS allocation, steam time and LPUE from different areas. If for example, LPUE could be increased by more than 10% by adjusting the trip lengths more optimally as a result of stacking, keeping the fishing mortality constant may require a mortality adjustment close to a 20% instead of the 9% suggested by the PDT.
b. Increase in vessel flexibility could help to increase LPUE not only when the trip length is increased resulting in fewer trips, but also by reducing the trip length when LPUE is higher for shorter trips but vessels has to take longer than optimal trips due to the constraints imposed by lower DAS allocations. An example of an increase in LPUE from lowering the trip length (and increasing the number of trips) is provided in Table 15.
c. Increase in vessel flexibility to end a trip if catch rates are not satisfactory could lead to overall increase in LPUE and catch when open area days-at-sea allocations are combined on a single boat. An example of this situation shown in Table 16 indicates that LPUE could increase by 12% by doubling the open area DAS allocation.
d. Newer vessels are estimated to have a higher LPUE compared to older boats ranging from 2% to 7% depending on how new the vessel is. Thus a smaller but a newer vessel could have a higher LPUE compared a larger boat with higher horsepower. There is no adjustment, however, for the vessel age when DAS is transferred from an older boat to a newer vessel.
e. The production model explains 92% of variation in landings, so it is clear that there are other factors that influence LPUE that cannot be included in the production model – e.g. the skill of the captain and the crew, reduction gear ratio, size and shape of kort nozzle, and other characteristics of the vessel's platform. For example, if the DAS is transferred to a boat with a more skillful crew, catch per DAS and landings could increase from that factor alone.

While some factors such as described in (a) to (c) are probably reflected in the production model to some extent, other factors described in (d) and (e), such as the impacts of the vessel age, skill of the captain and the crew on LPUE are not included in the 9% adjustment. The PDT discussed if the adjustment should be higher than 9% to account for these factors, but instead decided that there are also issues that could constrain a vessel with more DAS that would potentially reduce LPUE. For example, if an access area is closed because of YT TAC, or measures for turtles restrict fishing during certain seasons, the owners who stacked permits on single boats may have less flexibility relative to the ones that didn't, thus could send two of their boats to fish at the same time before the areas closed (Please see Section 1.4.3.2.3 for more discussion). **Ultimately, the PDT**

[5] Some Scallop Advisors also suggested LPUE could increase by much more than 5% predicted from the model because of the reasons discussed below.

was most comfortable with a range of 7-11% for this mortality adjustment because that is based on the best available science including the variance from the model output (standard deviation of 2% in either direction). It was also discussed that this adjustment could be re-evaluated after Amendment 15 to determine if 9% was the appropriate value to use and if not could be adjusted by framework.

c) If the LPUE and the fishing mortality increase as a result of stacking, the allocations has to be adjusted in the next management action to lower the fishing mortality rate to the sustainable levels. Such adjustment could lead to adverse impacts on boats that are not involved in DAS leasing and permit stacking (Table 26 and Table 35). In addition, if the increase in scallop fishing mortality results in higher management uncertainty, the ACT's could be adjusted downwards negatively impacting all the vessels in the fishery.

1.4.3.2.1 Production Model

The annual open area production model was estimated using different functional forms and variables including horsepower, gross tonnage, length, crew size, DAS-used, dredge size, time trend, a proxy for open area biomass, and variables separating the impacts of small dredge and scallop trawl vessels. The goal was to derive a relatively simple functional form with variables that could be measured reliably and couldn't be changed easily. For example, as some scallop industry members indicated, gross tonnage of a vessel could be altered relatively easily compared to changing the length of the vessel. Similarly, it would be relatively easy to change number of crew (up to the crew limit) and dredge size. In fact, the regression analyses for the period 2000-2007 showed that the impacts of crew and the dredge size multiplied by the number of dredges were statistically insignificant. Instead dummy variables for small dredge and scallop trawls captured the impacts of the dredge size and using trawls for scallop fishing better.

Consistent with these concerns, a step-wise regression analysis identified DAS-used, proxy for biomass, horsepower, length and small dredge and scallop trawl dummy variables as significant at the 0.15 level. The statistical results indicate that these variables accounted for more than 92% of the variance in open area scallop landings per vessel and support a simple Cobb-Douglas production model. Overall, the model provides a very good fit to the actual scallop landings as Table 6 shows.

Table 6. Cobb-Douglas Production function with length

```
                              model - 12 GMM with HCCME=1

                                  The MODEL Procedure

                         Nonlinear GMM Summary of Residual Errors

                     DF      DF                                                  Adj    Durbin
 Equation         Model   Error         SSE         MSE  Root MSE  R-Square     R-Sq    Watson

 lnscdealb            7    1957     91.4130      0.0467    0.2161    0.9253   0.9251    1.4361


                             Nonlinear GMM Parameter Estimates

                                                  Approx                   Approx
             Parameter       Estimate      Std Err    t Value     Pr > |t|

             intc            -2.78036       0.3156      -8.81       <.0001
             daco            1.070604       0.0101     106.49       <.0001
             hpco            0.211258       0.0253       8.36       <.0001
             lenco           0.096521       0.0626       1.54       0.1235
             dftco           -0.45447       0.0261     -17.40       <.0001
             lpueco          1.081665       0.0293      36.86       <.0001
             trwco            -0.1018       0.0332      -3.06       0.0022


                  Number of Observations     Statistics for System

                  Used              1964    Objective      1.554E-21
                  Missing             50    Objective*N    3.051E-18
```

Parameter	95% confidence interval	
intc	-3.399	-2.162
daco	1.051	1.090
hpco	0.162	0.261
lenco	-0.026	0.219
dftco	-0.506	-0.403
lpueco	1.024	1.139
trwco	-0.167	-0.037

Variable Definitions and data sources

LNSCDEALB= Logarithm of annual scallop landings per fishyear in pounds (source: dealer data)
INTC= Intercept
DACO= The coefficient for DAS-used (source: DAS data)
HPCO= The coefficient for Horse-power (source: Permit data)
LENCO= The coefficient for vessel length (source: Permit data)
DFTCO= Dummy variable for small dredge (equal to "1" if the vessel is small dredge, "0" if it is not).
LPUECO= The coefficient for average LPUE of the vessels that fished every year since 1994 (14 years). This variable is used as a proxy for open area average scallop abundance.
TRWCO= Dummy variable for scallop trawls (equal to "1" if the vessel is small dredge, "0" if it is not).

The production function is estimated using a subset of the DAS database, which was matched to the trip records in the dealer database and excluded a few outlier records. About half of the DAS records had a corresponding record in dealer database, which could be easily matched and constitute a good sample for the purpose of analyses presented here. For example, DAS data includes 317 full-time vessels that took open area trips in the 2006 fishing year, but there were matching records for 269 of these vessels in the dealer dataset. During estimation the observations with high influence statistics including H, RSTUDENT, DFFITS, and Cook's D are also excluded from the sample. All of coefficients of the explanatory variables have the expected sign, and they are statistically significant.

Because the coefficient for DAS is greater than unity, this function exhibits increasing average and marginal returns to DAS variable for the period covered in this estimation, i.e., from fishing year 2000 to 2007. In other words, landings per DAS increase (but at a diminishing rate) as DAS used increase for the range of open area DAS allocations observed during this period. An implication of this increase in LPUE is that if no adjustment is made for this increase, total scallop landings could go up as a result of DAS leasing or permit stacking even if adjustment is made for the fishing power of the vessels based on HP and GRT. The simulation results based on the production model coefficients indicated that the LPUE (landings per days-absent) is estimated to increase by about 5% if open area days-at-sea used is doubled as result of stacking or leasing. The 95% confidence interval indicated that LPUE could increase by 3% to 7% as a result of stacking.

In addition to the Cobb-Douglas model, the PDT also estimated a translog function which includes a domed relationship between DAS and LPUE, that is, a function where LPUE first increases as the DAS-used increase, reaches a maximum and then starts declining at higher effort (DAS-used) levels. However, this model was not used for purposes of calculating the fishing power and mortality adjustment because a translog model based on the period 2000 – 2007 with limited open area allocations (less than 60 days for most of the period) may not be able to capture the actual point of diminishing return. In fact, the concern that this model artificially resulted in diminishing returns at 76 days due to insufficient data points above these DAS levels that led the PDT to adopt the Cobb-Douglas Model during the previous meeting. The estimates of the translog model for different time periods, in fact, resulted in point of diminishing returns at different DAS levels. The estimates for the period 1994-2007 using horsepower and vessel length resulted in diminishing returns at 160 days. The production model estimated in 1995 using the data for 1987 to 1993 resulted in average diminishing returns to be reached at 187 days. Thus, there is no question that the estimates are affected by the period and by the levels of DAS allocations that were observed in each period. In addition, there wouldn't be a significant change in fishing power and mortality adjustment estimates with either the Translog or the Cobb-Douglas model in so far as open area DAS allocations remained close to the levels observed during the period 2000-2007.

Adjustment factors based on the estimates of the Cobb-Douglas production model are shown in Table 8 for 8-HP and two-length groups using the full-time scallop fleet characteristics. The adjustment factors in relative LPUE are expressed as follows:

A_{ij}= LPUE $_i$/LPUE$_j$ where

LPUE $_i$= Landings per DAS for vessel 'I';

LPUE $_j$= Landings per DAS for vessel 'J';

The adjustment factor (A_{ij}) for DAS exchanges between two vessels (vessel "i" and vessel "j") are calculated using the production function estimates of relative LPUE's.

The full-time time dredge vessels are grouped into 13 groups by their HP and length (Table 8). This grouping allows many vessels with similar characteristics and adjustment factors to be placed in the same group. In terms of HP, 8 groups are constructed starting with 500 HP and with including vessels up to 20% higher HP in the same group using the vessel replacement criteria for HP. The length grouping identifies small vessels with 50 to 70 feet and large vessels with more than 70 feet.

Table 8 shows the adjustment factors for this group of vessels for fishing power, i.e., for HP and length. Although, larger length groups could be subdivided into more subgroups, the examination of Table 8 shows that the incremental difference in the adjustment factors for HP and length is already quite small between these 13 groups, and having more groups would possibly have a marginal influence on the adjustment values. The same adjustment factors are relevant for DAS transfers full-time, part-time and occasional dredge vessels, between small scallop dredges or between scallop trawls. If DAS transfers take place between a regular and a small dredge or between a dredge and a trawl, however, the adjustment coefficients would be lower than shown in Table 8.

Table 7. Full-time Dredge Vessel Characteristics

HP	Length	HP-Length Group	Number of vessels	HP	GRT	Length
<500	50-70	11	5	392	59	61
<500	>70	12	9	431	122	77
500-599	50-70	21	5	523	79	64
500-599	>70	22	25	530	132	77
600-719	50-70	31	4	618	99	66
600-719	>70	32	37	641	146	81
720-863	50-70	41	4	763	119	65
720-863	>70	42	74	814	166	83
864-1036	50-70	51	1	950	111	64
864-1036	>70	52	30	959	167	86
1037-1243	>70	62	38	1,121	183	89
1244-1492	>70	72	12	1,299	178	90
>=1493	>70	82	11	1,545	186	99

Table 8. Adjustment factors for fishing year 2007 (Based on group means for HP and length for 255 full-time dredge vessels)

HP	Length	HP-Len Group	adj11	adj12	adj21	adj22	adj31	adj32	adj41	adj42	adj51	Adj52	Adj62	Adj72
<500	50-70	11	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
<500	>70	12	0.958	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
500-599	50-70	21	0.936	0.977	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
500-599	>70	22	0.917	0.957	0.980	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
600-719	50-70	31	0.903	0.942	0.965	0.985	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
600-719	>70	32	0.876	0.914	0.936	0.955	0.970	1.000	1.000	1.000	1.000	1.000	1.000	1.000
720-863	50-70	41	0.862	0.900	0.921	0.940	0.955	0.984	1.000	1.000	1.000	1.000	1.000	1.000
720-863	>70	42	0.831	0.867	0.888	0.906	0.920	0.948	0.964	1.000	1.000	1.000	1.000	1.000
864-1036	50-70	51	0.825	0.861	0.882	0.900	0.914	0.942	0.957	0.993	1.000	1.000	1.000	1.000
864-1036	>70	52	0.800	0.835	0.855	0.873	0.886	0.914	0.928	0.963	0.970	1.000	1.000	1.000
1037-1243	>70	62	0.771	0.805	0.824	0.841	0.854	0.881	0.895	0.928	0.935	0.964	1.000	1.000
1244-1492	>70	72	0.747	0.780	0.798	0.815	0.827	0.853	0.866	0.899	0.905	0.933	0.969	1.000
>= 1493	>70	82	0.714	0.745	0.763	0.779	0.791	0.815	0.828	0.859	0.865	0.892	0.926	0.956

The examples using these adjustment factors and the mortality adjustment are shown in Tables?? in Section??

1.4.3.2.2 The impact of vessel's age on LPUE and implications for stacking/leasing options

The production model described above did not include vessel's age as an explanatory variable because this variable was not considered as a factor to be used in adjusting DAS after stacking/leasing. Several scallop industry members indicated, however, that the newer vessels are more efficient than the older boats, therefore stacking DAS from the old boats to the new ones could increase fishing mortality. In fact, empirical estimates indicate that the newer vessels have a higher LPUE than the older ones.

Table 9 shows the difference of the LPUE of the vessels by vessel's age and HP for 2006 fishing year. Even when newer vessels had a lower average HP, lend and GRT, their average LPUE exceeded the average LPUE of the older vessels. For example, LPUE of the newer boats with a HP of 1000 or more was 24% higher than the LPUE of the older boats. Although this Table gives some insight about the impacts of the vessel's age on LPUE, because vessels with different HP, length and GRT are grouped together, the impacts of vessel age should be best estimated separated from the impacts of the vessel size. For this reason, production model is re-estimated by including vessel age as another explanatory factor as follows (2007-1999):

Table 9. Landings per DAS-used by the vessel's age and horsepower (2006 Fishyear, FT dredge vessels)

Fishing Year	Horse Power	Data	1 to 10 years	10 years and older	% Difference
2006	200-599	Number of vessels	4	28	
		LPUE	**1347**	**1415**	**6%**
			6.0	27.7	
		HP	454	505	-12%
		Length	68	76	-7%
		GRT	83	125	-33%
		Year built	2002	1980	
	600-999	Number of vessels	8	104	
		LPUE	**1944**	**1761**	**9%**
		Age	4.8	27.5	
		HP	718	786	-11%
		Length	81	82	-2%
		GRT	121	159	-22%
		Year built	2003	1980	
	>=1000	Number of vessels	10	44	
		LPUE	**2514**	**2026**	**24%**
		Age	4.6	26.6	
		HP	1218	1215	0%
		Length	90	91	-1%
		GRT	176	184	-4%
		Year built	2003	1981	

Note: Age=1 is 2007.

Table 10 - Cobb-Douglas Production function with vessel age

GMM with HCCME=1
The MODEL Procedure

Nonlinear GMM Summary of Residual Errors

Equation	DF Model	DF Error	SSE	MSE	Root MSE	R-Square	Adj R-Sq	Durbin Watson
lnscdealb	8	1957	91.4220	0.0467	0.2161	0.9253	0.9250	1.4452

Nonlinear GMM Parameter Estimates

Parameter	Estimate	Approx Std Err	t Value
Intercept	-2.7272	0.27795	-9.81
lndasused	1.07117	0.00774	138.47
lnhp	0.20735	0.01959	10.58
lnlen	0.10701	0.05153	2.08
lnlpueop14	1.08058	0.02752	39.26
DFT	-0.45374	0.0182	-24.93
TRW	-0.10726	0.02338	-4.59
lnagev	-0.02068	0.00854	-2.42

Number of Observations		Statistics for System	
Used	1965	Objective	1.83E-21
Missing	643	Objective*N	3.595E-18

<u>Variable Definitions and data sources</u>

LNSCDEALB= Logarithm of annual scallop landings per fishyear in pounds (source: dealer data)
Lndasused = Logarithm of DAS-used (source: DAS data)
HP = Logarithm of Horse-power (source: Permit data)
LEN= Logarithm of vessel length (source: Permit data)
DFT= Dummy variable for small dredge (equal to “1” if the vessel is small dredge, “0” if it is not).
LNLPUEOP14= The logarithm of average LPUE of the vessels that fished every year since 1994 (14 years). This variable is used as a proxy for open area average scallop abundance.
TRW= Dummy variable for scallop trawls (equal to “1” if the vessel is small dredge, “0” if it is not).
LNAGEV= The logarithm of vessel age.

According to this model, age of a vessel have a negative impact on the LPUE of a vessel. Following Table shows these impacts:

Table 11. Vessel Age and LPUE

Vessel Age	%Ch.LPUE
20 to 30	-6.39% to -7.29%
10 to 19	-4.88% to -6.28%
5 to 9	-3.38% to -4.65%
2 to 4	-1.44% to -2.91%

$$LPUE1/LPUE2= (AGEV2^{-0.0268} / DA)/ (AGEV1^{-0.0268} / DA) = (AGEV1/AGEV2)^{-0.0268}$$

For example, if BLT1=2007 and BLT2=1980 or
Age of vessel, AGEV1=1 AND AGEV2=28
%Change in LPUE= $((AGEV2^{-0.0268} - (AGEV1^{-0.0268})/ (AGEV1^{-0.0268}) = 7.2\%$

1.4.3.2.3 Overall Mortality adjustment

The PDT recommends that a second adjustment be applied to all stack/DAS lease transactions to recognize that LPUE increases when DAS increase, and there are other factors that influence LPUE that cannot be included in the production model – e.g. the skill of the captain and the crew, the age of the vessel, reduction gear ratio, size and shape of kort nozzle, etc.

The simulation results based on the production model coefficients indicated that the LPUE (landings per days-absent) is estimated to increase by about 5% if open area days-at-sea used is doubled as result of stacking or leasing. For example, consider a vessel that had an open area LPUE of 2000 lb. per days absent while fishing with 42 open area days-at-sea. The model results suggested that if this vessel doubles it open area days from 42 to 84 days through leasing/stacking, its LPUE could increase to 2100 per day-at-sea, increasing the total catch by 5%. Therefore, in order to keep the total catch constant, total days should be reduced by 5% from 84 days to approximately 80 days. To be consistent with the fishing power adjustment which is applied only to the transferred days, the same result could be obtained by reducing the transferred days, that is, 42 days-at-sea by about double of 5%. The reason why the adjustment is less than 10% (5%*2) has to do with the decline in LPUE as the number of transferred days is reduced (as a result of the adjustment). Taking this into account, the simulation model indicated that the transferred days-at-sea, i.e., 42 days, should be reduced approximately by about 9%, by about 4 days, to 38 days, in order to keep the fishing mortality constant.

The PDT discussed if the adjustment should be higher than 9% to account for factors that are not accounted for in the production model discussed below, but instead decided that there are also situations that could constrain a vessel with more DAS that would potentially reduce LPUE. Ultimately, the PDT was most comfortable with a range of 7-11% for this mortality adjustment because that is based on the best available science including the variance from the model output (standard deviation of 2% in either direction). It was also discussed that this adjustment could be re-evaluated after Amendment 15 to determine if 9% was the appropriate value to use and if not could be adjusted by framework.

The additional reasons why LPUE might increase as a result of permit stacking or DAS leasing as listed below.

1. If vessels are permitted to fish more DAS on one vessel the model suggests that average catch per DAS will increase for that vessel because it will have more flexibility in determining trip length. The examples are provided in Section 1.4.3.2.3.1 below.
2. LPUE is expected to increase by some degree due to other aspects of the vessel that influence fishing power that are not measured thus cannot be modeled (reduction gear ratio, use of kort nozzle, etc.).
3. LPUE is also expected to increase because it is assumed that DAS will transfer to the boat with more experienced and skillful crew and captain. If more DAS are fished by more efficient crew, more catch is expected.
4. The newer vessels have a higher LPUE and stacking permits on these boats (even when they are smaller in size) would increase fishing mortality if no overall DAS adjustment is applied.
5. LPUE is could change because of changes in fishing patterns. For example, a multi-vessel owner that sends both of its vessels to the most productive areas at the same time will not be able to do that after stacking/leasing. If this reduces the number of vessels that fish in that area per-unit of time, the overall LPUE would also decline at a slower rate than before.
6. On the other hand, a vessel owner could send two boats at the same time to fish in a very productive area, but with stacking it will not be able to do that. If this pushes the fishing date to seasons when the meat-weight is lower, than, LPUE could decline because of stacking. The overall result would depend whether the increase in LPUE because of the spreading out effort outweighs the negative impact on LPUE because the fishing takes place when meat-weigh is lower. If three fourths of the boats share the same crew as was indicated by many boat owners, this means the vessels owned by multi boat owners usually do not fish at the same time most of the year. If this is the case, there might not be significant impacts on LPUE from changing the fishing patterns. In other situations, if an access area is closed because of YT TAC, or measures for turtles restrict fishing during certain seasons, the owners who stacked permits on single boats may have less flexibility relative to the ones that didn't. For example, multi-boat owners could send two of their vessels to fish at the same time before the areas are closed before Yellowtail TAC is reached, whereas the owners who stacked permits on one boat will not be able to do that and avoid closure.

1.4.3.2.3.1 The impacts of flexibility on LPUE and catch

If vessels are permitted to fish more DAS on one vessel the model suggests that average catch per DAS will increase for that vessel primarily because it will have more flexibility in determining trip length.

The production function estimates indicated that LPUE increases (but at a diminishing rate) as DAS used increase for the range of open area DAS allocations observed during the period 2000-2007. This implies that if no adjustment is made for increasing returns to the DAS-used, total scallop landings could increase as a result of DAS leasing or permit stacking even if adjustment is made for the fishing power of the vessels based on HP and length.

In estimation of the production model, LPUE (or average returns to the DAS) is defined as landings per DAS-used (includes steam time), not landings per day-fished, which is an important distinction for a proper interpretation of the increasing returns. The increase in LPUE is applicable here only to situations where the same number of allocated DAS is fished on two separate boats are combined on one boat. Under these circumstances, fishermen would be subject to same process of selection of most efficient conditions when they were using their DAS allocations on two different boats, except that they would have more flexibility in determining the trip length.

Table 12 to Table 16 illustrates how LPUE (per DAS-used) could increase by combining allocations. For example, consider a multi-boat owner that operates two vessels fishing 30 days each in open areas, totaling 60 days. Assume that the upper limit for the optimal trip length is 12 and with 30 days, the vessel could take 3 trips. That means 6 trips for an owner who has two boats. But if this vessel can increase its allocation to 60 days, then it can take 5 trips at 12 days each, saving on steaming time and increasing its LPUE per DAS-used by 4% (Table 12).

The second example in Table 13 assumes different steaming times and LPUE's for each trip with 42 days-at-sea allocation, resulting in an increase in LPUE by 7% when the open area days are combined on one boat (84 days). The third example (Table 14) also assumes that longer trips, i.e.,., 12 days in this case, would result in higher LPUE and more steaming time perhaps because vessels fishes in a more productive area farther from the port when they take longer trips. Combining days-at-sea allocations would result in a 13% increase in LPUE in this case. The fourth scenario (Table 15) shows a case when LPUE declines as the trip length is increased. Again, a vessel would take 4 trips in this case with a 45 open area DAS allocation, totaling to 8 trips and 90 days for a multi-boat owner. By combining days-at-sea allocations on one boat, the vessel than could take 9 trips at the optimal trip length of 10 days each increasing the total LPUE by 3%. Finally, Table 16 shows a case when a trip becomes less productive due to a decline in LPUE, but the vessel continue to fish because interrupting the trip could result in higher costs due to the steaming time of taking another very short trip. Combining the days on the same vessel, the captain will have more choices when to break a trip and then combine remaining days with another trip, resulting in a 12% increase in LPUE. More examples could be constructed assuming different levels of days-at-sea allocations, different LPUE's and steaming times for each trip. But the main point here is to illustrate that stacking open area days-at-sea allocations on one boat could lead to increased flexibility in determining the optimal trip length, higher LPUE and catch from given days-at-sea allocations.

Table 12. Increase in LPUE with combined DAS allocations assuming constant LPUE and steam time (30 days)

	Open area						
DAS Allocation	30	Trips	Trip-1	Trip-2	Trip-3	Total	2 Boats
	DAS-used	3	10	10	10	30	60
	Steam time		2	2	2	6	12
	DF		8	8	8	24	48
	Landings per DF		1800	1800	1800	1800	
	Landings (lb)		14400	14400	14400	43200	86400 lb.
	LPUE (lb/DAS)		1440	1440	1440	1440	
After DAS transfer							
DAS Allocation	60	Num.trips	Trip length			Total	
	DAS-used	5	12			60	
	Steam time		2			10	
	DF		10			50	
	Landings per DF		1800			1800	
	Landings (lb)		18000			90000	90000 lb.
	LPUE (lb/DAS)		1500			1500	**Increase in LPUE= 4%**

Table 13. Increase in LPUE with combined DAS allocations assuming higher LPUE and steam time for longer trips (42 days)

								2 boats 84 days
Before Transfer	42	Trips	Trip-1	Trip-2	Trip-3	Trip-4	Total	
	DAS-used	4	12	12	12	6	42	
	Steam time		3	3	3	2	11	22
	DF		9	9	9	4	31	62
	Landings per DF		2800	2800	2800	1800	2671	
	Landings		25200	25200	25200	7200	82800	165,600
	LPUE		2100	2100	2100	1200	1971	
After DAS transfer								
DAS Allocation	84	Num.trips	Trip-length	Num.trips	Trip-length	Total		
	DAS-used	7	12	0	0	84		
	Steam time		3	0	0	21		
	DF		9	0	0	63		
	Landings per DF		2800	0	0	2,800		
	Landings		25200	0	0	176400		176,400
	LPUE		2100	0	0	2100		7%

Table 14. Increase in LPUE with combined DAS allocations assuming higher LPUE for longer trips (42 days)

Before Transfer	42	Trips	Trip-1	Trip-2	Trip-3	Trip-4	Total	84 days
	DAS-used	4	12	10	10	10	42	
	Steam time		3	2	2	2	9	18
	DF		9	8	8	8	33	66
	Landings per DF		2800	2200	2200	2200	2364	
	Landings		25200	17600	17600	17600	78000	156,000
	LPUE		2100	1760	1760	1760	1857	
After DAS transfer								
DAS Allocation	84	Num.trips	Trip-length	Num.trips	Trip-length	Total		
	DAS-used	7	12	0	0	84		
	Steam time		3	0	0	21		
	DF		9	0	0	63		
	Landings per DF		2800	0	0	2,800		
	Landings		25200	0	0	176400		176,400
	LPUE		2100	0	0	2100		13%

Table 15. Increase in LPUE with combined DAS allocations assuming higher LPUE for shorter trips (42 days)

Before Transfer	45	Trips	Trip-1	Trip-2	Trip-3	Trip-4	Total	2 boats, 8 trips, 84 days
	DAS-used	4	10	11	12	12	45	
	Steam time		3	3	3	3	12	24
	DF		7	8	9	9	33	66
	Landings per DF		2800	2600	2500	2500	2588	
	Landings		19600	20800	22500	22500	85400	170,800
	LPUE		1960	1891	1875	1875	1898	
After DAS transfer								
DAS Allocation	90	Num.trips	Trip-length			Total		
	DAS-used	9	10			90		
	Steam time		3			27		
	DF		7			63		
	Landings per DF		2800			2,800		
	Landings		19600			176400		176,400
	LPUE		1960			1960		3%

Table 16. Increase in LPUE with combined DAS allocations with different LPUE's per trip (42 days)
Assumption: Trip 1 and Trip 2 – LPUE is 2500 first 4 days, declines to 1000

Before Transfer	42	Num.Trips	Trip-A	Trip-B	Trip-C	Total	84 days
	Number of trips		1	1	2		
	DAS-used		8	10	12		
	Steam time		2	2	2		
	DF		6	8	10		
	Total DAS-used		8	10	24	42	
	Landings per DF		2000	1750	2500		
	Landings		12000	14000	50000	76000	152,000
	LPUE		1500	1400	2083	1810	

After DAS transfer	84	Num.Trips	Trip-A	Trip-B	Total	% Change
	Number of trips		2	6	8	
	DAS-used		6	12		
	Steam time		2	2	16	
	DF		4	10	68	
	Total DAS-used		12	72	84	
	Landings per DF		2500	2500	5000	
	total Landings		20000	150000	170000	12%
	LPUE		1667	2083	2024	12%

There are also additional reasons why LPUE might increase as a result of permit stacking/DAS leasing that cannot fully be taken into account with the production model. As described on page 5 of this document, transferring DAS to the boat with a better and more efficient platform or to the boat with a better and more experienced crew could increase LPUE even if this vessel had the same HP or length as the original boat. In addition, DAS leasing/stacking could impact the fishing pattern and distribute effort more evenly during the fishing season, reducing the decline in overall LPUE per unit of time especially during the months with highest fishing activity. Overall impacts of spreading effort are uncertain, however, depending on the season the fishing takes place as explained above.

1.4.3.3 Overview of economic impacts of permit stacking and leasing

The permit stacking alternatives are expected to reduce the size of the scallop fleet by allowing two permits to be stacked on one vessel resulting in improved technical efficiency, in lower fishing costs, higher profits and producer surplus and a larger total economic benefit for the scallop fishery. There could be some adverse distributional impacts, however, on the vessels that are not involved in permit stacking/leasing if the fishing mortality increase as result of open area DAS transfers. Permit stacking could also have some negative impacts on employment as IMPLAN model (Section ??) indicated and as discussed in the Social Impacts Section?? depending on the degree of consolidation of the scallop fleet.

If the fishing power and mortality adjustments are effective in keeping the fishing mortality constant, however, permit stacking and leasing alternatives will not affect scallop landings and prices and will have no significant impacts on the consumer benefits and the total fleet revenue. The negative impacts on the participants of the fishery that are not able to stack permits or lease allocations will also be reduced if the fishing mortality is kept constant with proper adjustments for the fishing power and efficiency gains from DAS transfers. There could be some negative impacts on the value of the scallop boats, however, as the supply of boats on the market for sale increase as a result of stacking. Limiting stacking to two limited access permits would prevent excessive consolidation in the fishery, compared to unrestricted permit stacking. In case of permit stacking, another benefit could be removing older and less efficient vessels from the fleet improving safety, overall productivity and competitiveness of the scallop fleet. As the idled vessels are sold or scrapped the dock space would improve as well.

The fishing power adjustments are expected to reduce total open area DAS-used and lower the trip costs for the fleet if the DAS is transferred from vessels with a smaller HP and length to larger vessels that can land the same amount scallops in a shorter time. If the DAS are transferred from a larger boat to a smaller boat there will be no adjustment for the fishing power, thus there will be no decline in total DAS-used on that account. The total DAS-used or effort will decline in both cases, however, if an additional mortality adjustment is applied to DAS transfers. In the case of access area trip stacking or leasing, there will be no adjustment for fishing power or mortality given that the landings from these trips are restricted by the possession limit. Overall DAS-used for fishing in the access areas could still decline if the trips are leased or stacked on more powerful vessels with a higher LPUE. As a result, the overall trip costs for the fleet are estimated to be lower as a result of stacking or leasing.

The most significant benefits of permit stacking would be a reduction in the fixed costs, resulting in higher profits and a larger producer surplus for the scallop fishery. Although the results of the analyses are discussed in terms of permit stacking, similar conclusions would be valid for the impacts of leasing alternatives with some qualifications. In the case of leasing, the fixed costs would still be lower for the vessels that transfer their allocations, but the vessel still needs to be maintained and the owner would incur some insurance costs. Therefore, the economic benefits would be lower in the case of leasing compared to permit stacking. The economic impacts of permit stacking and leasing options are estimated using a simulation model which includes production function, trip and fixed cost equations, lay-system and definitions for producer surplus and profits presented in Appendix??. The simulation model takes into account the constraints that are placed on the number of permits that could be stacked and the impacts of fishing power and mortality adjustments. The economic analysis also includes a discussion of distributional impacts on vessels that are not involved in stacking and/or leasing.

The economic impacts of the permit stacking and leasing options are analyzed using two different scenarios with permit stacking/leasing, including a maximum stacking scenario such that the number of vessels in the fishery is reduced by half (Scenario 1, Section 1.4.3.4.1), and another one involving stacking by the multi-vessel owners only (Scenario 2, Section 1.4.3.4.2). These scenarios are constructed to estimate maximum potential impacts on fishing mortality with and without adjustments for fishing power and efficiency. There is no question that maximum stacking scenarios could become a reality over time if the vessel owners could gain from stacking two permits on one vessel and if the risks associated with stacking are not significant. The results of the scenario analyses with stacking of permits on more powerful/efficient vessels indicate that owners could reduce their fishing costs and increase their profits significantly by doubling the open area DAS and access area trips on one boat. On the other hand, there are advantages to having two boats that could fish in the access areas, for example, before the yellowtail TAC is reached and the area is closed. In addition, some owners have mortgages on their boats or have invested a considerable sum in their boats already and may not be able sell the extra boats at the prices they like in the short-term and may wait on stacking their permits. Therefore, in reality, permit stacking may involve a smaller number of vessels in the short-term, with smaller economic impacts and impacts on employment.

For example, if instead of a 50% stacking that reduces the number of vessels in the fleet by half, it is assumed that only 25% of the vessels in the fleet will stack their allocations, the economic impacts shown for the maximum stacking scenarios (in the Tables below) will decline by approximately by 50%. For example, in the case of 25% stacking, the overall fleet profits would not increase by 30%, but by 15%. The profits of the individual vessels could still increase by a larger amount depending on which vessels permits are stacked. The impacts of the permit stacking on fleet size and employment are shown in Table 18 using various assumptions with stacking from 25% to 50%.

The economic impacts of the scenario analyses could be summarized as follows:

- The economic impacts of a maximum stacking scenario is summarized in Table 17 and of permit stacking by multi-boat owners in summarized in Table 19. The analyses include 255 the limited access dredge vessels that had a permit in 2007 fishing year. The scenarios are constructed using the biomass conditions, prices and costs that were experienced in 2007 fishing year. As in the 2007 fishing year, it was assumed that each vessel would get open area allocation equal to 51 days and 5 access area trips with an 18,000 possession limit. Under the status quo conditions, total landings of these vessels would be 42.3 million pounds and the total revenues from scallops would equal to $275 million, which is close to the actual numbers materialized in 2007. Trip and fixed costs are estimated using the cost models presented in Appendix?? The association fees, communication costs and a captain bonus of 5% are deducted from the gross stock to obtain the net stock. Boat share is assumed to be 48% and the crew share is assumed to be 52% of the net stock. Profits are estimated by deducting fixed costs from the boat share. Net crew income is estimated by deducting the trip costs from the crew shares.

- For the maximum stacking scenario it is assumed all permits are stacked so that the number of vessels that remain in the fishery declines from 255 to 128. The production model is used to project open area landings with and without DAS transfers and adjustments for fishing power and mortality using the vessels characteristics of each limited access full-time dredge vessel. The middle block in the Table shows the results for stacking if a fishing power adjustment is applied to the transfers, and the bottom block shows the results with both fishing power adjustment.

- Total scallop landings from open and access areas would increase by 2% if there is no mortality adjustment to the open are DAS transfers. Open area landings would increase by 4.6% and access area landings would stay the same as a result of permit stacking. Overall fleet trip costs would decline by 4% and fixed costs by 24% due to stacking, resulting an increase in profits by 30% if the savings in trips costs go to the crew shares, or by 38% if the savings in trip costs leads to an increase in boat shares by a modification of the lay system. Producer surplus measured by the difference of total revenue from variable costs would increase by 3%.

- Permit stacking with a 9% mortality adjustment is estimated to keep the landings and revenues at the same levels, reduce the trip costs by 6% and the fixed costs by 24%. As a result, profits would increase 26% if the savings in trips costs go to the crew shares, or by 30% if the savings in trip costs leads to an increase in boat shares by a modification of the lay system. There would a slight increase in producer surplus by 1%.

Table 17 - Scenario 1: Permit-Stacking/DAS plus access area leasing – Change in landings, DAS-used, revenues and costs (Assuming $6.50 price per pound of scallops)

Scenario	Data	Total	% Change from Status Quo
Status quo (255 vessels)	Scallop landings	42,377,553	
	Scallop revenue	275,454,095	
	Trip costs	35,248,119	
	Fixed costs	64,608,838	
	Net crew income	113,878,537	
	Profits	60,333,271	
	Producer surplus	240,205,976	
Stacking/leasing Fishing Power adjustment (128 vessels)	Scallop landings	43,268,297	2%
	Scallop revenue	281,243,932	2%
	Trip costs	33,994,859	-4%
	Fixed costs	49,206,887	-24%
	Net crew income	118,621,574	4%
	Profits (Crew inc.increase)	78,689,331	30%
	Profits (Crew inc.same)	83,432,367	38%
	Producer Surplus*	247,249,073	3%
Stacking/leasing Fishing Power + 9% Mortality adjustment (128 vessels)	Scallop landings	42,350,325	0%
	Scallop revenue	275,277,114	0%
	Trip costs	33,105,995	-6%
	Fixed costs	49,206,887	-24%
	Net crew income	116,264,489	2%
	Profits (Crew inc.increase)	75,968,462	26%
	Profits (Crew inc.same)	78,354,414	30%
	Producer Surplus*	242,171,119	1%

Note: Producer Surplus does not include the savings in fixed costs.

Table 18 – Impacts of Permit Stacking on the scallop fleet size and employment

Number of vessels	Number of Multi-boat owners	Number of Single-boat owners	Number unknown	Total FT Dredge Vessels	**% Change**
Status Quo	202	46	7	255	
Scenario 1 - All vessels stack (50%)	101	23	4	128	-50%
Scenario 2 - Only multi-vessel owners stack	101	46	7	154	-40%
Scenario 3- 25% of all vessels stack	152	35	5	191	-25%
Scenario 4 - 25% of multi-vessel owners stack	152	46	7	205	-20%
Employment	6.75				
Status quo	852	194	30	1076	
Scenario 1 - All vessels stack (50%)	682	155	27	864	-20%
Scenario 2 - Only multi-vessel owners stack	682	194	30	905	-16%
Scenario 3- 25% of all vessels stack	767	175	27	968	-10%
Scenario 4 - 25% of multi-vessel owners stack	767	194	30	991	-8%

- These results depend on the impacts of permit stacking on overall landings and would vary according to whether the mortality adjustment is over- or underestimated. Two different situations identified below describe these effects:
  - According to the production model estimates, permit stacking could lead to an increase landings and fishing mortality by 5% even if the DAS transfer took place among boats with exactly same HP and length. For this reason, a 9% mortality adjustment is required to make permit stacking/leasing neutral in terms of open area fishing mortality, with a confidence interval of 7% to 11%. A 5% mortality adjustment lies outside of the 95% confidence interval and does not take into account other factors that could increase fishing mortality further, including transfer of DAS to a newer vessel with more skilful crew. Although, a mortality adjustment from 7% to 8% is within the 95% confidence interval estimated from the production model, again, the risks of overfishing in the open areas would be larger if overall LPUE on the vessel that receives the allocation/or permit is considerably higher than the vessel that makes the transfer. As discussed in Section 1.4.3.1 above, scallop fishing mortality could increase even after the transferred days-at-sea are reduced by the midpoint estimate, i.e., by a 9% mortality adjustment. Therefore, a mortality adjustment within range of 10% to 11% would minimize the risks of increasing mortality due to increase in efficiency from a variety of factors that are not be taken into account in the production model such as vessel's age, better platform and/or more skillful crew.
  - Not applying a mortality adjustment or applying one lower than necessary would have adverse impacts on other vessels, especially on the ones that are not involved in stacking, as discussed in Section 1.4.3.4.1.3 below. For example, if adjustment was made for fishing power but not for DAS and the scallop mortality increase by 4% leading to a reduction in DAS allocations in the next period, average scallop revenue per vessel could decline by $23,200.

- On the other hand, a mortality adjustment would lead to a reduction in total landings in the *unlikely case* of permit stacking between vessels with identical LPUE and vessel characteristics if more flexibility from higher DAS allocations does not lead to any significant efficiency gains. For example, an owner with two identical boats and equivalent LPUE would experience about 5% decline in total landings and revenues from two vessels as a result of a mortality adjustment if there is no increase in overall LPUE after stacking. Assuming that this owner lands 75,000 lb. from each vessel at a price of $7 per pound before stacking, the open area scallop revenue could decline by 5%, or $47,250. Permit stacking is still expected to increase profits, however, due to the savings in fixed costs and trip expenses from fishing with one vessel. For example, if the fixed costs on these two identical boats were $250,000 each (average per vessel in 2007) totaling $500,000, the savings would amount to $125,000 if the total fixed costs could be lowered by 25% and $165,000 if they are reduced by 33% as a result of stacking. In addition, there would savings in trip costs as a result of fishing with less DAS due to the mortality adjustment. Given that not too many vessels in the scallop fleet are exactly alike, it is expected that open area DAS will be transferred to the more efficient or newer vessels and there will be efficiency gains from combining allocations on one vessel. Therefore, it is unlikely for the mortality adjustment to reduce overall scallop landings in any significant way. If a reduction in mortality occurred, however, as a result of permit stacking, the scallop yield and allocations would be impacted positively in the next period and will benefit all vessels whether or not they are involved in stacking or leasing.

- The majority of the vessels and 202 out of 255 full-time dredges vessels in the scallop fishery are owned by multi-boat owners. As a result, a permit stacking scenario by multi-boat owners has similar economic impacts compared with maximum stacking scenario. The number of active FT dredge vessels would decline to 154 vessels, and the overall fleet profits would increase by 22% to 26% depending on whether the savings in trip costs go to the crew or to the boat owners (Table 19). The profits of the vessels that stacked the permits would increase by 28% to 32% as shown in Table 39.

- Another scenario would be to assume that permits are stacked on the vessels within the same HP-Length group to avoid payment in terms of reduced DAS due to the fishing power adjustment. The transfers of DAS should still be subjected to a mortality adjustment, however, to reduce the risks of overfishing and to prevent vessels that are not involved in stacking from being negatively impacted. As discussed in Section 1.4.3.2.3 above, without a mortality adjustment, landings could still increase if the transferred open area DAS are fished on a more efficient newer vessel with a better crew. In addition, the increased flexibility would allow the vessel owner or the captain to use the combined days more efficiently by adjusting the trip duration and by saving on the steam time as discussed in Section 1.4.3.2.3.1 above. Therefore, DAS transfers among the vessels within the same fishing power group would still reduce total DAS-used and trip expenses as a result on fishing on a better boat with a fewer DAS, although overall reduction in fleet DAS-used and trip costs would be less compared to the scenario where permits of smaller vessels are stacked on the larger boats. Similarly, the impacts on profits from stacking are still expected to be positive due to the savings in fixed costs.

- Yet, a less likely scenario is a transfer of DAS or permits from larger boats to less efficient vessels. Permit stacking from a more powerful vessel to a smaller vessel would probably not increase profits in the same extent because there would be no increase in the number DAS to compensate for the reduced efficiency, i.e., LPUE, of the smaller/older vessel. Thus, fishing the same number of days on a less efficient boat would lower the landings and revenues of the owner who stacked the permits on the smaller vessel. In addition, if all transfers of DAS are subject to a mortality adjustment, total DAS-used could decline and landings could decline further. On the other hand, the transfers of this nature may still be profitable if the savings in fixed costs and trip expenses outweigh the loss in revenues due to the decline in landings and revenues.

- Leasing alternatives would allow a vessel to lease part or all of its open area DAS allocation on an annual basis and lease any number of its access area trip allocations. Compared to leasing of a full permit, this option is more flexible because it allows smaller units of access to be leased compared to a full permit. Some individuals may only want to lease some access in order to make a full year, i.e. 20 DAS compared to a full DAS allocation and access area trips. This option may accommodate more individuals as business plans change during the year and/or equipment fails.

- The overall economic impacts of open area DAS and access area trip leasing will depend on how many vessels will resort to *leasing* rather than permit stacking, and on the extent of leasing, i.e., number of days or access area trips leased as well as on the cost of leasing. Leasing will provide flexibility for vessels to lease access area trips and open area DAS for an optimal level of operation and larger profits. Leasing of open area DAS or access area trips would take place in so far as it increases profits for the trading vessels after the costs of leasing are taken into account. A vessel would lease DAS or trips to another vessel only if the expected gain from leasing, that is, the value of lease exceeds the revenue it could obtain by fishing DAS itself net of trip, labor, and fixed costs. Similarly, a vessel would lease DAS or trips from another only if the expected revenue net of costs exceeds the value of the lease. For these reasons, leasing alternatives will provide an opportunity for the marginally efficient vessels to lease their allocations to more efficient vessels to maximize joint economic returns.

- As in the case of permit stacking, the fishing power and mortality adjustments are expected to prevent a vessel from increasing scallop landings by leasing DAS from another vessel. Thus, the scallop revenues that could be obtained from fishing with the leased days are estimated to be equal to the revenues that the lessor could derive from fishing these days. The same argument is valid for leasing the access area trips since the lessee will not be allowed to land any amount larger than the allocated scallop pounds and/or possession limit. Therefore, leasing could lead to an increase in profits of both lessor and the lessee only if the open area days or access area trips could be fished at lower costs on some vessels relative to others. The relative variable (trip) costs of fishing will depend, in turn, on the relative LPUE's and costs of the trading vessels. Leasing would also reduce the fixed costs of the lessee, including the expenses for maintenance, repairs, liability insurance and other operating costs. The savings in fixed costs will not be as large, however, as in the case of permit stacking since the vessel that is not fishing will still be maintained and incur some insurance costs. According to the estimates provided by some Scallop Industry members, keeping a vessel at the dock would cost about $25,000 a year even if that vessel is not used for fishing at all.

- Since the costs of leasing will be lower than buying a permit for stacking, some fishermen, especially single boat owners, may be able to benefit from such an option. For example, if two boat owners got together and combined the allocations and fished on one boat saving some fixed expenses on the other, they might be able to increase their overall profits. This could be done through leasing either with payment in cash or perhaps with a sharing arrangement of the catch.

- In the case of access area trips, the entire trip and associated possession limit for that trip would have to be leased as one unit. Leasing of access area trips could occur between permit types and gear types with certain restrictions. A vessel would not be permitted to combine access area trips, leading to lower the economic benefits since the vessels will not be able to save on the steaming time by combining trips. This alternative would not need a fishing power adjustment clause because access area trips are managed with a possession limit. There will be savings in trip costs, however, if access area trips are stacked on more efficient boats with more experienced crew.

- Presently, the limited access vessels would carry-over 10 days and the option to let the stacked permits to carry over 20 days are in line with the status quo. However, carrying over more DAS on the more efficient boat could increase landings in the next period if those carry-over DAS are used in the most productive season. Fishing power and mortality adjustments would reduce but not entirely eliminate this possibility since the adjustments are based on the annual average conditions and seasonal conditions could vary from this average. De-stacking of permits would allow more flexibility to vessels but are not expected to have positive impacts because the total fixed costs would increase when two permits are fished on two separate boats instead of one. The ownership cap of 5% of limited access permits (and/or allocations) and restrictions on leasing will limit further consolidation of the sea scallop fishery with uncertain economic but potentially beneficial social impacts.

Section 1.4.3.4 below describes the simulation model. Sections 1.4.3.4.1 and 1.4.3.4.2 provide a detailed analysis of open area DAS transfers on open area effort and landings using the fishing power and mortality adjustments as well as an analysis with stacking/leasing of both open area DAS and access area trip allocations. The actual economic costs and benefits will differ from the levels estimated using these methods since the transactions costs of combining effort or permits on fewer vessels are assumed to be zero. Because the emphasis is on the fleet-wide impacts, the cost of leasing or buying a permit is not taken into account since they are transfer payments from one vessel owner to another. These costs would impact the profits of the individual vessel owners, however. Also, the net profits after taking the opportunity costs of leasing or selling a permit would be lower even if the vessel owner, as in the case of a multi-boat owner, didn't make any payment for lease or the permit. The multiplier impacts of permit stacking on regional incomes and employment are analyzed in Section? using the IMPLAN model developed for the Sea Scallop Fishery. The distributional and social impacts of consolidation of the fishing activity in fewer boats through either permit-stacking or DAS are discussed in Section??, Social Impact Analysis.

Table 19 - Scenario 2: Permit-Stacking/DAS plus access area leasing – Change in landings, DAS-used, revenues and costs (Assuming $6.50 price per pound of scallops)

Scenario	Data	Total	% Change from Status Quo
Status quo (255 vessels)	Scallop landings	42,377,553	
	Scallop revenue	275,454,095	
	Trip costs	35,248,119	
	Fixed costs	64,608,838	
	Net crew income	113,878,537	
	Profits	60,333,271	
	Producer surplus	240,205,976	
Stacking/leasing Fishing Power adjustment (154 vessels)	Scallop landings	43,093,378	2%
	Scallop revenue	280,106,960	2%
	Trip costs	34,147,619	-3%
	Fixed costs	51,369,427	-14%
	Net crew income	117,785,317	3%
	Profits (Crew inc.increase)	75,948,347	26%
	Profits (Crew inc.same)	79,885,127	32%
	Producer Surplus*	245,959,340	2%
Stacking/leasing Fishing Power + 9% Mortality adjustment (154 vessels)	Scallop landings	42,358,350	0%
	Scallop revenue	275,329,274	0%
	Trip costs	33,433,911	-5%
	Fixed costs	55,679,696	-14%
	Net crew income	115,899,964	2%
	Profits (Crew inc.increase)	73,769,722	22%
	Profits (Crew inc.same)	75,791,148	26%
	Producer Surplus*	241,895,362	1%

* Producer surplus does not include the savings in fixed costs.

1.4.3.4 A Simulation Model for the Analysis of the Permit Stacking and Leasing Options

The impacts of the open area DAS and access area transfers on total scallop landings, revenues, crew income and profits with and without adjustments for fishing power and mortality are analyzed using the simulation techniques, the production model and the economic model described in Appendix?? As follows:

- In the first step, simulation model estimates technological production function, outputs its coefficients and then calculates average fishing power adjustment factors using these coefficients for the vessels grouped according to their HP and length. The estimation of the production model is based on a sample of limited access vessels that were active in the fishery from 2000 to the 2007 fishing years as described in Section 1.4.3.2.1.

- In the second step, a scenario analysis is constructed for DAS and access area transfers. For example, scenarios 1 and 2 described in the following sections assume that open area DAS and access area trips are stacked on more powerful vessels with a higher LPUE, while the second one assumes stacking assumes only within multi-boat owners. Adjustment factors and mortality adjustments are applied to estimate the open area DAS-used after stacking/leasing.
- The sample of vessels are expanded to include all the limited access dredge vessels that had a permit in 2007 fishing year, that is a total of 255 vessel. The scenarios are constructed using the biomass conditions, prices and costs that were experienced in 2007 fishing year.
- In the third step, production model is used to project landings with and without DAS transfers and adjustments for fishing power and mortality for each of the 255 vessels.
- Using an average price, revenues are estimated for each vessel in the fleet before and after stacking/leasing.
- The trip and fixed costs are estimated using the cost models presented in Appendix??.
- It is assumed that stacking and fishing two permits on one vessel will reduce the fixed costs by 33%. This is based on the input from the Scallop advisors that most fixed cost items, including insurance, maintenance, repairs, interest payments and other administrative costs will decline by 25% if the two permits are stacked on one vessel compared to total fixed costs from fishing two vessels separately. It is assumed that total improvement costs will decline by 50% since there will be only one vessel to improve. The average composition of fixed costs for the scallop and an example with stacking of two average permits on one vessel is shown in Table 20. This scenario results in a 33% decline in overall fixed costs if the two permits are stacked on one vessel and the same percentage is used in the scenario analyses presented in the following sections.

Finally, the impacts on profits and crew incomes are estimated as follows: The association fees, communication costs and a captain bonus of 5% are deducted from the gross stock to obtain the net stock. [6] Boat share is assumed to be 48% and the crew share is assumed to be 52% of the net stocks. Profits are estimated by deducting fixed costs from the boat share. Net crew income is estimated by deducting the trip costs from the crew shares.

[6] Association fees and communication costs are estimated to equal to $1,385,330 for the fleet of FT dredge vessels.

Table 20. Composition of fixed costs and reduction in fixed costs after stacking

Data	Annual Costs ($)	% of Total
Average improvement costs	77,158	31%
Average of repairs and maintenance	54,352	22%
Average interest payments	28,514	11%
Average hull and liability insurance	59,579	24%
Administrative and other costs	31,436	13%
Total fixed costs (average per vessel)	251,038	100%
Fixed cost for two vessels fishing separately		
Data	Annual Costs ($)	
Average improvement costs	154,317	
Average of repairs and maintenance	108,704	
Average interest payments	57,027	
Average hull and liability insurance	119,158	
Administrative and other costs	62,871	
Total fixed costs (average per vessel)	502,077	
After stacking: Fixed costs for the active vessel		
Data	Annual Costs ($)	Reduction from 2 vessels above
Average improvement costs	77,158	50%
Average of repairs and maintenance	81,528	25%
Average interest payments	42,770	25%
Average hull and liability insurance	89,368	25%
Administrative and other costs	47,153	25%
Total fixed costs (average per vessel)	337,978	33%

The impacts of potential effort transfers on costs and profits could also be estimated by using mathematical optimization techniques. This approach would use an optimization software, such as GAMS, to simulate a DAS or access area trip stacking or a leasing market. The objective of the model would be to maximize total industry profits subject to constraints on maximum DAS-use, on DAS transfers, or permit stacking, and subject to ACT by open and access areas. This model could include the production model, the costs equations and fishing power adjustment factors for transfers from a small to a larger vessel, a lease price per DAS or per access area trip, or a sale value for the permit in the case of permit stacking. A similar approach was used in the economic analysis of the leasing options for Multispecies Amendment 13, the shadow prices from the model indicating the value of the lease of DAS.

The application of the a similar model for the scallop permit stacking and/or DAS and access area trip options may not be as useful, however. The ownership structure of the scallop industry and the dominance of the multi-boat owners will probably have a major impact on the permit stacking among vessels. Because there will be no cash investment involved in stacking permits on vessels owned by the same person, the stacking will take place within those vessels even if the results of the optimization model indicated that permit stacking on another vessel would be more profitable. In addition, given that permit stacking is limited to 2 permits on one vessel, and leasing of DAS and access area trips are limited to the double of the allocation, it would be a straightforward conclusion that the profit maximization model (based on mathematical optimization techniques) would reduce the fleet size by half by transferring permits from the less efficient vessels to more powerful boats. This assumption is embedded in the scenario analyses shown below, along with another scenario that takes into account the ownership status of the vessels and the 13*13 matrix of fishing power adjustment for transfers of permits to vessels with different HP and length characteristics. Given that those scenarios with stacking/leasing show an increase in overall profits, the simulation model assumptions are probably not unrealistic and reflect a profit maximization behavior. Because the areas fished, where vessels land their fish, the transaction costs and other fisheries in which a vessel can participate are not taken into account, the actual stacking/leasing patterns can still differ from the results of a simulation as well as of a optimization model that does not take into account these factors.

Next sections describe the scenarios and present the results of the simulation model using various scenario analyses with permit stacking, including maximum stacking in the scallop fishery such that the number of vessels in the fishery is reduced by half (Scenario 1, Section 1.4.3.4.1), and another one involving stacking by the multi-vessel owners only (Scenario 2, Section 1.4.3.4.2) since no cash investment would be required to buy a permit or to lease DAS and access area trips from another owner. These scenario analyses are based on the assumption that vessel owners could gain from stacking two permits on one vessel. In fact, the results of the scenario analyses with stacking of permits on more powerful/efficient vessels indicate that owners could increase their profits significantly by doubling the open area DAS and access area trips on one boat by reducing their fixed costs and trip expenses. Another scenario would be to assume that permits are stacked on the vessels within the same HP-Length group to avoid paying for in terms of reduced DAS the fishing power adjustment. Yet, a less likely scenario is a transfer of DAS or permits from larger boats to less efficient vessels. The implications of these scenarios, and how the results obtained with maximum stacking or multi-vessel owner stacking are discussed in Section 1.4.3.4.3.

1.4.3.4.1 Scenario 1 – Maximum Stacking/DAS Leasing

Both scenarios 1 and 2 assume that open area DAS and access area trips are stacked on more powerful vessels with a higher LPUE. The extent of the increase in landings with and without fishing power and overall DAS adjustment is estimated using the following assumptions and the simulation model:

- The scenario analysis includes 255 full-time dredge vessels and do not include part-time or occasional vessels and full-time small dredge and trawl vessels. The results of the analysis are not expected to change significantly if it included all limited access vessels.
- Open area DAS allocations are assumed to be 51 days, similar to their values in 2007 fishing year. Similarly, 2007 fishing year biomass value is used to simulate the open area landings.
- Again, for the purpose of constructing a scenario which reflects the reality for the fishing year 2007, it is assumed that each full-time vessel is allocated 5 access area trips with 18,000 lb. possession limit.
- It was assumed that the largest vessels leased their DAS from the smallest vessels to magnify the differences between the LPUE of the buying and selling boats as specified in the following bullets.

    - Open area DAS is assumed to be transferred from 89 smaller full-time dredge vessels to 92 larger vessels. Specifically, it is assumed that the vessels with horse power less than 864 HP transferred their DAS to larger vessels with the exception of vessels in Group 8 (larger than 70 feet and with 720 to 863 HP, Table 21).
    - The 74 vessels in fishing power group-42 (720 to 863 HP and greater than 70 feet) is assumed to transfer their DAS to the other half of the vessels in the same group.
    - DAS for all vessels in the fishing power Group-41 and lower were set to zero.
- Finally, this scenario is constructed so that the DAS transferred do not exceed twice of the DAS-used of the leasing vessel, which is consistent with the Amendment 15 proposed alternative that limits leasing and stacking to double of the DAS allocation.

1.4.3.4.1.1 The impacts of stacking/leasing on DAS-used and landings in the open areas

The impacts of these DAS transfers on scallop landings are shown in Table 22 with and without adjustment. If DAS transfer takes place as a result of permit stacking, the number of full-time dredge boats would decline from 255 to 128 vessels in this scenario. The total transferred and used DAS after adjustments are shown in Table 21. In this scenario, about 6,426 days are transferred from smaller vessels and after adjustments 5,232 days of this could be used by the larger vessels that leased DAS. As a result, overall DAS-used would decline by 5.2% if only fishing power adjustment is applied and by 9.2% after adjusting both for fishing power and mortality. With both adjustments, open area DAS used would decline from 13,005 days to 11,811 days as a result of the stacking/leasing activity.

The transfer of DAS from small to large vessels without any adjustment is estimated to increase scallop landings by almost 11% (Table 22, Column 5). If the transferred DAS is adjusted only for the difference in fishing power using the adjustment factors in Table 8, total scallop landings would still increase by 4.1% (column 6). The results of the simulation model showed that a 9% adjustment is necessary to the transferred DAS after fishing power adjustment in order to prevent an increase in landings.

Applying a fishing power adjustment and a 9% overall DAS adjustment would keep the projected landings at almost pre-stacking/leasing levels according to the production model estimates (Column 7, Table 22). It should be cautioned, however, that the landings could increase more than 9% due to the factors that could not be fully taken into account with the production model as described above, including the quality of vessel platform and crew, changes in fishing patterns, other adjustments to vessel HP etc. that could increase vessel’s effectiveness and LPUE. Therefore, the overall DAS adjustment may need to be larger than 9% to prevent an increase in the fishing mortality with DAS leasing or permit stacking due to the factors that can not be captured by the production model.

Table 21 - Scenario 1: Permit-Stacking/Open Area DAS leasing - Total open area DAS-used before and after leasing with and without adjustment for fishing power (2007) and for 9% Overall DAS adjustment and (Assuming 51 DAS used)

Fishing Power Group	Open Area DAS-used before leasing **(Column 2)**	After Leasing				
		Number of vessels before leasing (Column 3)	**Number of active vessels after leasing (Column 4)**	**Unadjusted DAS (Column 4)**	**Leased DA (Adjusted for Fishing Power) (Column 5)**	**Leased DA (Adjusted for Fishing Power plus 9% reduction) (Column 6)**
11	255	5	-	-	-	-
12	459	9	-	-	-	-
21	255	5	-	-	-	-
22	1275	25	-	-	-	-
31	204	4	-	-	-	-
32	1887	37	-	-	-	-
41	204	4	-	-	-	-
42	3774	74	37	3,774	3,774	3604
51+52	1581	31	30	3,009	2887	2765
62	1938	38	38	3,876	3597	3448
72	612	12	12	1,224	1101	1057
82	561	11	11	1,122	971	934
Total	13,005	255	**128**	13,005	12,330	11,808
% Change					-5.2%	-9.2%

Table 22 - Scenario 1: Permit-Stacking/Open Area DAS leasing - Total open area landings before and after leasing with and without adjustment for fishing power (2007) and for 9% Overall DAS Adjustment and (Assuming 51 DAS used)

Fishing Power Group	Scallop landings by the group before leasing (Column 2)	Number of vessels before leasing (Column 3)	Number of active vessels after leasing (Column 4)	Scallop landings after leasing (No adjustment) (Column 5)	Scallop landings after leasing (after fishing power adjustment) (Column 6)	Scallop landings after leasing (after fishing power and 9% DAS adjustment) (Column 7)
11	316,390	5	-	-	-	-
12	594,822	9	-	-	-	-
21	338,438	5	-	-	-	-
22	1,726,915	25	-	-	-	-
31	280,614	4	-	-	-	-
32	2,674,737	37	-	-	-	-
41	293,775	4	-	-	-	-
42	5,638,776	74	37	5,921,595	5,921,595	5,636,769
51+52	2,450,393	31	31	4,896,418	4,684,370	4,472,526
62	3,119,789	38	38	6,552,532	6,048,988	5,780,563
72	1,017,275	12	12	2,136,595	1,907,715	1,826,184
82	975,629	11	11	2,049,126	1,755,629	1,684,283
Total	19,427,553	255	129	21,556,267	20,318,297	19,400,325
% Change				11.0%	4.6%	-0.1%

1.4.3.4.1.2 Open areas: Impacts on costs, revenues and producer surplus by fishing power group

Because the open area DAS is transferred to more efficient vessels that can land the same amount of scallops in less time and because the overall DAS-used is reduced as a result of fishing power and mortality adjustments, the overall trips costs will decline The reduction is trips would be about 1.8% after the fishing power adjustments and about 5.9% after applying both fishing power and mortality adjustments (Table 23). The decline in overall trips costs are less than the percentage decline in overall DAS-used because the simulation model takes into account the fact that larger boats have higher trip costs per DAS compared to the smaller boats.

Table 23 - Scenario 1: Permit-Stacking/Open Area DAS leasing - Total open area trip costs and revenues with and without adjustment for fishing power (2007) and for 9% Overall DAS Adjustment and (Assuming $6.50 price per pound of scallops)

Fishing Power Group	Total Trip costs for the group			Total Fixed Costs after Stacking*	
	Before leasing/ stacking (Column 2)	After leasing and power adjustment (Column 3)	After leasing, power and 9% mortality adjustment (Column 4)	Before leasing/ stacking (Column 5)	After leasing and power adjustment (Column 6)
11	302,426	-	-	709,487	-
12	698,563	-	-	1,711,839	-
21	342,973	-	-	865,672	-
22	2,049,318	-	-	4,845,922	-
31	284,599	-	-	727,268	-
32	3,003,394	-	-	9,325,271	-
41	332,583	-	-	637,368	-
42	6,333,746	6,333,746	6,048,728	17,216,888	11,449,230
51+52	2,632,256	4,827,953	4,623,706	8,902,785	11,601,426
62	3,385,294	6,283,333	6,022,510	11,261,032	14,977,172
72	1,055,788	1,899,517	1,823,581	4,243,160	5,643,402
82	955,006	1,653,209	1,590,371	4,162,148	5,535,656
Total	21,375,946	20,997,759	20,108,895	64,608,838	49,206,887
% Change		-1.8%	-5.9%		-24%

If the DAS transfers take place as a result of permit stacking, the fixed costs will decline as well. As indicated above, it is assumed that if an owner stacked its 2 permits on one boat, his/her fixed costs (incurred on both boats) will decline by 33%. Table 23 shows that overall fleet costs will decline by 24%, not by 33%, because the permits are stacked on larger boats with higher fixed costs. It is realistic to assume that a newer larger vessel would have a higher value, thus its hull insurance could be larger than a smaller and older boat. On the other hand, there may be fewer repairs needed on the newer better vessel, and the costs may decline by more than 33%. If that is the case, overall decline in fixed costs would decline and profits increase more than shown in those Tables.

It is also assumed that the vessels that are stacked from are either scrapped or sold so that they do not have any fixed costs for the owner after stacking, and the reduction in fixed costs would be less if the costs of scraping or keeping the vessel at the dock until it is sold is taken into account. In the case of DAS leasing, the fixed costs would either stay the same or decline much less as will be discussed in Section 1.4.3.4.3 below. The fixed costs show the changes for all areas, whereas, the trip costs are estimated for the open area fishing only, later to be combined with the trip costs for fishing in the access areas.

If the fishing power and mortality adjustments are successful in keeping the landings at the same level, there would be no change in revenues after permit stacking/DAS leasing and the overall producer surplus would increase slightly by 1% due to the decline in the trip costs (Table 24).

Table 24 - Scenario 1: Permit-Stacking/Open Area DAS leasing - Total open area trip costs and revenues with and without adjustment for fishing power (2007) and for 9% Overall DAS Adjustment and (Assuming $6.50 price per pound of scallops)

Fishing Power Group	Total Scallop Revenue for the group			Total Producer Surplus*		
	Before leasing/ stacking (Column 2)	After leasing and power adjustment (Column 3)	After leasing, power and 9% mortality adjustment (Column 4)	Before leasing/ stacking (Column 5)	After leasing and power adjustment (Column 6)	After leasing, power and 9% mortality adjustment (Column 7)
11	2,056,536	-	-	1,754,111	-	-
12	3,866,345	-	-	3,167,781	-	-
21	2,199,850	-	-	1,856,877	-	-
22	11,224,945	-	-	9,175,627	-	-
31	1,823,990	-	-	1,539,392	-	-
32	17,385,792	-	-	14,382,398	-	-
41	1,909,539	-	-	1,576,956	-	-
42	36,652,041	38,490,371	36,639,001	30,318,294	32,156,624	30,590,273
51+52	15,927,552	30,448,402	29,071,417	13,295,296	25,620,449	24,447,712
62	20,278,629	39,318,421	37,573,659	16,893,335	33,035,088	31,551,149
72	6,612,286	12,400,149	11,870,197	5,556,499	10,500,633	10,046,615
82	6,341,589	11,411,588	10,947,841	5,386,583	9,758,379	9,357,471
Total	126,279,095	132,068,932	126,102,114	104,903,149	111,071,173	105,993,219
% Change		4.6%	-0.1%		6%	1%

Table 25 - Scenario 1: Open Area DAS leasing – Change in landings, DAS-used, revenues and costs (Assuming $6.50 price per pound of scallops)

Scenario	Data	Total	% Change from Status Quo
Status quo	Number of active vessels	255	
	DAS used	13,005	
	Scallop landings	19,427,553	
	Scallop revenue	126,279,095	
	Trip costs	21,375,946	
	Fixed costs	64,608,838	
	Producer surplus	104,903,149	
	Total number of crew	1,083	
Stacking/leasing Fishing Power adjustment	Number of vessels	126	-49%
	DAS used	12,330	-5%
	Scallop landings	20,318,297	5%
	Scallop revenue	132,068,932	5%
	Trip costs	20,997,759	-2%
	Fixed costs	49,206,887	-24%
	Producer surplus	111,071,173	6%
	Total number of crew	867	-20%
Stacking/leasing Fishing Power + 9% Mortality adjustment	Number of vessels	128	-49%
	DAS used	11,808	-9%
	Scallop landings	19,400,325	0%
	Scallop revenue	126,102,114	0%
	Trip costs	20,108,895	-6%
	Fixed costs	49,206,887	-24%
	Producer surplus	105,993,219	1%
	Total number of crew	867	-20%

1.4.3.4.1.3 The impact of DAS transfers on future revenues without adjustment for fishing power or mortality

Table 26 provides a straightforward analysis of the consequences of the DAS transfers in the absence of fishing power or DAS adjustments. If no adjustments were made and landings increased by 11%, the DAS allocations may have to be reduced during the next management cycle to prevent fishing mortality exceeding target levels. In order to provide a rough estimate of the impacts, it is assumed that it would be necessary to reduce DAS allocations in the same proportion as the increase in landings. Assuming a 51 days-at-sea allocation, an 11% reduction in allocation would reduce DAS by 5.6 days for all vessels in the fleet whether or not they have engaged in DAS leasing or permit stacking. Assuming an average LPUE of 1585 lb. per DAS and a price of $7.0 per pound of scallops, this reduction in DAS allocations could reduce the open area scallop revenue by $62,243 per vessel. If adjustment was made for fishing power but not for DAS, the reduction in allocations in the next period would be 4.1% and the reduction in average scallop revenue per vessel would be $23,200.

Actual impacts will be less or more than these amounts depending on the overall scallop biomass in the open and access areas, the fishing mortality targets and the extent of the adjustment in DAS allocations that would be necessary to keep landings at sustainable levels after stacking/DAS leasing. If the DAS is transferred to newer boats and if the LPUE and fishing mortality increase even after the fishing power and mortality adjustments, the revenues of the boats that are not involved in stacking/open area leasing would decline by a larger amount than shown in Table 26 above, whereas the revenues of the vessels would increase more than shown in Table…. On the other hand, if the mortality adjustment exceeds the actual increase in efficiency, there would a decline in fishing mortality in the period the stacking takes place. As a result, if the open area DAS allocations are increased in the next period for all vessels, the vessels that were not involved in stacking/leasing would also reap the benefits of a reduced fleet size.

Table 26 - Scenario 1: The estimated decline in open area DAS, Scallop Landings and Revenue with adjustment of DAS allocations in the next management period (assuming a base open area DAS of 51 days, average LPUE of 1585 lb. per day and scallop price of $7 per lb.)

DAS adjustment Scenarios	Adjustment in Open Area DAS	Reduction in DAS Allocations per FT vessel	Reduction in Scallop landings per vessel	Reduction in Scallop Revenue per vessel
No adjustment	11.0%	5.6 days	8,892	$62,243
Fishing power adjustment only (No DAS Adjustment)	4.1%	2.1 days	3,314	$23,200

1.4.3.4.1.4 Economic impacts of permit stacking: Scenario 1

Scenarios 1 and 2 are constructed using the biomass conditions, prices and costs that were experienced in 2007 fishing year. As in the 2007 fishing year, it was assumed that each vessel would get open area allocation equal to 51 days and 5 access area trips with an 18,000 possession limit. Under the status quo conditions, total landings of these vessels would be 42.3 million pounds and the total revenues from scallops would equal to $275 million, which is close to the actual numbers materialized in 2007 fishing year by the FT dredge vessels. Trip and fixed costs are estimated using the cost models presented in Appendix?? The association fees, communication costs and a captain bonus of 5% are deducted from the gross stock to obtain the net stock. Boat share is assumed to be 48% and the crew share is assumed to be 52% of the net stock. Profits are estimated by deducting fixed costs from the boat share. Net crew income is estimated by deducting the trip costs from the crew shares. The economic impacts of stacking/leasing on landings, revenues, costs, profits and crew incomes are shown in Table 27 to Table 31 by vessel HP-length groups and summarized in Table 32 below for the overall fleet.

Table 27 - Scenario 1: Permit-Stacking/ DAS and access area trip leasing - Total landings from all areas before and after leasing with and without adjustment for fishing power (2007) and for 9% Overall DAS Adjustment and (Assuming 51 DAS used, and 5 access area trips at 18,000lb. possession limit)

Fishing Power Group	Scallop landings by the group before stacking /leasing (Column 2)	Number of vessels before leasing (Column 3)	Number of active vessels after leasing (Column 4)	Scallop landings after stacking/ leasing (No adjustment) (Column 5)	Scallop landings after stacking/ leasing (after fishing power adjustment) (Column 6)	Scallop landings after stacking/ leasing (after fishing power and 9% DAS adjustment) (Column 7)
11	766,390	5	-	-	-	-
12	1,404,822	9	-	-	-	-
21	788,438	5	-	-	-	-
22	3,976,915	25	-	-	-	-
31	640,614	4	-	-	-	-
32	6,004,737	37	-	-	-	-
41	653,775	4	-	-	-	-
42	12,298,776	74	37	12,581,595	12,581,595	12,296,769
51+52	5,240,393	31	31	10,476,418	10,264,370	10,052,526
62	6,539,789	38	38	13,392,532	12,888,988	12,620,563
72	2,097,275	12	12	4,296,595	4,067,715	3,986,184
82	1,965,629	11	11	4,029,126	3,735,629	3,664,283
Total	42,377,553	255	128	44,776,267	43,538,297	42,620,325
% Change				6%	3%	0.6%

Table 28 - Scenario 1: Permit-Stacking/ DAS and access area trip leasing - Total revenue from all areas before and after leasing with and without adjustment for fishing power (2007) and for 9% Overall DAS Adjustment and (Assuming 51 DAS used, and 5 access area trips at 18,000lb. possession limit)

Fishing Power Group	Number of vessels (Column 2)	Total Scallop revenue before stacking/ leasing (No adjustment)	Total Scallop revenue after stacking/ leasing (after fishing power adjustment)	Total Scallop revenue after stacking/ leasing (after fishing power and 9% DAS adjustment)	Scallop revenue per vessel before stacking/ leasing	Scallop revenue per vessel after stacking/ leasing (after fishing power and 9% DAS adjustment)
11	5	4,981,536	-	-	996,307	-
12	9	9,131,345	-	-	1,014,594	-
21	5	5,124,850	-	-	1,024,970	-
22	25	25,849,945	-	-	1,033,998	-
31	4	4,163,990	-	-	1,040,998	-
32	37	39,030,792	-	-	1,054,886	-
41	4	4,249,539	-	-	1,062,385	-
42*	74*	79,942,041	81,780,371	79,929,001	1,080,298	2,160,244
51+52	31	34,062,552	65,548,402	64,171,417	1,098,792	2,070,046
62	38	42,508,629	83,778,421	82,033,659	1,118,648	2,158,780
72	12	13,632,286	26,440,149	25,910,197	1,136,024	2,159,183
82	11	12,776,589	24,281,588	23,817,841	1,161,508	2,165,258
Total	255	275,454,095	281,828,932	275,862,114		-
% Change			2%	0.15%		

Note: After stacking it is assumed that 37 vessel will remain to be active in fishing power group 42.

Table 29 - Scenario 1: Permit-Stacking/ DAS and access area trip leasing – Trip and fixed costs before and after /stacking leasing with and without adjustment for fishing power (2007) and for 9% Overall DAS Adjustment and (Assuming 51 DAS used, and 5 access area trips at 18,000lb. possession limit)

Fishing Power Group	Number of vessels (Column 2)	Total trip costs before stacking/ leasing (No adjustment)	Total Trip costs after stacking/ leasing (after fishing power adjustment)	Total trip costs after stacking/ leasing (after fishing power and 9% DAS adjustment)	Total fixed costs before stacking/ leasing	Total fixed costs after stacking/ leasing
11	5	532,366	-	-	709,487	-
12	9	1,229,696	-	-	1,711,839	-
21	5	603,743	-	-	865,672	-
22	25	3,607,458	-	-	4,845,922	-
31	4	469,040	-	-	727,268	-
32	37	4,949,816	-	-	9,325,271	-
41	4	548,122	-	-	637,368	-
42*	74*	10,431,880	10,236,731	9,951,712	17,216,888	11,449,230
51+52	31	4,263,933	7,796,398	7,592,150	8,902,785	11,601,426
62	38	5,402,872	10,126,339	9,865,516	11,261,032	14,977,172
72	12	1,685,019	3,098,053	3,022,117	4,243,160	5,643,402
82	11	1,524,174	2,737,338	2,674,499	4,162,148	5,535,656
Total	255	35,248,119	33,994,859	33,105,995	64,608,838	49,206,887
% Change			-4%	-6%		-24%

Note: After stacking it is assumed that 37 vessel will remain to be active in fishing power group 42.

Table 30 - Scenario 1: Permit-Stacking/ DAS and access area trip leasing – Net crew income before and after /stacking leasing with and without adjustment for fishing power (2007) and for 9% Overall DAS Adjustment and (Assuming 51 DAS used, and 5 access area trips at 18,000lb. possession limit)

Fishing Power Group	Number of vessels (Column 2)	Net crew income before stacking/ leasing (No adjustment)	Net crew income after stacking/ leasing (after fishing power adjustment)	Net crew income after stacking/ leasing (after fishing power and 9% DAS adjustment)
11	5	2,165,515	-	-
12	9	3,714,784	-	-
21	5	2,172,101	-	-
22	25	10,392,065	-	-
31	4	1,786,512	-	-
32	37	16,180,590	-	-
41	4	1,753,968	-	-
42	74	32,844,474	34,145,733	33,423,606
51+52	31	14,174,526	27,454,539	26,909,707
62	38	17,606,542	35,333,842	34,645,515
72	12	5,694,540	11,248,984	11,036,625
82	11	5,392,920	10,438,476	10,249,036
Total	255	113,878,537	118,621,574	116,264,489
% Change			4.2%	2.1%

Table 31 – Scenario 1: Profits before and after /stacking leasing with and without adjustment for fishing power (2007) and for 9% Overall DAS Adjustment and (Assuming 51 DAS used, and 5 access area trips at 18,000lb. possession limit)

Fishing Power Group	Number of vessels (Column 2)	Profits before stacking/ leasing (No adjustment)	Profits after stacking/ leasing (after fishing power adjustment)	Profits after stacking/ leasing (after fishing power and 9% DAS adjustment)
11	5	1,550,948	-	-
12	9	2,430,850	-	-
21	5	1,460,114	-	-
22	25	6,883,640	-	-
31	4	1,162,595	-	-
32	37	8,378,298	-	-
41	4	1,291,505	-	-
42	74	19,040,883	25,744,719	24,900,494
51+52	31	6,545,214	17,939,589	17,311,684
62	38	8,016,491	23,119,376	22,323,764
72	12	1,939,559	6,379,702	6,138,044
82	11	1,633,173	5,505,944	5,294,476
Total	255	60,333,271	78,689,331	75,968,462
% Change			30.4%	25.9%

Note that if all the increase in crew income actually goes to profits by a change in lay system, that the total profits would go up to $78,769,345, which would a 31% increase in profits.

Table 32 - Scenario 1: Permit-Stacking/DAS plus access area leasing – Change in landings, DAS-used, revenues and costs (Assuming $6.50 price per pound of scallops)

Scenario	Data	Total	% Change from Status Quo
Status quo (255 vessels)	Scallop landings	42,377,553	
	Scallop revenue	275,454,095	
	Trip costs	35,248,119	
	Fixed costs	64,608,838	
	Net crew income	113,878,537	
	Profits	60,333,271	
	Producer surplus	240,205,976	
Stacking/leasing Fishing Power adjustment (128 vessels)	Scallop landings	43,268,297	2%
	Scallop revenue	281,243,932	2%
	Trip costs	33,994,859	-4%
	Fixed costs	49,206,887	-24%
	Net crew income	118,621,574	4%
	Profits (Crew inc.increase)	78,689,331	30%
	Profits (Crew inc.same)	83,432,367	38%
	Producer Surplus*	247,249,073	3%
Stacking/leasing Fishing Power + 9% Mortality adjustment (128 vessels)	Scallop landings	42,350,325	0%
	Scallop revenue	275,277,114	0%
	Trip costs	33,105,995	-6%
	Fixed costs	49,206,887	-24%
	Net crew income	116,264,489	2%
	Profits (Crew inc.increase)	75,968,462	26%
	Profits (Crew inc.same)	78,354,414	30%
	Producer Surplus*	242,171,119	1%

*Does not include the savings in fixed costs.

1.4.3.4.2 Scenario 2 –Multi-vessel owner stacking/DAS leasing

This scenario assumes that permit stacking happens only among the multi-boat owners and single boat owners do not engage in any DAS leasing or permit stacking. In order to estimate extent of this increase in landings with and without adjustment for the fishing power and overall LPUE increase, this scenario analysis is conducted by transferring open area DAS from the smaller vessels to larger vessels of the multi-boat owners. Same assumptions used in Scenario 1 regarding the DAS allocations and biomass are also used in this scenario.

The impacts of these DAS transfers on scallop landings and the fleet size are summarized in Table 33 by ownership type. Table 34 shows the results by HP and length group. Without any adjustment, transfer of DAS from small to large vessels would result in an increase of scallop landings by 9% because the landings by multi-boat owners constitute about 80% of the scallop landings by full-time dredge vessels (Column 5). If the transferred DAS is adjusted only for the difference in fishing power using the adjustment factors in Table 8, total scallop landings would still increase by 5% (Column 6). Applying a fishing power and a 9% DAS adjustment would keep the projected landings at almost pre-leasing levels (Column 7). It should be cautioned, however, that the landings could increase more than 9% due to the factors that could not be fully taken into account with the production model as described above, including the quality of vessel platform and crew, changes in fishing patterns, other adjustments to vessel HP etc. that could increase vessel's effectiveness and LPUE. Therefore, the overall DAS adjustment may need to be larger than 9% to prevent an increase in the fishing mortality with DAS leasing or permit stacking.

The potential impacts of these transfers on open area DAS allocations with adjustments are shown in Table 35. Again, if no adjustment is made and landings increased by 9%, DAS allocations might have to reduced during the next management cycle to prevent fishing mortality exceeding sustainable levels. Assuming a 51 days-at-sea allocation, LPUE of 1585 lb. per DAS, a 9% reduction in allocation could reduce open area scallop revenue by $50,926. If adjustment was made for fishing power but not for DAS, the reduction in allocations in the next period would be about 4% and the reduction in average scallop revenue per vessel would be $22,634. Again, actual impacts will be less or more than these amounts depending on the overall scallop biomass in the open and access areas, the fishing mortality targets and the extent of the adjustment in DAS allocations that would be necessary to keep landings at sustainable levels after stacking/DAS leasing.

Table 33. Scenario 2: Permit-Stacking/Open Area DAS leasing by Multiple boat owners only (Including only FT Dredge vessels, assuming 51 DAS allocation, 2007 resource biomass and using Cobb-Douglas Production Function Estimates)

Data	Multiple Owners	Single Owners	Unknown	Grand Total
Number of vessels before stacking	202	46	7	255
Number of vessels after stacking	101	46	7	154
Estimated DAS-used before stacking	10,302	2,346	357	13,005
Adjusted DAS-used after stacking	9,790	2,346	357	12,493
Adjusted DAS-used after fishing power and DAS adjustment	9,370	2,346	357	12,073
Percentage Change in DAS-used	-9%	0%	0%	-7%
Estimated landings before stacking	15,353,965	3,561,720	511,868	19,427,553
Estimated landings after stacking with no adjustment	17,006,920	3,561,720	511,868	21,080,508
Percentage Change in landings	11%	0%	0%	9%
Estimated landings after stacking with fishing power adjustment	16,069,791	3,561,720	511,868	20,143,378
Percentage Change in landings	5%	0%	0%	4%
Estimated landings after stacking with fishing power adjustment and DAS adj.	15,334,762	3,561,720	511,868	19,408,350
Percentage Change in landings	-0.2%	0.0%	0.0%	-0.1%

Table 34. Scenario 2: Permit-Stacking/Open Area DAS leasing among multi-boat owners - Total open area landings before and after leasing by *multi-boat owners* with and without adjustment for fishing power (2007) and for 9% Overall DAS adjustment and (Assuming 51 DAS used)

Fishing Power Group	Scallop landings by the group before leasing (Column 2)	Number of vessels before leasing (Column 3)	Number of active vessels after leasing (Column 4)	Scallop landings after leasing (No adjustment) (Column 5)	Scallop landings after leasing (after fishing power adjustment) (Column 6)	Scallop landings after leasing (after fishing power and 10% DAS adjustment) (Column 7)
11	253,206	4	-	-	-	-
12	397,703	6	-	-	-	-
21	271,153	4	-	-	-	-
22	1,312,161	19	-	-	-	-
31	280,614	4	-	-	-	-
32	2,459,371	34	-	-	-	-
41	148,622	2	2	312,153	309,530	289,127
42	4,726,387	62	32	5,044,080	4,882,810	4,716,767
51+52	1,898,360	24	24	4,076,145	4,040,397	3,690,113
62	2,303,951	28	28	4,839,018	4,455,495	4,293,187
72	504,293	6	6	1,059,173	945,031	921,313
82	798,144	9	9	1,676,351	1,436,527	1,419,076
Total	15,353,965	202	101	17,006,920	16,069,791	15,329,583
% Change				11%	5%	-0.2%

Table 35 - Scenario 2: The estimated decline in open area DAS, Scallop Landings and Revenue with adjustment of DAS allocations in the next management period (assuming a base open area DAS of 51 days, average LPUE of 1585 lb. per day and scallop price of $7 per lb.)

DAS adjustment Scenarios	Adjustment in Open Area DAS	Reduction in DAS Allocations per FT vessel	Reduction in Scallop landings per vessel	Reduction in Scallop Revenue per vessel
No adjustment	9%	4.6	7,275	50,926
Fishing power adjustment only (No DAS Adjustment)	4%	2.0	3,233	22,634

1.4.3.4.2.1 Overall impacts on revenues and costs - Scenario 2 – Multi-vessel Owner Stacking/DAS Leasing

As in Scenario 1, it was assumed that each vessel would get open area allocation equal to 51 days and 5 access area trips with an 18,000 possession limit. Trip and fixed costs are estimated using the cost models presented in Appendix?? The association fees, communication costs and a captain bonus of 5% are deducted from the gross stock to obtain the net stock. Boat share is assumed to be 48% and the crew share is assumed to be 52% of the net stock. Profits are estimated by deducting fixed costs from the boat share. Net crew income is estimated by deducting the trip costs from the crew shares. The economic impacts on revenues, costs, profits and crew incomes are shown in to by vessel HP-length groups and summarized in below for the overall fleet.

1.4.3.4.2.2 Impacts on costs, revenues and producer surplus by fishing power group

Table 36 - Scenario 2: Permit-Stacking/Open Area DAS leasing - Total open area trip costs and revenues with and without adjustment for fishing power (2007) and for 9% Overall DAS Adjustment and (Assuming $6.50 price per pound of scallops)

Fishing Power Group	Total Trip costs for the group			Total Fixed Costs after Stacking*	
	Before leasing/ stacking (Column 2)	After leasing and power adjustment (Column 3)	After leasing, power and 9% mortality adjustment (Column 4)	Before leasing/ stacking (Column 5)	After leasing and power adjustment (Column 6)
11	302,426	57,610	57,610	709,487	157,991
12	698,563	228,170	228,170	1,711,839	627,066
21	342,973	61,791	61,791	865,672	219,011
22	2,049,318	493,752	493,752	4,845,922	1,053,765
31	284,599	-	-	727,268	-
32	3,003,394	232,175	232,175	9,325,271	574,115
41	332,583	507,608	491,856	637,368	746,510
42	6,333,746	6,333,746	6,099,214	17,216,888	12,398,989
51+52	2,632,256	4,642,974	4,462,010	8,902,785	11,341,592
62	3,385,294	5,520,343	5,328,189	11,261,032	14,081,495
72	1,055,788	1,484,277	1,445,713	4,243,160	4,886,864
82	955,006	1,529,892	1,478,152	4,162,148	5,282,029
Total	21,375,946	21,092,338	20,378,630	64,608,838	51,369,427
% Change		-1%	-5%		-20%

* It's assumed that the vessels that are stacked from are either scrapped or sold so that they do not have any fixed costs for the owner after stacking. In the case of DAS leasing, the fixed costs would either stay the same or decline much less.

Table 37 - Scenario 2: Permit-Stacking/Open Area DAS leasing - Total open area trip costs and revenues with and without adjustment for fishing power (2007) and for 9% Overall DAS Adjustment and (Assuming $6.50 price per pound of scallops)

Fishing Power Group	Total Scallop Revenue for the group			Total Producer Surplus*		
	Before leasing/ stacking (Column 2)	After leasing and power adjustment (Column 3)	After leasing, power and 9% mortality adjustment (Column 4)	Before leasing/ stacking (Column 5)	After leasing and power adjustment (Column 6)	After leasing, power and 9% mortality adjustment (Column 7)
11	2,056,536			1,754,111		
12	3,866,345			3,167,781		
21	2,199,850			1,856,877		
22	11,224,945			9,175,627		
31	1,823,990			1,539,392		
32	17,385,792			14,382,398		
41	1,909,539			1,576,956		
42	36,652,041			30,318,294		
51+52	15,927,552			13,295,296		
62	20,278,629			16,893,335		
72	6,612,286			5,556,499		
82	6,341,589			5,386,583		
Total	126,279,095			104,903,149		
% Change						

1.4.3.4.2.3 Overall economic impacts: Scenario 2 - Multi-boat Owner Stacking/DAS and Access area trip leasing

As in Scenario 1, it was assumed that each vessel would get open area allocation equal to 51 days and 5 access area trips with an 18,000 possession limit. Trip and fixed costs are estimated using the cost models presented in Appendix?? The association fees, communication costs and a captain bonus of 5% are deducted from the gross stock to obtain the net stock. Boat share is assumed to be 48% and the crew share is assumed to be 52% of the net stock. Profits are estimated by deducting fixed costs from the boat share. Net crew income is estimated by deducting the trip costs from the crew shares. The economic impacts on revenues, costs, profits and crew incomes are summarized in Table 38 below for the overall fleet and in Table 39 for the multi-boat owners only.

Table 38 - Scenario 2: Permit-Stacking/DAS plus access area leasing – Change in landings, DAS-used, revenues and costs (Assuming $6.50 price per pound of scallops)

Scenario	Data	Total	% Change from Status Quo
Status quo (255 vessels)	Scallop landings	42,377,553	
	Scallop revenue	275,454,095	
	Trip costs	35,248,119	
	Fixed costs	64,608,838	
	Net crew income	113,878,537	
	Profits	60,333,271	
	Producer surplus	240,205,976	
Stacking/leasing Fishing Power adjustment (154 vessels)	Scallop landings	43,093,378	2%
	Scallop revenue	280,106,960	2%
	Trip costs	34,147,619	-3%
	Fixed costs	51,369,427	-14%
	Net crew income	117,785,317	3%
	Profits (Crew inc.increase)	75,948,347	26%
	Profits (Crew inc.same)	79,885,127	32%
	Producer Surplus*	245,959,340	2%
Stacking/leasing Fishing Power + 9% Mortality adjustment (128 vessels)	Scallop landings	42,358,350	0%
	Scallop revenue	275,329,274	0%
	Trip costs	33,433,911	-5%
	Fixed costs	55,679,696	-14%
	Net crew income	115,899,964	2%
	Profits (Crew inc.increase)	73,769,722	22%
	Profits (Crew inc.same)	75,791,148	26%
	Producer Surplus*	241,895,362	1%

*Producer surplus does not include the savings in fixed costs.

Table 39 - Scenario 2: MULTI-Boat owners only - Permit-Stacking/DAS plus access area leasing – Change in landings, DAS-used, revenues and costs (Assuming $6.50 price per pound of scallops)

Scenario	Data	Total	% Change from Status Quo
(202 vessels)	Scallop revenue	217,970,774	
Status quo	Trip costs	27,939,472	
	Fixed costs	51,547,419	
	Net crew income	90,065,286	
	Profits	47,319,860	
Fishing Power adjustment	Scallop revenue	222,623,639	2%
(101 vessels)	Trip costs	26,975,826	-3%
	Fixed costs	38,308,008	-25%
	Net crew income	93,835,212	4%
	Profits (Crew inc.increase)	62,934,936	33%
	Profits (Crew inc.same)	66,704,862	41%
Fishing Power + 9% Mortality adjustment	Scallop revenue	217,845,953	0%
(101 vessels)	Trip costs	26,262,118	-6%
	Fixed costs	38,308,008	-25%
	Net crew income	91,949,859	2%
	Profits (Crew inc.increase)	60,756,311	28%
	Profits (Crew inc.same)	62,640,884	32%

1.4.3.4.3 Other Scenarios with stacking/leasing

Both scenarios presented above assumed that open area DAS and access area trips are stacked on more powerful vessels with a higher LPUE. There is no question that some vessel owners might transfer DAS and trips on a vessel with a similar size, not incurring any adjustment for fishing power differential, but would still be subject to a mortality adjustment if that is included as a proposed option. Without a mortality adjustment, the landings could still increase if the transferred open area DAS are fished using a newer vessel with a better crew even if that vessel has the same HP and length characteristics. In addition, the increased flexibility would allow the vessel owner or the captain to use the combined days more efficiently by adjusting the trip duration and saving on the steam time as discussed in Section 1.4.3.2.3.1 above. Therefore, for DAS transfers among the vessels in the same fishing power groups, the total reduction in total DAS-used and would be the savings in trip expenses would be smaller. Overall, the impacts on profits from stacking are still expected to be positive due to the savings in fixed costs.

Yet, a less likely scenario is a transfer of DAS or permits from larger boats to less efficient vessels. Permit stacking from a more powerful vessel to a smaller vessel would probably not increase profits in the same extent because there would be no increase in the number DAS to compensate for the reduced efficiency, i.e., LPUE, of the smaller/older vessel. Thus, fishing the same number of days on a less efficient boat would lower the landings and revenues of the owner who stacked the permits on the smaller vessel. In addition, if all transfers of DAS are subject to a mortality adjustment, total DAS-used could decline and landings could decline further. On the other hand, the transfers of this nature may still be profitable if the savings in fixed costs and trip expenses outweigh the loss in revenues due to the decline in landings and revenues.

1.4.3.4.4 Impacts of leasing alternatives

Although the results of the analyses are discussed in terms of permit stacking, similar conclusions would be valid for the impacts of leasing alternatives, including the fishing power and mortality adjustment with some qualifications. In the case of leasing, the saving in the fixed costs would be lower than compared with stacking options, but leasing will provide some additional flexibility to some vessels with positive economic impacts as summarized below:

- Leasing alternatives would allow a vessel to lease part or all of its open area DAS allocation on an annual basis and lease any number of its access area trip allocations. Compared to leasing of a full permit, this option is more flexible because it allows smaller units of access to be leased compared to a full permit. Some individuals may only want to lease some access in order to make a full year, i.e. 20 DAS compared to a full DAS allocation and access area trips. This option may accommodate more individuals as business plans change during the year and/or equipment fails.

- The overall economic impacts of open area DAS and access area trip leasing will depend on how many vessels will resort to *leasing* rather than permit stacking, and on the extent of leasing, i.e., number of days or access area trips leased as well as on the cost of leasing. Leasing will provide flexibility for vessels to lease access area trips and open area DAS for an optimal level of operation and larger profits. Leasing of open area DAS or access area trips would take place in so far as it increases profits for the trading vessels after the costs of leasing are taken into account. A vessel would lease DAS or trips to another vessel only if the expected gain from leasing, that is, the value of lease exceeds the revenue it could obtain by fishing DAS itself net of trip, labor, and fixed costs. Similarly, a vessel would lease DAS or trips from another only if the expected revenue net of costs exceeds the value of the lease. For these reasons, leasing alternatives will provide an opportunity for the marginally efficient vessels to lease their allocations to more efficient vessels to maximize joint economic returns.

- As in the case of permit stacking, the fishing power and mortality adjustments are expected to prevent a vessel from increasing scallop landings by leasing DAS from another vessel. Thus, the scallop revenues that could be obtained from fishing with the leased days are estimated to be equal to the revenues that the lessor could derive from fishing these days. The same argument is valid for leasing the access area trips since the lessee will not be allowed to land any amount larger than the allocated scallop pounds and/or possession limit. Therefore, leasing could lead to an increase in profits of both lessor and the lessee only if the open area days or access area trips could be fished at lower costs on some vessels relative to others. The relative variable (trip) costs of fishing will depend, in turn, on the relative LPUE's and costs of the trading vessels. Leasing would also reduce the fixed costs of the lessee, including the expenses for maintenance, repairs, liability insurance and other operating costs. The savings in fixed costs will not be as large, however, as in the case of permit stacking since the vessel that is not fishing will still be maintained and incur some insurance costs. According to the estimates provided by some Scallop Industry members, keeping a vessel at the dock would cost about $25,000 a year even if that vessel is not used for fishing at all.

- Since the costs of leasing will be lower than buying a permit for stacking, some fishermen, especially single boat owners, may be able to benefit from such an option. In this respect, it would be useful to distinguish leasing, i.e, transferring DAS or trips, from one vessel to another of a multi-boat owner that will not incur a cash payment for this transfer from leasing by single-boat owners who would be required to pay for the lease. Leasing would allow two single boat owners to get together and combine and fish their allocations on one boat saving some fixed expenses on the other. As a result, these two vessels may be able to increase their overall profits depending on the differences in LPUE and their relative fishing costs. This could be done through leasing either with payment in cash or perhaps with a sharing arrangement of the catch.

- In the case of access area trips, the entire trip and associated possession limit for that trip would have to be leased as one unit. Leasing of access area trips could occur between permit types and gear types with certain restrictions. A vessel would not be permitted to combine access area trips, leading to lower the economic benefits since the vessels will not be able to save on the steaming time by combining trips. This alternative would not need a fishing power adjustment clause because access area trips are managed with a possession limit. There will be savings in trip costs, however, if access area trips are stacked on more efficient boats with more experienced crew.

1.4.4 Measures to adjust specific aspects of FMP to make overall program more effective

1.4.4.1 Measures to adjust the current overfishing definition (OFD) to be more compatible with area rotation

The modified overfishing definition is designed to maximize scallop yield and increase flexibility for setting annual fishing mortality targets to meet area rotation objectives. Overall, three alternatives are considered in this section: the No Action (existing definition), the spatial/time averaged alternative (slightly modified version of the OFD that was proposed and not selected in Amendment 10), and a hybrid alternative (uses the threshold from No Action and the target from Amendment 10). Under the no-action alternative, the OFD will remain the same, which spatially averages the fishing mortality estimate over the resource as a whole. The A10-modified definition had favorable characteristics like reducing potential impacts on bycatch and habitat by reducing area swept, increasing catch by 10% with larger average scallop size, and in the long-term, producing higher stock biomass. If these objectives are materialized, this measure could increase landings and revenues and reduce costs for the scallop fishery resulting in higher producer, consumer and net national benefits compared to the no action alternative.

1.4.4.2 Minor adjustments to the limited access general category management program

These alternatives include several potential modifications to the limited entry program recently implemented for the general category fishery. Amendment 11 to the Scallop FMP limited access in the general category fishery and implemented an IFQ program for qualifying vessels. This action is currently considering alternatives to address the following specific issues: rollover of IFQ, consideration of a general category sector application, modification of the general category possession limit, and modification of the maximum quota restriction one vessel can harvest. No action would maintain that IFQ expires at the end of a fishing year. A permit owner would be prohibited from carrying forward any unused IFQ into the following fishing year.

The rollover option is expected to have positive economic impacts on the LAGC fishery, on overall scallop revenue, producer and consumer benefits compared to the no action scenario. Thus the impacts on total economic benefits will be positive although this impact would be small given that the scallop allocation for the general category fishery constitutes a small proportion, i.e., 5% of the total scallop landings. The 15% rollover option would have smaller positive economic impacts compared to the no action since the vessels that were not able to land more than 15% of their allocation will still have lower revenues and profits as compared to the full rollover option that would allow them to recover their losses completely in the next fishing year.

On the other hand, allowing IFQ rollover could increase management uncertainty for the following fishing year, increasing the likelihood of a larger buffer and reducing the total quota allocated to the general category fishery.

The Council is considering a modification to the general category possession limit in response to requests from some of the industry that the current possession limit is not economically feasible. These alternatives are not expected to change the scallop landings, at least, not directly and not in a significant way. Therefore the scallop revenues are not expected to change. An increase in the general category possession limit is expected to reduce fishing costs and increase profits for these vessels. As a result, total producer surplus and net economic benefits could increase. The results would depend on the costs per day and the steaming time.

The costs savings from the elimination of the possession limit will be larger than the alternative that would modify the possession limit up to 1,000 pounds. Thus, this option would result in higher profits for the general category vessels. The producer surplus and net economic benefits for the scallop fishery will increase as well although the increase is expected to be small given that the scallop allocation for the general category fishery constitutes a small proportion, i.e., 5%, of the total scallop landings. This alternative would change the nature of the general category fishery, however, from a small scale fishery to a full-time operation like in the limited access fishery.

Another alternative would modify the ownership restrictions and would make them consistent with each other. There are currently two ownership restrictions in place: 1) a restriction on the maximum amount of quota an individual can own (5%); and 2) a restriction on the maximum amount of quota that can be harvested from one platform (2%). No Action alternative would maintain the current restriction of 2% maximum quota allocation on each general category vessel. Making the ownership restrictions consistent would provide more flexibility to vessels to adjust their harvest levels to changes in the scallop resource conditions and will have positive impacts on profits. On the other hand, consolidation of quota could have some negative impacts on some communities which would be addressed by the social impact analysis.

The alternatives that would allow general category limited access permit owners to transfer permanently or lease their IFQ quota to another IFQ permit holder or to a community-based trust or permit bank could have positive impacts on the participants. It would allow fishermen to combine their allocations and to benefit from an economically viable operation when the allocations of individual vessels are too small to make scallop fishing profitable. Under these conditions, general category scallop TAC is likely to be fully utilized by qualifiers with positive impacts on revenues and producer and consumer benefits.

Another alternative would establish a process for the creation of Community Fishery Associations (CFAs), non-profit organizations that are allowed to hold (permits ?) and quota on behalf of a defined community. These groups may be formed around a common homeport or landing port, and can include just fishermen or other members of the community.

The purpose of establishing this process is to allow greater opportunities for fishery participants to proactively engage in resource governance, provide greater flexibility for participants, to enable communities to thrive by establishing a community-driven plan, and to create outcomes that are more socially and economically beneficial for communities within the biological limitations of the fishery. These entities would also support qualified new entrants to the fishery.

The goals of establishing Community Fishing Associations are to:

- Mitigate the potentially negative economic and social impacts of current transitions to quota management in the LAGC fishery.
- Provide affordable local industry access to fisheries resources
- Provide opportunities for qualified new entrants to the fishery
- Preserve traditional fishing communities and necessary onshore infrastructure

The establishment of CFAs will not impact overall scallop landings and revenues from the general category fishery. It will have positive impacts on the participants, however, by allowing fishermen to combine their allocations and to fish using fewer vessels in order to reduce fishing costs. This will provide an opportunity for fishermen to establish and benefit from an economically viable operation when the allocations of individual vessels are too small to make scallop fishing profitable. Under these conditions, general category scallop TAC is likely to be fully utilized by qualifiers with positive impacts on revenues and producer and consumer benefits. There could be some indirect positive impacts if the associations identify ways to fish more efficiently, reduce bycatch, and prevent interactions with the protected species.

There is some concern that CFAs could change the nature of the general category fishery from a small day-boat fishery to a fishery dominated by a few large boats fishing like offshore boats with multiple day trips. As long as general category fishery is subject to a 400 lb. possession limit per trip, however, there will be less incentive to consolidate shares on boats with higher fishing power or to invest in larger capacity boats. On the other hand, for fishing in the access areas, it may be beneficial to put allocations on vessels with higher fishing power in order to maximize the landings before an area closes to general category fishing. In such a case the participants of an association could gain at the expense of other vessels that fish individually or belong to a sector with smaller vessels. If the general category fishery is managed by a vessel allocation system (whether in terms of individual fishing quota, trips, or tiers.), there will be less incentive for race to fish in access areas since scallop pounds or trips would be deducted from a vessel's allocation no matter where they fish.

It remains to be seen how CFAs will affect employment and crew incomes in the general category fishery. Although scallop fishing with fewer vessels would reduce employment to some extent, given that many general category vessels participate in other fisheries as well, these negative impacts on crew could be small. There are also potential issues related to sectors and cooperatives such as a decline in competition and price fixing, especially when a few sectors dominate the fishery. Such impacts for sectors in general category fishery could be small since the general category fleet lands a small proportion of the total scallop catch. A 20% limit on sector shares would also reduce such potentially negative impacts.

1.4.4.3 Measures to address EFH closed areas if Phase II of the EFH Omnibus Amendment is delayed

No action alternative would maintain the measures in place to minimize impacts on EFH. Specifically, areas closed in Amendment 10 and Amendment 13 to minimize impacts on EFH would apply to the scallop fishery unless modified under Phase II of the EFH Omnibus Amendment (Amendment 14 to the Scallop FMP). This increases impacts on the scallop resource if fishing is in suboptimal areas, as well as increases bottom time having impacts on bycatch and EFH.

The alternative would modify the EFH areas closed to scallop gear under Scallop Amendment 10 to be consistent with Multispecies Amendment 13. If selected, only the areas closed for EFH under Amendment 13 would be closed to scallop gear; the areas closed for EFH under Amendment 10 would be eliminated. As a result, effort could be allocated to Closed Area 1 where the scallops are larger instead of allocating more open area effort in areas with lower catch rates. This in turn could have positive effects on the scallop resource and future yield. According to the estimates, the future yield could increase by 526mt or by 1.2 million lb. a year, resulting in about $8 million (assuming a price of $7 per lb.) more revenues from the scallop fishery per year. Fishing in more productive areas would also reduce the fishing costs. Therefore this alternative is expected to increase revenues, profits and producer and consumer surpluses from scallop fishery with overall positive impacts on net economic benefits.

1.4.4.4 Measures to improve research set-aside program

These alternatives are expected to have positive indirect economic benefits for the sea scallop fishery by improving the timing and administration of the research set-aside program. One alternative would remove additional TAC specifically for scallop survey work in areas scheduled to open for scallop access, totaling 3% of TAC for research compared to 2% under status quo. Having dedicated resource for funding research to survey access areas will improve the Council's ability to allocate the appropriate amount of effort to prevent overfishing and optimize yield. Eliminating the crew restriction on research trips is to enable more researchers onboard. Allowing research trips access in Elephant Trunk during the seasonal closure of September 1-October 31 could help researching turtle interactions and to determine if indeed these two months have greater probability of interaction than other times of year. Eliminating the requirement to return to port if fishing in more than one area on a research trip would reduce the steaming time and allow more flexibility. If as a result of these measures, the program can be more streamlined and worthwhile projects can occur with fewer obstacles, better and timelier research will result in indirect benefits on the scallop resource and yield and will increase economic benefits from the scallop fishery.

1.4.4.5 Measures to change the scallop fishing year

Changing the start of the fishing year to either May 1 will reduce the time lag between the fishing year and the time when the survey data becomes available. A more accurate estimation of TACs for the access areas will reduce uncertainty associated with the rotational area management, and an implementation time that coincides better with the fishing year will benefit the scallop fishery and have positive economic impacts on the participants. On the other hand, there will be some business risks associated when the fishing year starts at a later date as discussed below. Under the no action alternative there will be no change in the scallop fishing year and the issuance date for general category permits. Since overfishing of the scallop resource due to mis-estimation of TACs and DAS allocations needs to be corrected by the framework, the no action alternative will result in more stringent regulations and a decline in scallop landings in future years, which will have negative impacts both on the scallop fishermen and on seafood consumers.

The change in the fishing year will, however, require a change in the business plans of the scallop fishermen and create some risks if plans do not materialize due to unforeseen conditions. Presently, the fishing year begins at a time when meat-weight of scallops begins to increase and a higher yield per unit effort could be obtained from scallop fishing. As a result, the vessels start using their day-at-sea based on the current resource and market conditions and fishing costs (such as fuel prices). If the fishing year starts in May, the vessel owners may need to postpone part of their day-at-sea allocations until the following March, since 15% to 18% of scallops are usually landed during the months of March and April. If during these months, the resource and market conditions turn out to be less favorable than they expected a year ago, for example, if scallop prices or catch per-unit effort decline due external factors, they will incur a loss from not using them in earlier months. Also unforeseen conditions, such as a vessel breakdown, illness, or unfavorable weather could affect how many of the day-at-sea allocations could be used at the end of the fishing year.

Present regulations allow a vessel to carry over 10 days-at-sea to the next fishing year. Therefore, if a vessel could not use more than 10 days of its day-at-sea allocation at the end of the fishing year due to unforeseen conditions, it will face a decline in revenue unless there is a change in regulations to take into account such conditions. In other words, starting the fishing year at a later date will require longer term planning and will create some risks due to reduced predictability of the resource and market conditions over a longer horizon. Negative impacts associated this change could decline over time, however, as the vessel-owners gain experience with the new fishing year and learn to adjust their business plans more efficiently to the new conditions. Even though there could be some short-term decline in producer benefits if landings do not occur under the most optimal conditions due to the reasons discussed above, there is no question that more accurate estimation of area TACs and day-at-sea allocations will improve scallop yield over the long-term, increase revenues, and reduce the business costs associated with constantly changing regulations. Therefore, the positive economic impacts of changing the fishing year are expected to outweigh the negative impacts in some circumstances when the scallop resource and market conditions turn out to be less favorable than expected.

Table 40. Distribution of scallop landings by limited access vessels by month and calendar year

MONTH	2000	2001	2002	2003	2004	2005	2006	2007
1	1.39%	4.30%	3.55%	2.86%	2.42%	4.76%	3.00%	1.82%
2	3.54%	3.55%	4.95%	3.46%	4.55%	4.28%	2.76%	1.19%
3	6.97%	5.81%	6.43%	7.11%	7.95%	6.84%	6.56%	12.68%
4	9.66%	10.44%	10.26%	8.50%	10.09%	10.01%	10.12%	10.51%
5	14.70%	13.36%	11.72%	13.31%	12.43%	13.55%	11.21%	12.57%
6	12.67%	12.13%	12.82%	13.65%	13.15%	12.85%	16.13%	17.46%
7	11.88%	12.65%	11.58%	12.86%	10.53%	13.60%	15.85%	12.45%
8	11.31%	9.66%	11.96%	10.70%	9.51%	11.45%	15.13%	10.56%
9	8.31%	8.14%	8.90%	6.82%	7.74%	8.45%	7.19%	6.20%
10	8.83%	8.36%	7.05%	9.91%	6.49%	5.45%	5.50%	5.23%
11	5.00%	6.02%	5.92%	6.78%	8.79%	5.09%	3.66%	4.76%
12	5.74%	5.57%	4.87%	4.03%	6.36%	3.66%	2.86%	4.56%
Grand Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Table 41. Distribution of scallop landings by limited access vessels by period

Period	2000	2001	2002	2003	2004	2005
March-Apr.	15%	16%	16%	15%	18%	18%
March-July	52%	53%	53%	55%	53%	58%
Aug.-Feb.	48%	47%	47%	45%	47%	42%
Grand Total	100%	100%	100%	100%	100%	100%

1.5 SOCIAL IMPACTS

The social impacts of this action are described below. There are three overall sections of the social impacts. First, a qualitative discussion of the expected impacts of each measure individually. Second, a detailed social impact assessment literature review of leasing and permit stacking related to research on impacts of consolidation. Third, an assessment of potential impacts of stacking on shoreside businesses that describes the direct, indirect, and induced multiplier effects that remain within the local economy before and after stacking. These three sections combined describe the potential impacts on alternatives under consideration in this action, with more emphasis on the potential impacts on the social structure of fishing communities and other shoreside businesses in the Northeast.

1.5.1 Summary of qualitative social impacts of measures under consideration

1.5.1.1 Compliance with re-authorized Magnuson-Stevens conservation and management act

If the measures to implement accountability measures (3.2.3.9) help prevent overfishing, then the positive impacts to the resource will in the long-run provide positive social benefits for scallop fishermen and communities. Proposed accountability measures for a sub-ACL of YT flounder (3.2.3.11.2.1.1 and 3.2.3.11.2.1.2) that limit fishing areas may have social impacts given potential effort shifts predicted in the biological impacts section. Fishing in areas with lower meat weights, in terms of social impacts, would lower incomes while labor expenditures increased, while closing areas could negatively impact those fishermen who fish in those areas and who do not practice a mobile fishing strategy. Derby fishing that may result from the possibility of reduced days (3.2.3.11.2.1.3 and 3.2.3.11.2.1.4) could have negative safety implications for fishermen as well as negative impacts on the spacing and amount of income.

1.5.1.2 Permit Stacking and Leasing

Economic signals such as quota prices for example, which are theoretically expected to reflect embodied resource rent, often mirror more complex sociocultural pressures and values in the case studies above. Fishermen do not always lease or sell when expected, and prices may reflect more structural relations between more and less powerful segments of an industry or community than they do an unbiased reflection of value. Thus, as the case studies in Section 1.5.2 demonstrate, consolidation measures like ITQs, but also more generally leasing and stacking, tend to have their negative impacts on those less powerful segments of the fishing industry, namely the crew, or the small business owners without a fleet of vessels or vertically integrated business. Those who are better able to take advantage of measures like leasing or stacking are then increasingly able to exert control in various markets, such as leasing quota, hiring crew, or even affecting prices that fishermen receive for their product. These kinds of changes, in turn, affect the structure of communities—through changing relations between people and shifts in dominant values—and affect the viability of fishing communities as some are disproportionally impacted by geographic shifts in fishing businesses.

National Standard 8 requires that fishery management plans “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)). NS8 directs important attention to how measures like leasing and stacking may impact the sustained participation of fishing communities dominated by smaller operations and the cumulative effects of market changes reflecting more dominant interests, in which new participants find entry increasingly difficult and smaller operations are increasing dominated by larger ones. As Connor and Alden (2001: 396) write of the experience of Australia, "given the effective use of output controls and the low opportunity costs of vessel capital, any expressed urgency regarding structural adjustment of the fleet must be regarded as unwarranted. If vessels are scrapped, the efficiency gains will be very small, and the social costs of loss of employment and local economic activity in regional coastal towns would not have to be large to tip the balance in favour of the status quo."

1.5.1.3 Measures to adjust the current overfishing definition (OFD) to be more compatible with area rotation

By removing the influence of the un-harvested biomass from closed areas from the open areas' mortality estimate, the expected higher F_{targ} would provide greater fishing opportunities in line with rotational management, with positive social impacts for scallop fishermen.

1.5.1.4 Minor adjustments to the limited access general category management program

A rollover allowance for general category IFQ permit holders (3.4.2.1) would provide greater flexibility for fishermen. Modifying the general category possession limit (3.4.2.3) might increase economic returns for these fishing trips, with positive social impacts, but the further the fishery moves from trip limits to a pure ITQ, the further it moves from the small-scale, day-boat fishery that Amendment 11 sought to ensure. Allowing LAGC quota to be transferred from IFQ permits (3.4.2.5.1) could also move the fishery closer to a pure ITQ with a host of potential negative impacts (see stacking and leasing above). The transfer of quote to a community-based trust (3.4.2.5.2), however, could have many positive impacts, as the literature on co-management and community-based management suggests.

1.5.1.5 Measures to address EFH closed areas if Phase II of the EFH Omnibus Amendment is delayed

Modifying the EFH areas closed to scallop gear under Scallop Amendment 10 to be consistent with Multispecies Amendment 13 (3.4.3.2) would have positive social impacts in that it would expand the area available in the access program for fishermen to fish, enhancing flexibility.

1.5.1.6 Measures to improve research set-aside program

Improvements to the research set-aside program, in that they would enhance the possibilities for and benefits from research, would provide positive social impacts for scallop fishermen and communities that participate in the fishery.

1.5.1.7 Measures to change the scallop fishing year

Keeping the scallop fishing year at March 1 (No Action, 3.4.5.1) would create no negative impacts in the short-term on the fleet associated with changes in business or fishing practices. It would however, continue problems resulting from mis-estimation of TACs and the need for compensatory regulatory action, and the fact that actions are not implemented at the start of the fishing year. These problems indirectly cause problems for fishermen from the constant barrage of regulatory action, which itself can unsettle business and fishing practices. If the start of the fishing year is changed to May 1 (3.4.5.2), then consistency would be created across most fisheries and regulatory action might be more consistently applied depending on timing of research surveys, with positive benefits for the fishery, though there would be the cost associated if fishermen had to change their fishing practices in any way.

1.5.2 Social impact assessment literature review of leasing and permit stacking

Leasing and permit stacking, though different in many respects, are both forms of fleet consolidation within a fishery. In terms of their social impacts, one can expect similarities to other forms of consolidation, such as ITQs, because many of the social impacts stem directly from the reduction in capacity or from the costs associated with leasing or buying quota, irrespective of whether such quotas are transferable. Further, because ITQs have been widely studied in many different contexts around the world, they help provide a full picture of potential consequences from consolidation. Since the scallop fishery is a limited access fishery, privatization of the resource—one of the criticisms of ITQs—has already occurred, yet any windfall gain can only be realized if a permitted vessel is sold and the owner leaves the fishery. That is to say, the lack of transferability has tended to slow down consolidation and accompanying social impacts, but this would be loosened with leasing and stacking. Moreover, measures like stacking could become "an effective intermediate step towards IQs" (Hastie 2000), thus their potential impacts become doubly significant. The primary social impacts that have been documented in empirical cases involving consolidation (explained in greater detail below) range from employment loss, decreased income, decreased quality of life, changing relations of production, structural disadvantages to smaller vessels and firms, dependency and debt patronage, concentration of capital and market power, inequitable gains, regulatory stickiness, reduced stewardship, decreased community stability, loss of cultural values, and so on.

Leasing and stacking may provide a greater degree of flexibility for business operations, which would be a positive economic and social impact. Yet although economic theory tends to predict positive benefits in terms of efficiency and profitability, these gains—if and when they occur—accrue primarily to permit-holders and boat-owners remaining in the fishery. And while permit stacking and leasing may or may not lead to or further all the negative social consequences listed above, real-life examples demonstrate the complex social relations involved in consolidation, with negative impacts more apparent when the fishery and the community are seen in totality. Stacking of course can only be utilized by owners of multiple vessels, but even with leasing, smaller entities and others impacted, like crew, tend to be at a disadvantage. The following thus begins with a summary of the impacts to crew and businesses, but moves on to situate these impacts in their reciprocal effects on fishing households and communities.

- ***Impacts to crew***

NMFS does not specifically collect information on crew apart from crew size on trips and information on the vessel operators. Unfortunately, it is difficult to assess overall employment impacts from crew size alone, given that rotating crew among vessels may disguise already reduced employment levels; the collection of basic information on crew and variations in the lay system would enrich assessments of fishery-specific outcomes in particular places. Nonetheless, case studies on consolidation impacts provide a rich source of information about such issues. In most instances when consolidation measures are implemented, employment on vessels decreases as can the income received by crew. Employment numbers in the Mid-Atlantic surf clam fishery dropped by nearly 80 percent between 1990 and 1999 (from 155 to 34 employed crew members) as the industry consolidated in the wake of ITQs (Brandt and Ding 2008: 744). McCay et al. (1995: 101) also found decreases in this fishery, even though labor was already rotating among boats (similar to claims in the scallop fishery). Employment reductions have also been noted in Australia's southern bluefin tuna fishery (Guyader and Thébaud 2001: 107) and the halibut fishery in British Columbia, where numbers of fishermen decreased 32% from both reductions in the size of crew on remaining vessels and loss of employment on displaced vessels (Casey et al. 1995: 225). In the Icelandic case however, employment numbers on vessels actually increased, while shore-side employment decreased. As Eythórsson (1996: 217) writes, between 1984 and 1992, the number of fishermen working onboard a fishing boat increased 23 percent, or 1,300 people. "The most obvious explanatory factors are the growth of the labour-intensive small boat fleet [outside ITQ regulation] and the growing percentage of frozen fish products processed on board [factory trawlers, operated by companies selling their quota to other fishermen]." Yet, he continues, "During the same period, the number of workers employed in the land based fishing industry had reduced by one third, from approximately 10,500 to 7,000 employees" (ibid.). In this case, effort displaced from the quota-regulated fishery into other fisheries increased capacity overall when fishing is seen ecosystem-wide, at the same time that it had overall negative employment impacts in fishing communities.

As Bonnie McCay writes, "When captains and crew are rewarded for their work through shares of the catch, the sharing formula often changes under ITQs reflecting the shift in power, so that the owner retains a larger portion of the total. There may also be a movement toward wages instead of shares" (1995: 9). Such a movement towards wages has been documented in a number of fisheries, such as the Tasmanian rock lobster fishery (see Bradshaw 2004: 108). These pressures are not confined to buying quotas, such as in an ITQ system, but also concern leasing, as is being considered in Amendment 15, for it is the competition for quota, whether bought or leased, that creates this dynamic: "The smaller the crew rate, the higher the willingness to pay for quota […] Even if firm 4 is the most efficient from a technical point of view, the weakness of its capital owner in bargaining with the crew can affect its bargaining power on quota markets. The implication is that the most cost-efficient operators on quota markets will likely be those who, not only are the most efficient in terms of fishing operations, but also who have best been able to reorganise their internal structure, particularly as regards contracts between vessel owners and crews" (Guyader and Thébaud 2001: 110).

Crew shares and crew incomes were found to have decreased in the mid-Atlantic surf clam and ocean quahog, and Nova Scotian (McCay et al. 1995: 101-102), and Icelandic fisheries (Eythórsson 1996: 218). In these cases, the negative impact on crew income stems in part from leasing costs being passed onto crew, for example by decreasing the lay given to crew, or by taking out the cost of quota from catch value before shares are calculated. According to McCay et al. (1995: 101), firms that hired kin or neighbors were less likely to pass the costs on to crew, whereas larger firms were more likely to. The implication of this is that measures like stacking and leasing that are designed ostensibly to just reduce capacity or increase economic efficiency may in fact change the very forms of fishing, favoring a more industrial rather than kin or community-based approach fishing. When fishing with leased quota in Iceland, fishery income of smaller boat owners was also reduced from 40-50 percent (Helgason and Pálsson 1997: 457).

Additionally, "speculative leasing transactions (kvótabrask) were in some cases undertaken in order to reduce wages" (Eythórsson 2000: 488). In the case of the British Columbia halibut fishery, Pinkerton and Edwards (2009: 711) also found considerable decreases: "[Crew] are now an unorganized surplus labor force (because so many crew jobs have been eliminated) hired at whatever the market will bear. They formerly got 10–20% of the catch value before ITQs and now get 1–5%. Whereas the value of the halibut fishery has increased by 25% between 1990 and 2007, the proportion of that value retained by the crew share has dropped by 73%."

In contrast to earlier studies (e.g. McCay et al. 1995), Brandt and Ding (2008: 744) found that crew income eventually increased in the surf clam fishery. In this case, an increase in vessel profitability compensated for reduced shares, through "an increase in the mean amount of time vessels spent at sea." Working longer hours, however, can result in diminished quality of life, especially when fishermen are no longer able to participate as much in family or community life, as was found in the Nova Scotia (McCay et al. 1995: 102). Whether increased income from a fishing trip can compensate for changes in social relations and daily life is an empirical question. On a related concern, a recent study on vessel safety has also found that accident rates in ITQ fisheries do not decrease, at least among those that do not limit ownership, as is often claimed:

> Small operators are often limited to leasing quota from large corporations or non-fishers, or to working under contract for vertically integrated businesses. In such cases, the expected safety benefits of IQs (e.g., reduced incentives to rush for fish or operate in poor conditions) may be negated if pressures from quota holders supersede the independent decision-making of vessel owners. This may have safety implications for the fisheries of Atlantic Canada, where owner/operator and fleet separation policies are being undermined by so-called 'trust agreements' in which processors essentially pay for licenses and vessels on behalf of small-scale vessel owners and subsequently exercise some control over their fishing activities (Windle et al 2008: 707, reference omitted).

Lack of control, especially over important decisions such as when to fish, can thus negatively impact both safety-at-sea and quality of life for fishermen, fishing households, and fishing communities.

- ***Impacts to small boat-owners***

In many cases, capacity reduction measures do decrease capacity through the number of vessels participating in a fishery and lead to consolidation among firms. In the ocean quahog and surf clam fishery of the Mid-Atlantic, a "significant reduction in the number of vessels" came about due to the decisions of owners of multiple vessels "to consolidate harvesting on fewer vessels" and because of "owners of ITQs who cease harvesting but participate in the fishery by leasing their ITQs" (Brandt 2005: 21). In New Zealand, "In 1996, 86% of total allowable commercial catch allocated as ITQ was allocated to the largest 12 companies (fishers) compared to 49% in 1986 [6]. Stewart and Callagher found that concentration in the industry has continued. The exit of fishers had not been matched by entry, showing that net exit occurred and implying that the released quota was being purchased by incumbent firms" (Stewart et al. 2006: 329). Similarly, Gibbs (2007: 113) writes of how ITQ management in New Zealand has led to "the rationalisation or aggregation of fishers and vessels into a small number of larger vertically integrated fishing companies [7]. This was partly a consequence of the development of capital-intensive deep-water fisheries over the same period; however, there has been a significant decline in the number of owner-operated vessels in the inshore fleets." In Icelandic cod fisheries, "there have been radical changes in the total number of quota holders, a reduction from 535 to 391 (27%), from 1984 to 1994" (Pálsson and Helgason 1995, quoted in Pálsson 1998: 283). The reduction in quota holders corresponds to increasing concentration in the fishery: from 1984 to 1994, the percentage of ITQs in Iceland owned by 70% of the smallest holders decreased from 20% to 10%, leading to "a continual increase in the level of inequality and a growing concentration of ITQs at the top" (Pálsson and Helgason 1995: 130).

In others cases however, capacity actually increases in a consolidation program because of the political-economic context in which it operates and because of the sociocultural values of fishermen who attach other than monetary values to continuing in the fishery. For example in the Icelandic case, while the number of quota-holders decreased, capacity—in terms of vessel power—actually increased: "Since the introduction of ITQs in 1984 to the end of 1997, the fleet has in these terms [of vessel size] expanded by almost 13%, or 14.100 GRT. Engine power, which also provides an indication of catching capacity, has increased correspondingly" (Eythórsson 2000: 487). The reasons in this case have to do with the particular combination of an increase in larger vessels that could move into international fishing waters while they leased their quota to smaller vessels, and the movement of small vessels into a non-quota inshore fishery reserved for small boats (Eythórsson 1996: 215). In Australia, on the other hand, a low "salvage value" for vessels and quotas convinced many fishermen to stay in the South East Trawl fishery "because the pay-offs of waiting for a small increase in quota price can remain positive even where average total costs are very high. Hence, in the SETF, the combination of uncertainty over stocks, and therefore the appropriateness of TAC levels, and lack of alternative fisheries to move to may tend to lock-in existing vessels for the duration of their serviceable lives […] In fact, overall vessel numbers in the fishery have remained more or less static since the introduction of ITQs." (Connor and Alden 2001: 391-392). Cultural values can also motivate fishermen to remain in a fishery despite consolidation measures or financial incentives to leave; as Bonnie McCay (1995: 7, footnote omitted) explains "'Job satisfaction', a confluence of personal, situational and socio-cultural community values, is among the factors that can affect appraisal of opportunity costs and the price of exit. Another of these factors can simply be that the value of the vessel is likely to be low […] the fishing vessel is where capital is reinvested and, like the family farm, the hoped-for basis of future income. The big difference is, of course, that fishing vessels often have no alternative uses or values."

In general though, it is the smaller firms which tend to be disadvantaged in markets for buying or leasing quota. This is of considerable importance for the scallop industry, given the preponderance of fleet-owned vessels, as shown in the table below. Because risk is included in the price of credit, those who have to borrow more to pay for leased quota "stand seriously exposed to continued stochasticity in annual allowable harvests. If quota buyers bought a number of shares and are now carrying debt-service obligations, they are seriously exposed if fish stocks fail to recover, or if they recover more slowly than initially imagined" (Bromley 2005: 224). As Copes and Charles (2004: 176) write, "when ITQs are freely tradable, corporations and large investors in the fisheries sector may use their financial power to buy up large aggregations of quota, thereby concentrating a substantial share of fishery access rights in their hands. They may assign their quota holdings to larger vessels which they operate directly, or lease out quota (with or without boats) to independent fishers, or provide loans to fishers to buy boats and quota—in all cases usually on condition that the fish caught be delivered to their plants." In Iceland, for example, many smaller operators received such small quotas that they had to lease more or sell what they had. "A major factor in the apparent success of the larger companies in accumulating fishing rights is their ready access to capital through the Icelandic banking system, something that is less available to the smaller operators. The larger companies are generally vertically integrated businesses that own two or more vessels. Their approach to 'business' and ITQs is very different to that of the smaller operators" (Pálsson and Helgason 1995: 134). McCay et al (1995:102) also found "that there is a strong trend to build upon the pre-existing structure of dominance by a few firms. By 1995, nine firms, including two large processors, controlled 82% of the ITQ for surf clams and 10 firms controlled approximately half of the ITQ for ocean quahogs." Likewise, they continued, that in Canada "such a trend is also apparent, despite measures intended to protect the small, independent owner-operated fishing venture" (ibid). Further, they write that consolidation in the SCOQ fishery "required investment. Larger owners reported having to invest large sums to purchase or lease ITQs in order to maintain supply or market position. In their calculations, this investment was equivalent to capital investment and thus 'capital stuffing' in quotas may be happening here as in New Zealand" (ibid: 103).

VALUES IN THIS TABLE ARE NOT ACCURATE – STILL UPDATING WITH NEW OWNERSHIP DATA.

	No. of corps (esti-mated)	No. of boats	landed value 2008	% of limited access vessels	% of landed value (2008)	Landed value/corp (not net value)	% landed value from Fulltime	% landed value from Fulltime small dredge
own 1 vessel	76	76	66,914,555	22.0	20.6	880,455	75.3	15.0
own 2-4 vessels	40	106	100,063,987	30.6	30.8	2,501,600	72.7	21.4
own 5 or more vessel	21	164	157,444,227	47.4	48.5	7,497,344	87.9	6.7

Single-boat owners may also be disadvantaged in hiring crew members, if fishermen desire year round employment that could be better accommodated by an owner with stacked permits. Single-boat owners may also be dependent on larger interests for access to waterfront and other port infrastructure, a dependence which could further weaken their position with increasing fleet consolidation as well as contribute further to impacts on a community's waterfront access for other users. Vessels that are in a better financial position are also better able to afford higher lease costs, which can eventually bid up the cost of leasing quota (Pinkerton and Edwards 2009: 709). In general, interests with multiple vessels may be able to negotiate for lower prices for insurance and other business costs that can be purchased in bulk, further consolidating advantages of scale. In the case of the Tasmanian rock lobster fishery, fishermen with smaller operations who had not bought extra licenses increased the market demand for leased quota, leading to increased leasing costs (Bradshaw 2004: 106). Stewart et al. (2006: 331) write similarly that "Historically major quota holders report higher rates of return than for minor quota holders, suggesting they would be prepared to pay higher prices for quota […which] could potentially make acquisition uneconomic for some minor quota holders […while leasing] places an additional direct cost which must be absorbed by the fisher, given the need to maintain competitive prices in the wholesale and retail markets they operate in. In reality, minor fishers are likely to be price takers." Finally, in Iceland, as Eythórsson (1996: 218) writes:

> the favourable position of the offshore fleet, relative to inshore vessels, is not necessarily due to more efficient use of capital and labour in the harvesting operation; it also depends on the more favourable options open to the offshore fleet, including the opportunity to fish outside the EEZ. Besides, large companies are likely to be in a better position to follow a long term strategy and to have easier access to bank credits and support from municipal authorities than the more marginal fisherman-owners of inshore vessels. The high quota leasing prices can to some extent be explained by the unequal positions of the offshore and inshore vessels. Facing a choice between quitting fishing for good or continuing fishing with leased quotas, in a situation of poor employment alternatives, fishermen owners of inshore vessels have been willing to pay astonishingly high leasing prices. With a large number of vessels with either too little or even no quota, the demand for quota far exceeds supply. It seems therefore, at least in a transitory period, that high quota prices may be generated by the very existence of excess catching capacity, a paradoxical situation in terms of the ITQ model.

Leasing prices that become a large cost to fishermen can result in a number of negative impacts in addition to decreased crew or owner income (discussed above), such as dependency and debt patronage, and changing structural relations of production. Together with pressures for consolidation, this can further reduce the bargaining power of many fishing participants at the same time that larger firms may increasingly have market power, which could lead to control of the prices of landed fish, of leased quotas, or of crew remuneration (NRC 1999). In Iceland, leasing prices for cod quotas during 1991-1995 were more than half of average cod landing prices (Eythórsson 1996: 216). Smaller firms that received too little quota to remain viable then become dependent on larger firms for leased quota (Eythórsson 1996: 218); in some of the arrangements between large companies and smaller owner-operators, the fishermen who catch the fish must then deliver it to the company's processing plant (Helgason and Pálsson 1997: 457) Such new relations of production have generated controversy in Iceland because they violate cultural norms concerning fairness and equity. In the words of many fishermen there, "boat owners without quota (the 'serfs') are granted access to the fishing stocks, the equivalent to the medieval estate, on the prerequisite that they hand over their catch to processing plants (the 'lords') in return for a fixed price. Fishers frequently argue that excessive quotas, those that are not used by quota holders, should not be leased for money but returned to a common pool and redistributed to other boat owners who have more use for them" (Pálsson 1998: 283-84). Yet with leasing, larger interests such as processors or vertically integrated firms—fairly common in the scallop fishery—could potentially exact profits from the fishery and potentially increase their market power and concentration in the fishery, without even physically maintaining a boat should measures allow fully market-based leasing.

Cultural norms can also interact with political economic relations to create other forms of debt patronage. In the British Columbia halibut fishery, Pinkerton and Edwards (2009: 709) note how the difficulties in violating norms of equity that were embodied in the share system, where crew were "co-venturers" along with owners, has resulted in markets inefficiencies:

> Many quota owners prefer to lease their quota out through a processor as a broker because the processor is in a better position to get the highest price and because, as several fishermen stated, they do not want to be 'guilted by other fishermen'

> about the high lease price they are asking. Similarly, many lessee fishermen do not wish to deal directly with the quota owner because of their hostility toward the high lease prices […] Processors are brokers of most of the leases because they can afford to pay more up front, both because of their access to capital and because of their power in allocating fishing opportunity through control of a large amount of quota […] The price of quota when it is leased out to fishermen by the processors is confidential; it varies with arrangements and the bargaining power of the lessee. The lessee usually agrees to deliver catch from other fisheries to the processor as part of the arrangement. There is, therefore, asymmetric information between buyers and sellers of quota leases […] which confers market power to quota owners and to a lesser extent to the processors who buy up and reallocate quota leases. Processors may not charge a fee for this transaction, but the guaranteed delivery of the fish to them gives them leverage over the price of the catch. This may be an even more important form of market power. The resulting allocation of quota leases, and the stated and unstated terms under which they are allocated, are not the product of a freely operating market with open competition.

As McCay (1995: 6) writes, whether markets function as expected depends on the number of participants and transactions, as well as how quota management systems are devised, cautioning further that many "equity preservation measures lose their effectiveness and may even be abandoned as operators find innovative means to get around the restrictions. It is also possible to argue, as was done for the US surf clam and ocean quahog ITQ system, that excessive concentration of shares would be adequately handled by monitoring the allocation of shares and working with agencies whose job it is to protect against monopoly formation. However, that too may be weak protection" (ibid: 10, footnote omitted).

- ***Impacts to fishing practices***

Some analysts have argued that crew on boats with no stake in fishery will have no incentive to conserve or practice sustainable fishing (Phillips et al 2002). The reasons have to do with who is actually fishing, and with the incentive structure in a fishery characterized by perceived inequity. Regarding the first, for example, Bradshaw (2004: 108) writes "Many of the second generation of fishers under quota management are likely to lease rather than own an entitlement to the resource. It may be debatable whether ownership contributes to compliance, co-management and sustainable practices—and these may be possible without ownership—but it is undeniably the case in the Tasmanian commercial rock lobster fishery that fewer owners are on the water to exercise any supposed sustainability ethic." Indeed despite its recent popular attention, as Macinko and Whitman (2009) argue, it is effectively an underlying hard TAC that enables catch shares to manage overall landings, not incentives stemming from ownership.

Concerning the incentive structure itself and with a widening gap between labor and capital in the fishery, actual fishing practices may differ than are expected from capacity reduction measures. In a study designed specifically to contrast effort levels on leased quota trips, Brandt and Ding (2008: 746) found that given how costs are spread with a given lay system, "where the cost of leasing quota is shared between boat owner and crew, the crew will expend a lower effort level than on trips where the quota is owned outright by the boat owner. The consequence of this hidden action is observable as a higher harvest rate for trips using the boat owner's own quota than for trips using leased quota, as confirmed by an analysis of the surf clam fishery." More generally, communities "characterised by inequality, productivity-sapping competitiveness, disunity, and other attributes of social dysfunction lack the necessary entrenchment of values and institutional mechanisms essential to successfully implementing sustainable patterns of use in fisheries and of other environmental resources" (Phillips et al. 2002: 467, references omitted).

- ***Impacts to households and communities***

While transferable quota systems have in many cases increased profits for those remaining in the fishery, this comes with costs to crew and smaller operations, as detailed above. These impacts have direct impacts on communities from unemployment or reduced income from fishing trips, but there are also longer-term implications for the stability of fishing communities, like difficulties for new or younger fishermen to enter the fishery. In some communities, this had led to the erosion of place-based ways of fishing and collective measures of success in favor of individualized competition (Carothers 2008). Fishing households with reduced income may face stresses that multiply at the community level, but they do not only stem from monetary changes but from the loss of fishing opportunities more generally, as Pollnac et al. (2006: 5) explain:

> Regulations requiring large capital investments can limit investments in other important areas such as vessel maintenance, the fishermen's homes, and their children's education—all impacting well-being. Changes that result in the loss of fishing opportunities, however, will have the greatest negative impacts, as alternative income projects are often problematic for this group […] Social problems associated with job dissatisfaction, as well as other variables mentioned above, can impact aspects of community structure including community solidarity and levels of compliance with fishery regulations. In turn, levels of compliance can feed back and impact aspects of fishery management. Further, other aspects of community structure, such as occupational structure, can impact activity attributes. Community power structure, which might include powerful fisheries organizations, can directly influence management as well as the external forces that influence management. Finally, individual attributes, social problems, and community structure all have an effect on well-being.

Consolidation measures like ITQs, as well as stacking and leasing, are highly divisive among scallop fishermen and within communities precisely for such reasons (e.g. Olson 2006).

Some impacts are especially pronounced in quota systems because of the "transitional gains trap," in which first generation fishermen receive a windfall profit that future generations pay for (Copes 1986: 287), a situation that would also apply to a limited access fishery in which leasing is possible. As Philips et al. (2002: 465, references omitted) argue, a "dramatic increase" in quota prices in Tasmania has resulted in "increased ownership of quota units by non-fishing investors and increased ownership by non-Tasmanians. The high cost of quota units has now made it almost impossible for fish-workers without capital to work their way up from deck-hand to skipper, to eventually acquiring access rights and becoming owner-operators, the path followed by many in the past. The separation between capital and labour is becoming increasingly entrenched. Ownership of property in the form of quota units is increasingly providing power over dependent suppliers of contract labour." The likelihood of monopoly gains and concentration, in fact, are precisely why many critics argue for the superiority of either auctions or community development quotas, in that they can create possibilities for “coastal and fishing communities to collect and take ownership in the resource rent through co-management” (Trondsen 2004: 381) and which can direct attention to human capital that can become “stranded” when mobile capital leaves a community (Bromley 2005: 222).

Such capitalization and concentration, write Copes and Charles (2004: 176), can lead to “geographical concentration” in larger ports:

> This will occur for reasons of operational efficiency and control, with quota owners tending to concentrate the fleets they own, or support, close to their processing and holding facilities. Diversion of quotas to larger centers has a cumulative economic effect in the smaller communities. Since they have fewer active boats left, boat repair, baiting, and other related activities are reduced, whereby total fishery-related employment is diminished to an even greater extent. Furthermore, a reduction in the economic multiplier effect from shrinking fishing income in the local economy means that in addition to fishery-related job losses, there may be considerable job losses elsewhere in affected communities. Thus, despite higher profits for the original group of vessel owners, the extent of job losses may swiftly produce an overall negative impact on smaller communities.

Thus in Iceland, Eythórsson (2000: 488) describes new community relations where “there is a trend towards an ideological shift within the industry, leaving behind the idea that fisheries and fish processing should be locally embedded in fisheries communities. Many fisheries companies have joined the Icelandic stock-market, and ownership is in many cases not linked to any particular community. Investors without fisheries background are now well represented among the owners of quota holding companies.” The impact of this falls particularly hard on remote communities that are dependent on fishing: “During the nineties, the vulnerability of fishing communities, especially small communities with poor employment alternatives, has become more visible as several fishing villages have lost most their quota as the owners have moved or sold out. A comparison of different size categories of fishing communities gives a clear impression that small communities with less than 500 inhabitants have on the average lost a much larger share of their quotas than the bigger communities” (ibid: 489).

McCay et al. (1995: 104) also write how geographic re-distribution can affect the security of coastal communities from loss of fishing income and from impacts on shore-side businesses: “the sell-out of the ITQ and harvesting and processing capital by a large multinational corporation [in the SCOQ fishery] resulted in the complete cessation of clamming and processing for one major coastal community of New Jersey for at least a year. In the Under 65’ Nova case, the ability to purchase ITQ has contributed to a striking regional imbalance, which is also caused by differences in the health of the groundfish stocks in different regions.” Shore-side businesses would also be affected by a decrease in servicing vessels, if fleet owners did consolidate.

These impacts go beyond the economic, and affect the quality of life and the nature of community:

> "There may also be serious non-economic losses for those who would rather have stayed in the familiar surroundings of their community if it had remained economically viable. Many of them would grieve the loss of accustomed social relations and a familiar and attractive physical environment. Finally, it should be noted that the reduction in the number of inhabited places along the coast would have adverse consequences for the country at large, for instance, in terms of tourism, by reducing serviced access to parts of the country that would be attractive to visit. The fundamental point here is that the economic costs to society of the concentration of fishing operations through ITQs are likely to be quite significant, and may be substantially larger than the gains enjoyed by the benefitting companies and vessel operators" (Copes and Charles 2004: 177)

These community-level difficulties can lead "to the loss of existing social capital which can be a critical force behind economic growth [… and with 'a reduced demand for fishing-specific skills' comes] a reduction in the value of the human and social capital involved in the industry" (Wingard 2000: 50). In Nova Scotia, "the egalitarian ethos of those communities is severely strained by the ability of a few processors and entrepreneurs to take advantage of the ITQ system, which has exacerbated differences in wealth and status within the community […which now reflect] one's position *vis-à-vis* government allocation and financial institutions [rather than the 'ideology of hard work']" (McCay et al. 1995: 105).

Capacity reduction measures—whether leasing, stacking, or transferable quotas—establish a trajectory that can be difficult to reverse once implemented. Fisheries that begin with limitations on transferability can quickly lobby to remove them given market pressures, as in Canada (McCay et al. 1995: 107), Iceland (Eythórsson 2000: 491), and Tasmania (Bradshaw 2004: 106). In Tasmania for example, a proposal supported by both government and the Tasmanian Rock Lobster Fishermen's Association to support quotas to help new fishermen to enter the fishery was blocked by quota owners: "There is a question mark, then, over the ability of the state, attenuated by the existence of private access rights that it created, to act responsibly in the longer-term interests of the fishery" (Bradshaw 2004: 108). Regarding the same fishery, Phillips et al. (2002: 465) write "the strength of vested interest that has become established as a result of past management policies, and the priority the legal and political systems give to promoting the financial interests associated with private property, means that government is severely constrained in how it manages the fishery […] at the expense of the broader public interest that would be better served by a wider distribution of the resource wealth."

- ***Conclusion***

Economic signals such as quota prices for example, which are theoretically expected to reflect embodied resource rent, often mirror more complex sociocultural pressures and values in the case studies above. Fishermen do not always lease or sell when expected, and prices may reflect more structural relations between more and less powerful segments of an industry or community than they do an unbiased reflection of value. Thus, as the case studies above demonstrate, consolidation measures like ITQs, but also more generally leasing and stacking, tend to have their negative impacts on those less powerful segments of the fishing industry, namely the crew, or the small business owners without a fleet of vessels or vertically integrated business. Those who are better able to take advantage of measures like leasing or stacking are then increasingly able to exert control in various markets, such as leasing quota, hiring crew, or even affecting prices that fishermen receive for their product. These kinds of changes, in turn, affect the structure of communities—through changing relations between people and shifts in dominant values—and affect the viability of fishing communities as some are disproportionally impacted by geographic shifts in fishing businesses. National Standard 8 requires that fishery management plans "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)). NS8 directs important attention to how measures like leasing and stacking may impact the sustained participation of fishing communities dominated by smaller operations and the cumulative effects of market changes reflecting more dominant interests, in which new participants find entry increasingly difficult and smaller operations are increasing dominated by larger ones. As Connor and Alden (2001: 396) write of the experience of Australia, "given the effective use of output controls and the low opportunity costs of vessel capital, any expressed urgency regarding structural adjustment of the fleet must be regarded as unwarranted. If vessels are scrapped, the efficiency gains will be very small, and the social costs of loss of employment and local economic activity in regional coastal towns would not have to be large to tip the balance in favour of the status quo." Thus the question of capacity reduction is ultimately not simply an issue of economic efficiency, but a question of what values to promote and what the future of the fishery and its fishing communities should look like.

1.5.3 Potential impacts of stacking on shoreside businesses and overall economy in the Northeast

The measures under consideration to address excess capacity in the limited access fishery and provide more flexibility for efficient use of the scallop resource include alternatives for permit stacking and leasing. Both types of programs are expected to cause some level of consolidation in the fleet. Consolidation had different impacts on the social environment that are described above. In addition, consolidation does generally reduce costs and increase profits for some sectors of the industry, primarily vessel owners. There are ways to assess the potential impacts of consolidation on the regional economy overall, including the impacts on fewer industry based jobs compared to increases in other sectors of the economy that benefit from increased profits. This section describes an analysis that was conducted to describe the potential impacts on shoreside businesses and the overall economy in the Northeast as a result of consolidation.

A regional input-output model was used with various data about the scallop fishery. This model estimates the types of businesses that will be positively/negatively impacted and the magnitude of the impact (sales, income, and employment). An input/output model captures the inter-industry transactions between businesses and final consumers in the economy. The trickle down effects are captured until all expenditures are outside the local economy (Maine to North Carolina).

A well established modeling approach called regional input-output analysis was used to measure the economic contribution of the full-time limited access scallop dredge harvesting sector to the Northeast regional economy (Maine through North Carolina) under different permit stacking scenarios. The economic contribution of scallop harvesting to the overall regional economy extends well beyond simply measuring the income, employment and ex-vessel revenues of harvesting activities. In addition to these direct effects, indirect effects to the regional economy are generated through linkages to non-fisheries sectors. For example, scallopers purchase goods and services to maintain and operate their vessels. Businesses providing these goods and services must also purchase inputs from their suppliers in order to conduct these transactions. In turn, these suppliers then purchase goods and services from their own suppliers, triggering a whole series of additional indirect multiplier effects. This cascading series of industry-to-industry, backward-linked multiplier effects and the cycle of consumption spending induced by all the incomes generated in these economic activities, contributes to the economy's employment and income base and continues until all of the multiplier effects are derived from outside the local economy. The summation of the direct, indirect, and induced multiplier effects that remain within the local economy represent the total economic contributions or impact of a particular industry sector to the overall regional economy.

In the assessment provided here, a ready-made regional input-output system called IMPLAN Pro (Minnesota IMPLAN Group, Inc) was employed to predict the contribution of the full-time limited access scallop fleet, under different stacking scenarios, to the overall regional economy in the Northeast. The resulting total estimated sales, personal income and employment contributions are differentiated by (1) the direct contributions attributed to harvesting, (2) the values attributed to the fleets' operating expenditures, and (3) the values originating from income expenditures by vessel owners, captains, and crew. It is desirable to show separation of the impact contributions in this manner in order to highlight the differing results across stacking scenarios.

The analysis compares the contribution of the full-time limited access scallop fleet in 2007 (status quo) to two hypothetical stacking scenarios. Scenario 1 assumes that all full-time limited access scallop dredge permit holders stack permits resulting in a decline in the fleet from 252 vessels to 126. After stacking, total fixed costs are assumed to decline by 24% and total trip costs by 6%. Scenario 2 assumes that only multi-boat owners stack permits. The PDT has estimated that 202 of the 252 full-time limited access scallop dredge permits were held by multi-boat owners in 2007 so the multi-boat owner fleet is assumed to decline to 101 vessels in scenario 2. The single owner fleet is assumed to remain constant at 50 vessels so the total number of boats modeled in scenario 2 was 151. Total fixed and trip costs are assumed to decline by 21% and 5%, respectively, for the boats that stack permits. All costs are assumed to remain constant for the vessels that do not stack permits. These two scenarios are the same ones that were analyzed in the economic impact section of this amendment.

The analysis is based on full-time limited access scallop dredge permit holders (category 2) that landed scallops in 2007 (Table 42). According to the Northeast dealer, permit, logbook and weighout data there were 252 category 2 permit holders with scallop landings in 2007. These vessels landed 42.867 million pounds of scallops valued at $269.3 million (about 73% of total scallop value). On trips where scallops were landed, an additional $3.566 million in revenues were earned from other species (primarily monkfish) for a total ex-vessel value of $272.897 million in 2007 from all species landed on scallop trips by category 2 permit holders.

Data

The input data is important and several different sources were used. The inputs being used include cost and earnings information from fishery stakeholders, which is very difficult to obtain. Vessel cost and earnings data used in the assessment were derived from cost models estimated by the PDT, trip cost data collected by NMFS Northeast Observer Program and fixed cost data collected from an annual NMFS' voluntary survey provided to owners when applying for a fishing permit.
A production function was developed from these data that shows the average estimated proportions of commodities, services, labor payments and income associated with one dollar of output (i.e., ex-vessel revenue) for the 252 vessels included in the analysis. The proportions were then multiplied by total gross revenues earned by the fleet ($272.897 million) and entered into the model to determine impacts under the status quo scenario (prior to stacking). All these input data are described in Table 43.

Several assumptions have to be made prior to running the model. These assumptions were developed by the PDT with input from the Scallop Advisory Panel. The Advisory panel reviewed the final assumptions and results and agreed that the assumptions are reasonable and likely close to fleet averages. The key assumptions of the model include: 1) how much specific trip and fixed costs are expected to decline after stacking; 2) how many crew members currently fish more than one permit to evaluate the number of crew loss as a result of stacking; and 3) how much would it cost to leave a vessel tied to the dock if all scallop effort was leased to another vessel. The last assumption was not integrated into the IMPLAN model results because all vessels that transferred scallop permits to another vessel were assumed to be scraped, but if a vessel decided to lease instead of stack, or stack but keep the vessel tied up, those cost savings of scraping the vessel would not be realized. The scallop advisors suggest that it costs about 25,000 dollars a year to keep a vessel tied to the dock including dock fees, hull insurance, electrical for generators, etc.

As for the first set of assumptions related to how much costs are expected to decline after stacking, the major assumptions made were related to insurance costs declining 25% when two permits are stacked, maintenance and repair costs would decline 25%, and vessel improvements would decline 50%. The industry advisors agreed with these assumptions overall, and suggested that maintenance and repair costs may even reduce 50%, and vessel improvements may only decline 33% because the one vessel will run through equipment faster. The last assumption that greatly affects the results of this analysis is the assumption about the number of crew that currently fish more than one permit. If too few crew are assumed to fish more than one permit then the expected job loss from stacking will be exaggerated, and if too many are assumed to fish on multiple vessels, then impacts will be underestimated. The assumption used for this analysis is that ¾ of all crew and captains currently fish more than one permit. The scallop advisors reported that on average this assumption is probably close to reality when all ports and businesses are combined. Several responded that 2/3rd is what their businesses do, several others have 100% of crew on more than one permit, and a few reported that some vessels still have dedicated crews that do not fish more than one permit.

Thus, 189 of the 252 full-time scallop dredge vessels in the analysis were assumed to share crew. The PDT has estimated that the average number of crew per trip is 6.75 for each scallop dredge vessel so the total number of unique crew members on vessels that share crew was assumed to be 638 (189/2 * 6.75). The remaining 63 boats that do not share crew were estimated to employ 425 crew members (63 * 6.75) for a total of 1,063 unique crew members. For the first stacking scenario (all owners stack), the total number of unique crew is assumed to decline by approximately 20% to 851. The number of vessels that share crew declines to 94.5 (189/2), but since these vessels were already sharing crew it assumed that there will be no change in the number of unique crew that are employed on these vessels (638 crew). The number of boats that do not share crew declines to 31.5 (63/2) and the crew employed on these vessels therefore declines to 213 (425/2). The total number of unique crew in the second scenario (only multi-boat owners stack) is assumed to decline by about 16% to 893. Assuming ¾ of the multi-boat owners share crew, they employ 511 unique crew members ((202*.75)/2 * 6.75) whom will be unaffected by stacking. The remaining ¼ of the multi-boat owners that do not share crew employ 341 crew (50.5 * 6.75) and after stacking these jobs are assumed to decline to 171. Since the number of crew employed on single-owner boat remains unchanged total crew jobs decline to 893 (1,063 – 171) under scenario 2.

Table 42 – Summary of input data about the scallop fishery used from 2007

Input-Output Model Landings and Revenue Data	
Scallop-Lim AC-Full Time Category 2 Permit Holders, excludes small dredge	
	2007
Number of full-time limited access scallop dredge permit holders	255
Number of full-time limited access scallop dredge permit holders with landings	252
Scallop Value ($'s)	269,330,845
Avg. Value per boat($'s)	1,068,773
Scallop Landings (lbs)	42,867,103
Avg. Scallop Landings per boat (lbs)	170,108
Avg. price/lb ($'s)	6.28
Other value ($'s)	3,566,194
Avg. Other value per boat ($'s)	14,152
Total value ($'s)	272,897,039
Avg. Total value per boat ($'s)	1,082,925

Table 43 - Status Quo Input-Output Model Cost Data

Shares from Cost Models				Status Quo Production Function	
% of Gross		Shares from observer data		Used in Analysis	
net crew share	0.35	trip costs		owner's net share	0.2200
trip costs	0.14	fuel	0.76	net crew share	0.3500
overhead & loans	0.14	oil	0.03	captain bonus	0.0500
repair/maintenance	0.10	ice	0.05	non crew labor	0.0028
owner's net share	0.22	food	0.11	fuel	0.1064
captain bonus	0.05	supplies	0.05	oil	0.0042
	1	water	0	ice	0.0070
			1	food	0.0154
		Shares from Fixed Cost Survey		supplies	0.0070
		overhead & loans		water	0.0000
		permit fees	0.01	permit fees	0.0014
		taxes	0.09	taxes	0.0128
		lease	0	lease	0.0000
		haulout	0.13	haulout	0.0185
		mooring	0.03	mooring	0.0043
		vehicle	0.05	vehicle	0.0071
		travel	0.02	travel	0.0028
		professional fees	0.02	professional fees	0.0028
		association fees	0.01	association fees	0.0014
		insurance	0.4	insurance	0.0569
		communications	0.03	communications	0.0043
		crew benefits (insurance)	0.03	crew benefits (insurance)	0.0043
		non crew labor	0.02	principal & interest on loans	0.0213
		principal & interest on loans	0.15	office	0.0014
		office	0.01	repairs	0.0508
			1	improvements	0.0469
		repairs/maintenance			1
		repairs	0.52		
		improvements	0.48		
			1		

Results

In addition to status quo (no stacking permitted) two scenarios were run: 1) everyone stacks; 2) only multi-boat owners stack. The percent of total gross revenue for each share and specific cost for a vessel for all three scenarios is summarized in Table 44 through Table 46. The input-output results are compared in Table 47. And the changes in employment for these two scenarios are described in Table 48.

The full-time limited access scallop dredge fleet contributed $566.5 million in total sales to businesses located in the Northeast regional economy in 2007, $271.1 million in personal income (wages, salaries and benefits) and supported approximately 3,129 jobs (both full and part-time) (Table 47). Scenario 1 (all owners stack) resulted in $558.0 million in total sales generated to Northeast region businesses, $284.0 million on personal income and 2,878 total jobs supported by the fishery (a decline of 252 jobs). Scenario 2 conditions (multi-boat owners stack) resulted in $559.7 million in total sales, $279.7 million in personal income and 2,930 jobs (a decline of 199 jobs). For the most part, the jobs that are expected to be lost are related to scallop harvesting (crew) and manufacturing (boat yards). New jobs will be in the finance, insurance and real estate fields as well as general services like hotels (Table 48).

These scenarios assume a relatively high amount of stacking, 100% stacking in first scenario, and 100% of multi-boat owners stack in second scenario. The PDT recognizes these are worse case type of scenarios; therefore they describe the maximum impacts expected assuming the assumptions are accurate. Therefore, if fewer vessels stack, the losses in employment would be lower, cost savings would be lower so income and profits would also be lower.

Table 44 – Status quo totals for implan model

Number of 2007 category 2 permit holders with landings		252	
Total 2007 ex-vessel revenue from trips where scallops were landed		272,897,039	
Total average ex-vessel revenue per boat		1,082,925	
		Status Quo	Status Quo
	% of total gross revenue	Avg. per boat	Fleet Total
owner's net share	0.22	238,243	60,037,349
net crew share	0.35	379,024	95,513,964
captain bonus	0.05	54,146	13,644,852
non crew labor	0.0028	3,080	776,250
fuel	0.1064	115,223	29,036,245
oil	0.0042	4,548	1,146,168
ice	0.0070	7,580	1,910,279
food	0.0154	16,677	4,202,614
supplies	0.0070	7,580	1,910,279
water	0.0000	0	0
permit fees	0.0014	1,540	388,125
taxes	0.0128	13,862	3,493,126
lease	0.0000	0	0
haulout	0.0185	20,022	5,045,626
mooring	0.0043	4,621	1,164,375
vehicle	0.0071	7,701	1,940,625
travel	0.0028	3,080	776,250
professional fees	0.0028	3,080	776,250
association fees	0.0014	1,540	388,125
insurance	0.0569	61,607	15,525,003
communications	0.0043	4,621	1,164,375
crew benefits (insurance)	0.0043	4,621	1,164,375
interest on loans	0.0087	9,421	2,374,204
principal payments	0.0126	13,681	3,447,672
office	0.0014	1,540	388,125
repairs	0.0508	55,060	13,875,046
improvements	0.0469	50,824	12,807,735
	1	1,082,925	272,897,039

Table 45 – Scenario 1 totals for implan model

Fleet size declines from 252 vessels to 126
Total fixed costs assumed to decline by 24%
Total trip costs assumed to decline by 6%

		All owners stack (single and multi-boat owners)		
Number of 2007 permit holders with landings		126		
Total 2007 ex-vessel revenue from trips where scallops were landed		272,897,039		
Total average ex-vessel revenue per boat		2,165,850		
			Avg. per boat	Fleet Total
owner's net share		0.2830	612,935	77,229,862
net crew share		0.3500	758,047	95,513,964
captain bonus		0.0500	108,292	13,644,852
non crew labor		0.0028	6,161	776,250
fuel		0.1001	216,850	27,323,106
oil		0.0040	8,560	1,078,544
ice	Trip costs assumed to decline	0.0066	14,266	1,797,573
food		0.0145	31,386	3,954,660
supplies		0.0066	14,266	1,797,573
permit fees		0.0011	2,289	288,368
taxes		0.0095	20,598	2,595,314
haulout		0.0137	29,752	3,748,787
mooring		0.0032	6,866	865,105
insurance	Fixed costs assumed to decline	0.0423	91,545	11,534,728
interest on loans		0.0065	14,017	1,766,111
principal payments		0.0094	20,313	2,559,412
repairs		0.0378	81,816	10,308,847
improvements		0.0349	75,523	9,515,858
vehicle		0.0071	15,402	1,940,625
travel		0.0028	6,161	776,250
professional fees		0.0028	6,161	776,250
association fees		0.0014	3,080	388,125
communications		0.0043	9,241	1,164,375
crew benefits (insurance)		0.0043	9,241	1,164,375
office		0.0014	3,080	388,125
		1	2,165,850	272,897,039

Table 46 – Scenario 2 totals for implan model

Fleet size declines from 252 vessels to 151

- Multi-boat owner fleet assumed to decline from 202 to 101 vessels
- No change in single owner boats remains at 50 vessels

Total fixed costs assumed to decline by 21% for stacked vessels

Total trip costs assumed to decline by 5% for stacked vessels

		Multi-boat owner fleet declines to 101			Single owner fleet remains at 50 vessels		
Number of 2007 permit holders with landings		101			50		
Total 2007 ex-vessel revenue from trips where scallops were landed		218,750,801			54,146,238		
Total average ex-vessel revenue per boat		2,165,850			1,082,925		
			Avg. per boat	Fleet Total		Avg. per boat	Fleet Total
owner's net share		0.2737	592,858	59,878,657	0.2200	238,243	11,912,172
net crew share		0.3500	758,047	76,562,780	0.3500	379,024	18,951,183
captain bonus		0.0500	108,292	10,937,540	0.0500	54,146	2,707,312
non crew labor		0.0028	6,161	622,232	0.0028	3,080	154,018
fuel		0.1014	219,615	22,181,156	0.1064	115,223	5,761,160
oil		0.0040	8,669	875,572	0.0042	4,548	227,414
ice	**Trip costs assumed to decline**	0.0067	14,448	1,459,287	0.0070	7,580	379,024
food		0.0147	31,786	3,210,431	0.0154	16,677	833,852
supplies		0.0067	14,448	1,459,287	0.0070	7,580	379,024
permit fees		0.0011	2,398	242,240	0.0014	1,540	77,009
taxes		0.0100	21,586	2,180,157	0.0128	13,862	693,081
haulout		0.0144	31,179	3,149,116	0.0185	20,022	1,001,116
mooring		0.0033	7,195	726,719	0.0043	4,621	231,027
insurance	**Fixed costs assumed to decline**	0.0443	95,937	9,689,588	0.0569	61,607	3,080,358
interest on loans		0.0068	14,689	1,483,597	0.0087	9,421	471,072
principal payments		0.0098	21,287	2,149,999	0.0126	13,681	684,062
repairs		0.0396	85,741	8,659,804	0.0508	55,060	2,752,985
improvements		0.0365	79,145	7,993,665	0.0469	50,824	
vehicle		0.0071	15,402	1,555,581	0.0071	7,701	385,045
travel		0.0028	6,161	622,232	0.0028	3,080	154,018
professional fees		0.0028	6,161	622,232	0.0028	3,080	154,018
association fees		0.0014	3,080	311,116	0.0014	1,540	77,009
communications		0.0043	9,241	933,348	0.0043	4,621	231,027
crew benefits (insurance)		0.0043	9,241	933,348	0.0043	4,621	231,027
office		0.0014	3,080	311,116	0.0014	1,540	77,009
		1	2,165,850	218,750,801	1	1,082,925	51,605,021

Table 47 – Input Output model results

Status quo (252 boats)

		Value to Northeast Region Economy		
	Operating Structure ($'s)	Sales ($'s)	Income ($'s)	Jobs
Scallop harvesting		272,897,039	169,972,414	1,063
Fleet operating expenditures	102,924,625	124,126,291	45,032,434	806
Income				
Captains	27,289,704	27,797,345	9,235,932	210
Owners	60,037,349	55,377,550	18,399,716	417
Crew members	81,869,112	85,275,993	28,102,145	625
Non-crew labor	776,250	1,044,504	346,206	8
	272,897,039	566,518,722	271,088,847	3,129

Scenario 1 - all owners stack (126 boats)

		Value to Northeast Region Economy		
	Operating Structure ($'s)	Sales ($'s)	Income ($'s)	Jobs
Scallop harvesting		272,897,039	187,164,928	851
Fleet Operating Expenditures	85,732,111	102,142,165	36,703,282	663
Income				
Captains	27,289,704	27,264,649	8,363,507	190
Owners	77,229,862	71,235,672	23,668,726	537
Crew members	81,869,112	83,392,032	27,707,794	629
Non-crew labor	776,250	1,044,504	346,206	8
	272,897,039	557,976,061	283,954,443	2,878

Scenario 2 - multi-boat owners stack (151 boats)

		Value to Northeast Region Economy		
	Operating Structure ($'s)	Sales ($'s)	Income ($'s)	Jobs
Scallop harvesting		272,897,039	181,725,895	893
Fleet operating expenditures	91,171,144	109,066,614	39,319,160	708
Income				
Captains	27,289,704	34,819,852	11,774,837	194
Owners	71,790,829	66,218,785	22,001,818	499
Crew members	81,869,112	97,695,920	32,957,759	628
Non-crew labor	776,250	1,044,503	346,205	8
	272,897,039	559,685,370	279,715,724	2,930

Table 48 – Employment contributions by industry type

		Scenario 1		Scenario 2	
	Status Quo	All Stack		Multi-Boat Owner Stack	
Scallop harvesting (crew)	1,063	851	(-212)	893	(-170)
Agriculture	14	13	(0)	13	(0)
Mining	20	19	(-1)	19	(-1)
Construction	0	0	(0)	0	(0)
Manufacturing	907	850	(-57)	866	(-41)
Transportation, communications and public utilities	81	78	(-3)	79	(-2)
Retail and wholesale trade	87	86	(-1)	86	(-1)
Finance, insurance and real estate	92	101	(+9)	99	(+7)
Services	866	879	(+13)	876	(+10)
	3,129	2,877	(-252)	2,930	(-199)

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1.7 APPENDIX – ECONOMIC MODEL

1.7.1 ESTIMATION OF PRICES, COSTS, PROFITS AND NATIONAL BENEFITS

The economic model includes an ex-vessel price equation, a cost function and a set of equations describing the consumer and producer surpluses. The ex-vessel price equation is used in the simulation of the ex-vessel prices, revenues, and consumer surplus 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 set of equations also includes the definition of the consumer surplus, producer surplus, profits to vessels, and total economic benefits.

1.7.2 Estimation of annual ex-vessel prices

Fish prices constitute one of the important channels through which fishery management actions affect fishing revenues, vessel profits, consumer surplus, and net economic benefits for the nation. The degree of change in ex-vessel price in response to a change in variables affected by management, i.e., scallop landings and meat count, is estimated by a price model, which also takes into account other important determinants of price, such as disposable income of consumers and price of imports.

Given that there could be many variables that could affect the price of scallops, it is important to identify the objectives in price model selection for the purposes of cost-benefit analyses. These objectives (in addition to developing a price model with sound statistical properties) are as follows:

- To develop a price model that uses inputs of the biological model and available data. Since the biological model projects annual (rather than monthly) landings, the corresponding price model should be estimated in terms of annual values.
- To select a price model that will predict prices within a reasonable range without depending on too many assumptions about the exogenous variables. For example, the import price of scallops from Japan could impact domestic prices differently than the price of Chinese imports, but making this separation in a price model would require prediction about the future import prices from these countries. This in turn would complicate the model and increase the uncertainty regarding the future estimates of domestic scallop prices.

In the past SAFE reports and Scallop Amendment and Frameworks, the average ex-vessel price for scallops was estimated from an annual price model as a function of total landings, average meat count of scallops landed, disposable income of consumers, and average import prices. Collection of price data by market category of scallops since 1998, however, made it possible to improve the price model by taking into account the changes in the size composition of scallops. The composition of scallops changed significantly in the last ten years toward larger sizes as a result of effort-reduction measures, area closures, and an increase in ring sizes implemented by the Sea Scallop FMP. The share of U10’s increased to 27% in 2007 from 7% in 2000 and the share of count 11-20 scallops increased from 18% in 2000 to over 50% in 2007 (Table 49).

The scallop price by market category is affected by the relative abundance or supply of that size category relative to total scallop landings. Until the 2005 fishing year, U10 scallops had a significant price premium, but as their supply in landings increased, the difference in the annual average price of U10’s and other size categories declined and in 2006, average price of U10s actually was lower than the price for other size categories (Table 50). The price model developed originally for Framework 18 captured these changes by estimating the prices by major meat count categories and including the relative share of each category in total supply of scallops as an explanatory variable.

Table 49. Composition of scallop landings by market category

Year	U10	11 to 20	21 to 30	Over 30	Unknown
2000	7%	18%	44%	20%	10%
2001	3%	24%	49%	11%	13%
2002	5%	15%	65%	4%	11%
2003	6%	21%	56%	3%	13%
2004	7%	41%	42%	2%	8%
2005	13%	57%	21%	2%	7%
2006	23%	52%	18%	1%	6%
2007*	27%	51%	13%	3%	5%

*Preliminary values

Table 50. Average annual price of scallops by market category (2006 prices)

Year	U10	11 to 20	21 to 30	Over 30	Unknown
2000	8.0	6.2	5.4	5.5	5.9
2001	6.6	4.3	4.0	4.3	4.2
2002	6.1	4.4	4.1	4.7	4.3
2003	5.2	4.4	4.4	4.8	4.3
2004	6.2	5.3	5.0	5.2	4.9
2005	8.0	7.9	7.7	7.6	7.7
2006	6.0	6.7	6.9	6.9	6.1
2007*	6.7	6.4	6.3	5.8	6.1

*Preliminary values

In addition to the changes in size composition and landings of scallops, other determinants of ex-vessel price include level of imports, import price of scallops, disposable income of seafood consumers, and the demand for U.S. scallops by other countries. The main substitutes of sea scallops are the imports from Canada, which are almost identical to the domestic product, and imports from other countries, which are generally smaller in size and less expensive than the domestic scallops. An exception is the Japanese imports, which have a price close to the Canadian imports and could be a close substitute for the domestic scallops as well.

The ex-vessel price model estimated below includes the price, rather than the quantity of imports as an explanatory variable, based on the assumption that the prices of imports are, in general, determined exogenously to the changes in domestic supply. This is equivalent to assuming that the U.S. market conditions have little impact on the import prices. An alternative model would estimate the price of imports according to world supply and demand for scallops, separating the impacts of Canadian and Japanese imports from other imports since U.S. and Canadian markets for scallops, being in proximity, are highly connected and Japanese scallops tend to be larger and closer in quality to the domestic scallops. The usefulness of such a simultaneous equation model is limited for our present purposes, however, since it would be almost impossible to predict how the landings, market demand, and other factors such as fishing costs or regulations in Canada or Japan and in other exporting countries to the U.S. would change in future years.

Since the average import price is equivalent to a weighted average of import prices from all countries weighted by their respective quantities, the import price variable takes into account the change in composition of imports from Canadian scallops to less expensive smaller scallops imported from other countries. This specification also prevents the problem of multi-colinearity among the explanatory variables, i.e., prices of imports from individual countries and domestic landings. In terms of prediction of future ex-vessel prices, this model only requires assignment of a value for the average price of imports, without assuming anything about the composition of imports, or the prices and the level of imports from individual countries. The economic impact analyses of the fishery management actions usually evaluate the impact on ex-vessel prices by holding the average price of imports constant. The sensitivity of the results affected by declining or increasing import prices could also be examined, however, using the price model presented in this section.

The price model presented below estimates annual average scallop ex-vessel price by market category (PEXMRKT) as a function of

- Meat count (MCOUNT)
- Average price of all scallop imports (PIMPORT)
- Per capita personal disposable income (PCDPI)
- Total annual landings of scallop minus exports (SCLAND-SCEXP)
- Percent share of landings by market category in total landings (PCTLAND)
- A dummy variable as a proxy for price premium for Under 10 count scallops (DU10).

Because the data on scallop landings and revenue by meat count categories were mainly collected since 1998 through the dealers' database, this analysis included the 1999-2005 period and five meat categories shown in Table 53. All the price variables were corrected for inflation and expressed in 2004 prices by deflating current levels by the consumer price index (CPI) for food. The ex-vessel prices are estimated in semi-log form to restrict the estimated price to positive values only as follows:

Log (PEXMRKT) = f(MCOUNT, PIMPORT, PCDPI, SCLAND-SCEXP, PCTLAND, DU10)

The coefficients of this model are shown in Table 52. The estimated model provided a good fit to the actual data for annual ex-vessel prices as Table 51 indicates. The F-test shows that the overall relation is statistically significant ($P<0.0001$), meaning that the explanatory variables as a whole have a significant influence on ex-vessel price. Adjusted R^2 indicates that changes in meat count, composition of landings by size of scallops, domestic landings net of exports, average price of all imports, disposable income, and price premium on under 10 count scallops explain 87 percent of the variation in ex-vessel prices by market category. Figure 2 and Table 53 also verify that the estimated values of ex-vessel prices closely track the actual values.

Table 51. Regression results for price model

Regression Statistics			
Multiple R	0.94		
R Square	0.89		
Adjusted R Square	0.87		
Standard Error	0.08		
Observations	35		
ANOVA			
	Degrees of Freedom	**Sum of Squares**	**Significance F**
Regression	6	1.54	P<0.0001
Residual	28	0.19	
Total	34	1.73	

Table 52. Coefficients of the Price Model

Variables	Coefficients	Standard Error	t Stat
INTERCEPT	-2.2597	0.7736	-2.9210
MCOUNT	-0.0049	0.0014	-3.3897
PIMPORT	0.0247	0.0678	0.3639
PCDPI	0.0478	0.0090	5.2981
SCLAND-SCEXP	-0.0251	0.0052	-4.8596
DU10	0.0649	0.0525	1.2352
PCTLAND	-0.3084	0.0843	-3.6565

All of coefficients of the explanatory variables have the expected sign, and they are statistically significant at least at the 5% level of significance, except for price of imports, and dummy variable for under-10 count scallops, which were kept in the model for theoretical reasons. There has been little change in import prices during the period of analysis (1999-2005) compared to other variables explaining price, which explains the low t-statistics for this variable. When the scallop price model included a longer time-series (1982 on) as presented in the SAFE 2000 report and later in Amendment 10, FEIS, the coefficient for the import price was statistically significant. The dummy variable, reflecting the price premium on under 10 count scallops, however, is statistically significant at the 22% level,.

In summary, these empirical results verify that the ex-vessel price of scallops is related inversely to the domestic supply, net of exports, and an increase as landings decrease or a decrease as landings increase. The price per pound of scallops is expected to increase as the meats per pound decrease. A negative sign for the meat count variable (MCOUNT) indicates that when other factors held constant, the price increased with the size of scallops. On the other hand, scallop price by market category is affected by the relative abundance or supply of that size category relative to total scallop landings. The negative sign for PCTLAND indicates that it is possible for smaller scallops to command a similar or even higher price in some circumstances if their supply declines to the scarcity levels in domestic markets. Positive sign and relatively high t-statistics for per capita income imply that an increase in the income of consumers will have a positive impact on the price of scallops for all market categories.

Overall, the model was successful in estimating average prices by market category during the 1998–2004 period, with a 3% difference at most from the actual price (Table 53). Similarly, predicted scallop price as an average of all market categories tracked very closely the actual annual price for scallops, with negligible differences from actual values in any single year. These numerical results should be interpreted with caution, however, since the analysis covers only 7 years of annual data from a period during which the scallop fishery underwent major changes in management policy including area closures, controlled access, and rotational area management. For Amendment 15 analyses, this price model will be updated using the most recent data for the period from 1999 to 2008.

Figure 2. Actual and predicted annual ex-vessel price

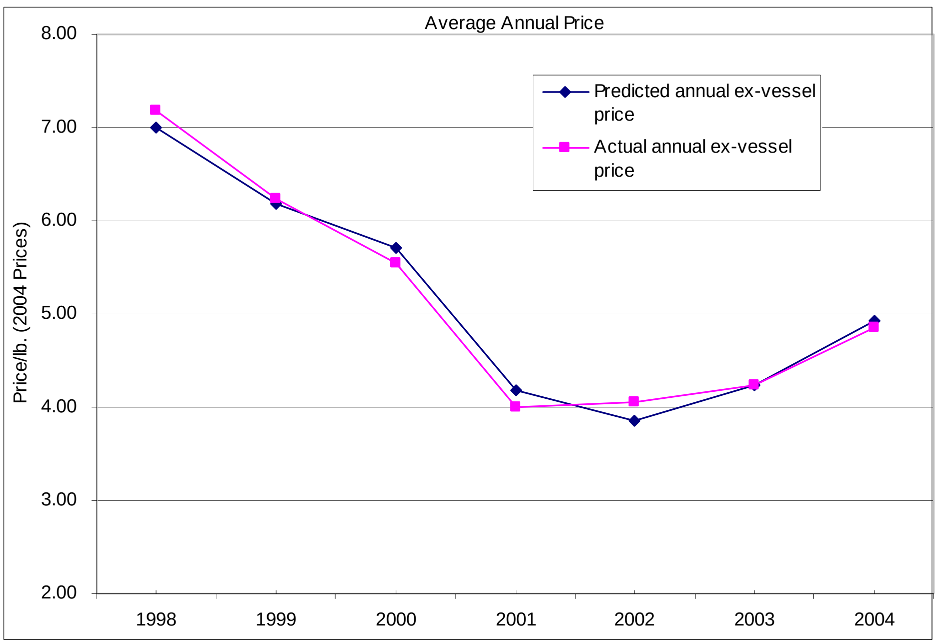


Table 53. Average predicted and actual ex-vessel price during 1998-2004

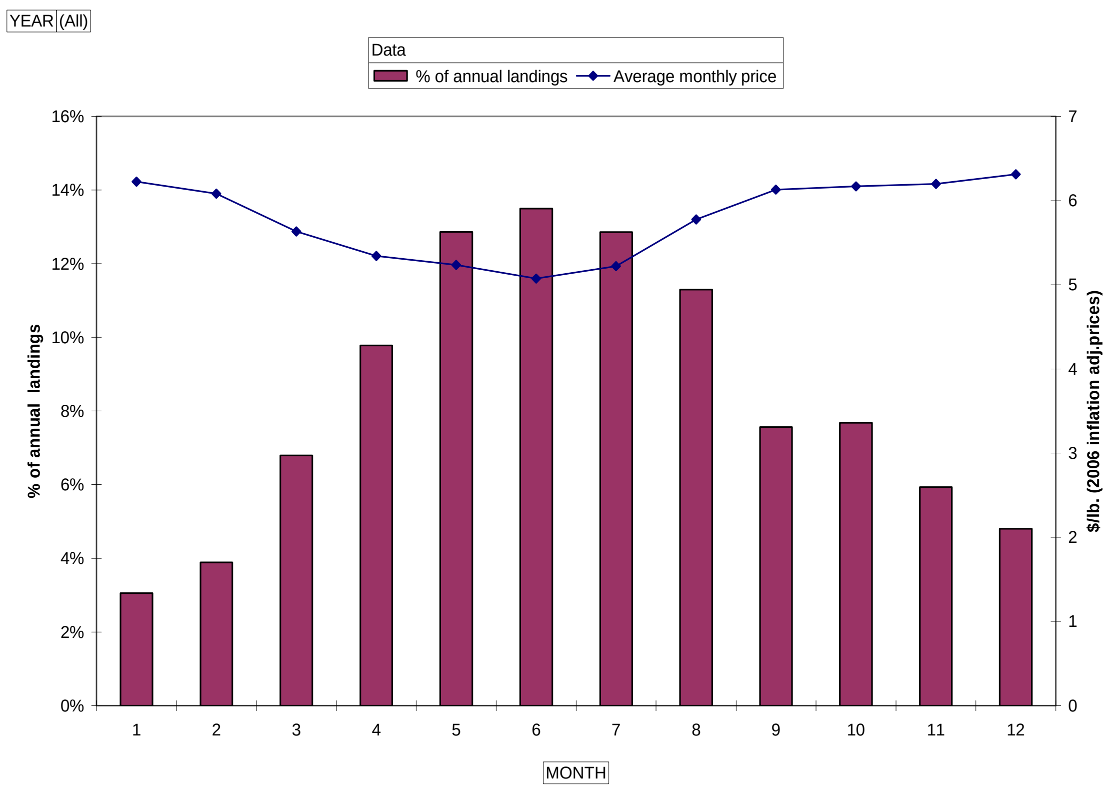
Market Size Category	Actual Price	Predicted Price	Percent Difference
Under 10 count	6.47	6.37	-1.6%
11-20 count	5.40	5.55	2.9%
21-30 count	5.08	4.93	-3.0%
31-40 count	5.17	5.21	0.8%
41 plus count	5.05	5.04	-0.3%

1.7.3 Monthly Price Model

In addition to the annual price model, the economic model includes a monthly price model developed to analyze the impacts of derby fishing and access area management. This model estimates ex-vessel prices by market size category using the monthly dealer data for 1999–2007 (up to September 2007) and takes into account the effect of the change in composition of landings, the changes in exports, import prices, and disposable income of consumers on monthly scallop prices.

In general, ex-vessel prices are lower during the months in early spring and summer as scallop landings increase during these months. Figure 3 shows this seasonal relationship between the seasonal composition of landings and the average price for scallops for the last 8 years. Scallop prices usually begin to decline from their high levels in January until the months of June to July, and then begin increasing as scallop landings decline in the fall and winter months.

Figure 3. Monthly composition of scallop landings and average ex-vessel price in 2006 inflation adjusted prices (1999-2006 average)



The monthly changes in prices differ from these average patterns, however, as a result of changes in landings and other factors that determine prices. Comparison of monthly data for 2006 and 2007 provide insight about these monthly patterns. For example, during June and July in 2006, the average price of scallops declined sharply as scallop landings that were mostly composed of larger scallops increased significantly during these months (Figure 4). In contrast, there was not a significant decline in ex-vessel prices in the summer of 2007, because landings were more or less evenly distributed from March to August compared to landings during these months in 2006 (Figure 5). During March of 2007, however, ex-vessel prices declined by more than 20% compared to the previous months, from about $7.96 per pound in February to about $6.12 per pound in March due to the large amount of landings from the Elephant Trunk area.

Figure 4. Scallop landings and ex-vessel price (in 2006 inflation adjusted prices) by month in 2006

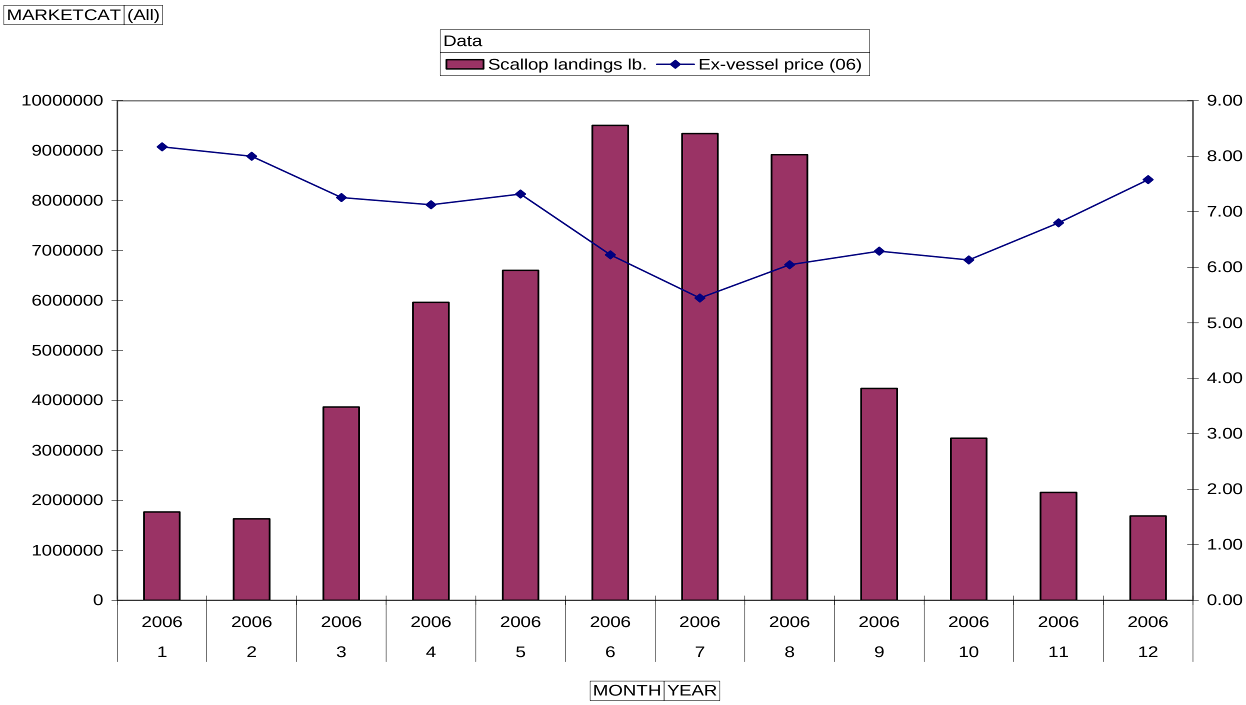
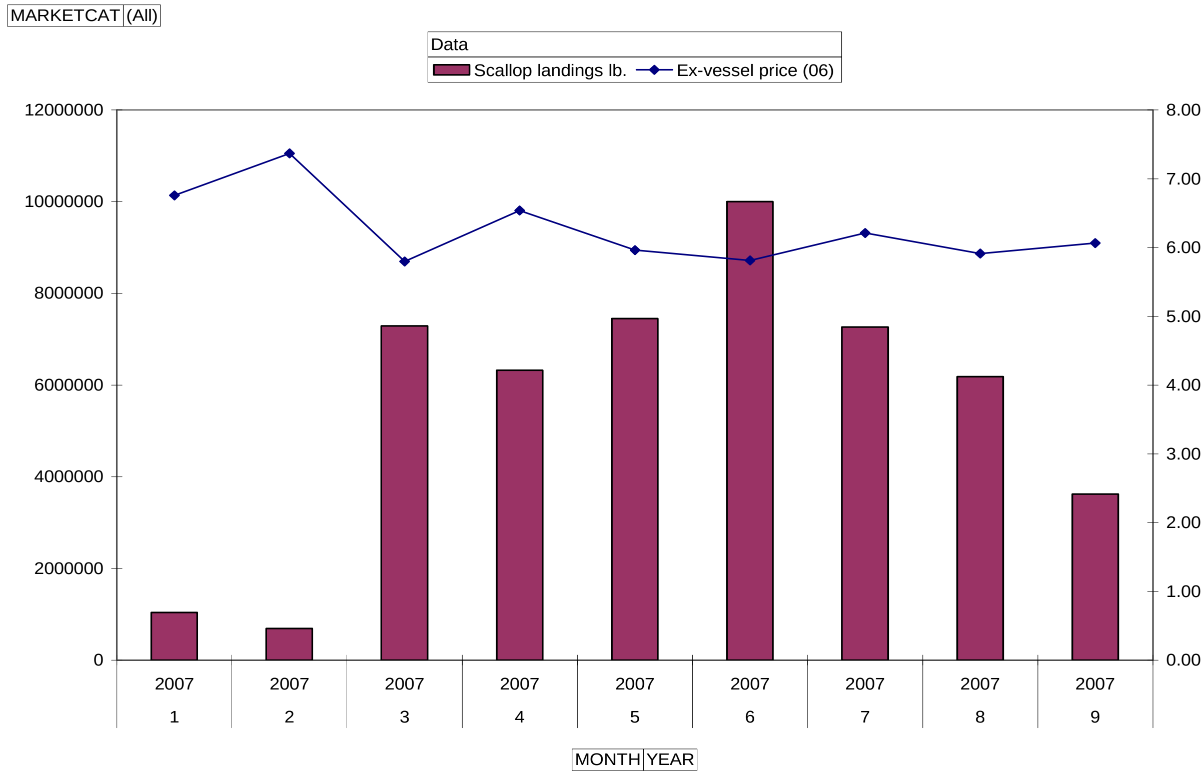


Figure 5. Scallop landings and ex-vessel price (in 2006 inflation adjusted prices) by month in 2007



These examples indicate that the rotational area management could have important impacts on prices, revenues, and the profits of fishermen. Even though larger scallops have a higher price, their prices also vary inversely with their share in the monthly scallop landings (Table 54). For example, in 2006 the *average* annual price of U10 scallops was lower than the average annual prices of smaller scallops because of the changes in the seasonal composition of scallops. Table 54 shows that until May 2006, when U10 scallops comprised less than 15% of the total supply, their price exceeded the prices of smaller scallops. During the months of June and July of 2007, however, landings of U10 scallops increased dramatically, comprising respectively 43% and 66% of the total scallop landings during these months. This influx of U10s reduced their price below the price of smaller scallops. After the month of August, however, U10's once again commanded a price premium as their supplies declined below 8% of the total scallop landings.

Table 54. Composition of landings and ex-vessel price by market category in 2006

Data	Market category	Month 1	2	3	4	5	6	7	8	9	10	11	12	Total
% of Monthly landings	<=10 count	5%	5%	6%	10%	14%	43%	66%	16%	8%	6%	6%	5%	16%
	11-20 count	63%	75%	53%	56%	66%	49%	28%	78%	67%	51%	49%	37%	56%
	21-30 count	30%	19%	40%	34%	19%	8%	6%	6%	23%	42%	42%	52%	27%
	>30 count	2%	1%	1%	0%	1%	1%	0%	0%	1%	2%	3%	6%	2%
Price (in 2006 inflation adj. prices)	<=10 count	8.9	8.5	8.0	7.6	7.5	5.8	5.3	6.2	6.7	7.1	8.1	8.2	7.3
	11-20 count	8.2	8.0	7.4	7.1	7.4	6.5	5.6	6.0	6.2	6.2	6.8	7.9	6.9
	21-30 count	8.0	8.1	7.2	7.1	7.3	6.9	6.4	6.4	6.5	5.9	6.6	7.4	7.0
	>30 count	8.4	8.2	7.3	7.3	7.5	6.8	6.4	6.7	6.7	5.9	6.4	7.1	7.1

In addition to the changes in size composition and landings of scallops, other determinants of ex-vessel price include the level of imports, the import price of scallops, disposable income of seafood consumers, and the demand for U.S. scallops by other countries measured by the quantity of exports.

The price model presented below estimates annual average scallop ex-vessel price by market category (PEXMRKT) as a function of

- Meat count (MCOUNT)
- Average monthly price of all scallop imports (PIMPORT)
- Per capita monthly personal disposable income (PCDPI)
- Total monthly scallop landings (in million lb.)
- Total monthly exports (in million lb.)
- Percent share of landings by market category in total monthly landings (PCTLAND)
- A dummy variable for 2005 (D2005)
- Lagged ex-vessel price (PEXMRKT1)

Because relatively reliable data on scallop landings and revenue by meat count categories were mainly collected since 1999 through the dealers' database, this analysis includes the 1999-2007 period and four meat categories shown in Table 56. All the price variables are corrected for inflation and expressed in 2006 prices by deflating current levels by the consumer price index (CPI) for food. The ex-vessel prices are estimated in semi-log form to restrict the estimated price to positive values only as follows:

Log (PEXMRKT) = f(MCOUNT, PIMPORT, PCDPI, SCLAND, SCEXP, PCTLAND, D2005, PEXMRKT1)

The coefficients of this model are shown in Table 55. The estimated model provides a good fit to the actual data for annual ex-vessel prices as Figure 6 indicates. The F-test shows that the overall relation is statistically significant (P<0.0001), meaning that the explanatory variables as a whole have a significant influence on ex-vessel price. Adjusted R^2 indicates that changes in meat count, composition of landings by size of scallops, domestic landings net of exports, average price of all imports, disposable income, explain 88 percent of the variation in ex-vessel prices by market category. Figure 6 and Table 56 also verify that the estimated values of ex-vessel prices closely track the actual values.

Table 55. Estimates (GLM) for price model

Dependent Variable	LNPRICE
N	418
Multiple R	0.942
Squared Multiple R	0.887
Adjusted Squared Multiple R	0.885
Standard Error of Estimate	0.085

Analysis of Variance

Source	Type III SS	df	Mean Squares	F-ratio	p-value
Regression	23.179	8	2.897	400.832	0.000
Residual	2.956	409	0.007		

Regression Coefficients B = (X'X)$^{-1}$X'Y

Effect	Coefficient	Standard Error	Std. Coefficient	Tolerance	t	p-value
CONSTANT	0.707	0.128	0.000	.	5.521	0.000
PEXMRKT1	0.119	0.004	0.715	0.454	28.974	0.000
PIMPORT	0.039	0.005	0.142	0.712	7.219	0.000
MCOUNT	-0.002	0.000	-0.092	0.801	-4.951	0.000
PCTLAND	-0.099	0.019	-0.093	0.887	-5.253	0.000
PCDPI	0.003	0.001	0.075	0.259	2.296	0.022
SCLAND	-0.018	0.002	-0.164	0.570	-7.436	0.000
SCEXP	0.030	0.011	0.092	0.226	2.642	0.009
D2005ONLY	0.050	0.015	0.064	0.738	3.297	0.001

Figure 6. Estimated and predicted prices ex-vessel price of scallops

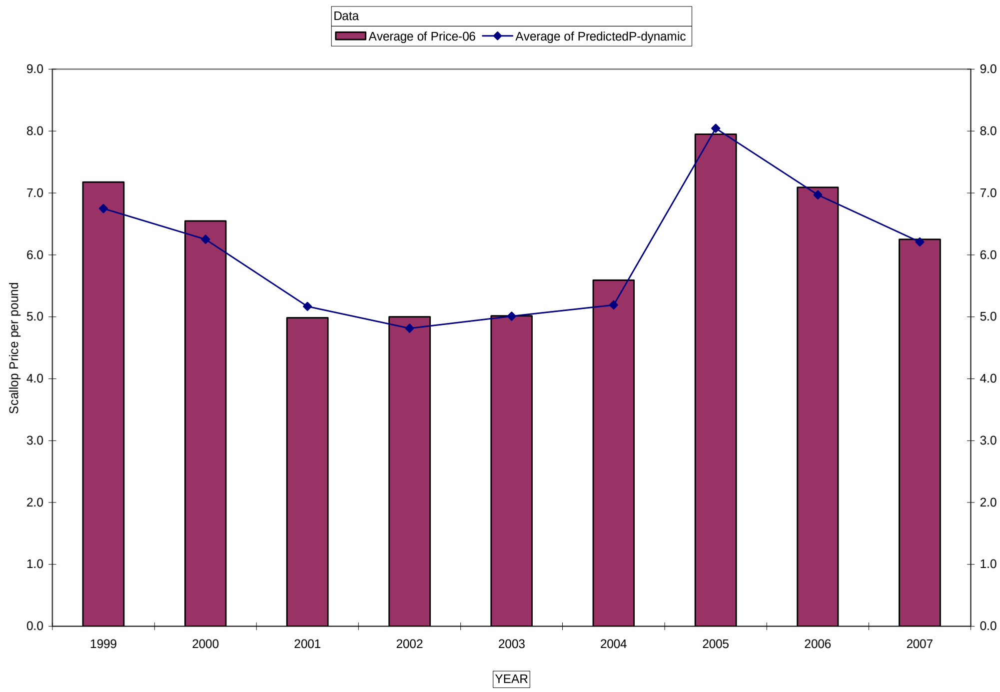


Table 56. Actual and predicted prices as an average of 1999-2007 monthly prices.

MARKETCAT	Price (06)	Predicted price (06)	% Difference of predicted from actual price
<=10 count	7.2	7.1	-1.4%
11-20 count	6.0	6.0	0.0%
21-30 count	5.8	5.6	-3.4%
>30 count	5.7	5.5	-3.5%
Grand Total	6.2	6.0	-1.4%

These numerical results should be interpreted with caution, however, since the analysis covers only 8 years of annual data from a period during which the scallop fishery underwent major changes in management policy including area closures, controlled access, and rotational area management.

A simulation model is constructed to analyze the impacts of the changes in the monthly composition of landings on annual prices. For example, Table 57 shows a rather extreme scenario when a major proportion of scallops (25%) are landed in March and April and the landings during the summer months are reduced by more than 50%. A simulation of prices based on the monthly price model indicates that the average annual price could have declined by as much as 9% (in 2005 for example) if such a shift in the seasonal composition of landings occurred. It must be cautioned, however, that the model assumes that the size composition of landings is independent of the amount of monthly landings --although the model could be used with different assumptions regarding the composition of scallops by market category for each month. It could be also possible to extend the model to include such changes in future research.

Table 57. Monthly composition of landings

Month	Simulation	Average for 1999-2006
1	3.05%	3.05%
2	3.89%	3.89%
3	25.00%	6.79%
4	25.00%	9.78%
5	10.00%	12.86%
6	5.00%	13.50%
7	5.00%	12.86%
8	5.00%	11.29%
9	5.00%	7.56%
10	5.00%	7.68%
11	5.00%	5.93%
12	3.06%	4.80%

Table 58. Change in annual prices

YEAR	SIMPRICE	Average of Predicted P-dynamic	Average of Annual land	% Change Price
1999	6.6	6.7	22.31	-1.2%
2000	6.0	6.1	32.24	-0.7%
2001	4.9	5.1	46.69	-4.4%
2002	4.5	4.7	52.67	-5.4%
2003	4.6	4.8	56.04	-3.6%
2004	4.7	5.1	64.19	-8.0%
2005	6.8	7.5	56.62	-9.4%
2006	6.3	6.5	58.94	-4.1%

1.7.4 Estimation of trip costs

1.7.5 Trip Costs

Data for variable costs, i.e., trip expenses include food, fuel, oil, ice, water and supplies. The trip costs per day-at-sea (ffiwospda) is postulated to be a function of vessel crew size (CREW), vessel size in gross tons (GRT), fuel prices (FUELP), and dummy variables for trawl (TRW) and small dredge (DFT) vessels. This cost equation was assumed to take a double-logarithm form and estimated with data obtained from observer database. The empirical equation presented in Table 59 estimated more than 70% of the variation in trip costs and has proper statistical properties. Table 60 shows the estimated model for the fuel costs with similar statistical properties.

Table 59. Estimation of total trip costs per DAS used

The MODEL Procedure

Nonlinear GMM Summary of Residual Errors

Equation	DF Model	DF Error	SSE	MSE	R-Square	Adj R-Sq	Durbin Watson
lnffiwospda	6	206	24.9349	0.1210	0.7159	0.7090	1.8100

Nonlinear GMM Parameter Estimates

Parameter	Estimate	Approx Std Err	t Value	Approx Pr > |t|
intc	3.991271	0.3129	12.76	<.0001
grtco	0.286919	0.0499	5.75	<.0001
crewco	0.632637	0.1411	4.48	<.0001
dftco	-0.27828	0.0794	-3.51	0.0006
trwco	-0.39799	0.1559	-2.55	0.0114
fuelpco	0.84357	0.0846	9.97	<.0001

Table 60. Estimation of fuel costs per DAS used

The MODEL Procedure

Nonlinear GMM Summary of Residual Errors

Equation	DF Model	DF Error	SSE	MSE	R-Square	Adj R-Sq	Durbin Watson
lnfuelcpda	6	205	25.7857	0.1258	0.7235	0.7168	1.9435

Nonlinear GMM Parameter Estimates

Parameter	Estimate	Approx Std Err	t Value	Approx Pr > |t|
intc	3.605563	0.3133	11.51	<.0001
grtco	0.32617	0.0504	6.47	<.0001
dftco	-0.33534	0.0865	-3.88	0.0001
trwco	-0.18154	0.0955	-1.90	0.0588
crewco	0.389788	0.1383	2.82	0.0053
fuelpco	1.248935	0.0834	14.98	<.0001

Table 61. Comparison of actual and estimated values for trip costs

		Year			
		2005	2006	2007	2008
Estimated trip costs per DAS		1483.39	1445.47	1603.01	1896.45
Actual trip costs per DAS		1306.36	1672.22	1684.29	2094.69
% Difference		15.46	-8.16	-2.48	-1.94
DAS per trip		11.29	9.36	11.00	10.50
LPUE	Mean	2143.67	1365.38	1229.04	1158.69
Actual fuel costs per DAS		939.45	1265.24	1284.92	1703.74
Estimated fuel costs per DAS		1034.55	1022.35	1182.27	1545.78
% Difference		14.42	-12.15	-5.31	-0.61
Fuel price (06)		2.08	2.16	2.33	3.15
GRT	Mean	163.14	146.91	167.64	124.00
HP	Mean	857.00	897.55	1025.07	507.25
LEN	Mean	82.41	80.64	86.01	76.13
Built	Mean	1981.00	1989.18	1982.50	1976.25
% Fuel		0.72	0.75	0.77	0.81
% Fuel Predicted cpred		0.70	0.70	0.74	0.81
N		7.00	11.00	14.00	4.00

1.7.6 Estimation of fixed costs

The fixed costs include those expenses that are not usually related to the level of fishing activity or output. These are insurance, maintenance, license, repairs, office expenses, vessel improvement, professional fees, dues, and utility, interest, communication costs, association fees and dock expenses. The data on these items are obtained from the 2006-07 Cost Survey data. The data included 196 observations and the fixed costs are estimated by using the 97 observations for vessels with dredge and trawl gear. Because the data on communications costs and association fees were missing for most observations, these costs were not included in the estimation but their average values for the scallop vessels were added on to fixed costs.

The following model is based on stepwise regression and estimates fixed costs as a function of length, year built, horse power and a dummy variable for boats that have multispecies permit.

Table 62. Estimation of fixed costs

The MODEL Procedure

Nonlinear GMM Summary of Residual Errors

Equation	DF Model	DF Error	SSE	MSE	Root MSE	R-Square	Adj R-Sq	Durbin Watson
lnfc	5	92	25.7672	0.2801	0.5292	0.5253	0.5047	2.3358

Nonlinear GMM Parameter Estimates

Parameter	Estimate	Approx Std Err	t Value	Approx Pr > |t|
intc	-261.633	85.2438	-3.07	0.0028
lenco	1.335278	0.2650	5.04	<.0001
bltco	35.10611	11.2451	3.12	0.0024
d10co	-0.30008	0.1252	-2.40	0.0186
hpco	0.236827	0.1588	1.49	0.1392

Table 63. Actual and predicted value of fixed costs for FT dredges: Annual average per vessel; Costs are in 2006 inflation adjusted prices.

DATA		year 2006	year 2007
N		25.00	12.00
Fixed costs/vessel		238480.88	236607.88
Predicted fixed cost		244971.88	203595.90
LENGTH	Mean	81.40	76.61
HP	Mean	867.24	577.08
GRT	Mean	154.00	131.50
Hull+Liability Insurance		62121.44	54461.83
Repairs and Maint.		47054.52	72271.92
Improvement Costs		71940.50	66275.00
Other Costs		103194.16	82481.69

Table 64. Average association fee and communication costs by vessel size

	Average annual association fee	Average annual Communication Costs
All Vessels	1610	3446
Large (>=80 feet)	1895	3939
Medium (<80 feet)	1459	3185

1.7.7 Profits and crew incomes

As it is well known, the net income and profits could be calculated in various ways depending on the accounting conventions applied to gross receipts and costs. The gross profit estimates used in the economic analyses in the FSEIS simply show the difference of gross revenue over variable (including the crew shares) and fixed expenses rather than corresponding to a specific accounting procedure. It is in some ways similar to the net income estimated from cash-flow statements since depreciation charges are not subtracted from income because they are not out-of-pocket expenses.

Gross profits per vessel are estimated as the boat share (after paying crew shares) minus the fixed expenses such as maintenance, repairs and insurance (hull and liability). Based on the input from the scallop industry members and Dan Georgianna on the lay system, the profits and crew incomes are estimated as follows:

- The association fees, communication costs and a captain bonus of 5% are deducted from the gross stock to obtain the net stock.
- Boat share is assumed to be 48% and the crew share is assumed to be 52% of the net stocks.
- Profits are estimated by deducting fixed costs from the boat share.
- Net crew income is estimated by deducting the trip costs from the crew shares.

1.7.8 Changes in Revenues, Costs, profits and crew incomes

Table 65. Costs, revenues, crew income and profits (all the values are in 2006 inflation adjusted prices)

Data	1999	2007
Scallop landings per vessel(lb.)	103,954	167,831
Scallop revenue per vessel	695,934	1,074,625
Fixed costs per vessel	228,815	246,567
Total trip costs per vessel	86,285	155,056
Shared costs: Communications cost+ Association fees+captain's bonus	40,284	59,148
DAS used per vessel	105	95
Trip costs per DAS	822	1,640
Length	84	82
GRT	161	155
Horse Power	857	837
LPUE	1,149	1,817
Fuel price	0.96	2.30
Ex-vessel price/lb.	6.69	6.40
Fuel cost per DA	406	1168
Fuel cost/Trip cost	0.50	0.71
Number of vessels	168	234

Note: For fcgrp<=0.50 23 obs in 1999 and 9 in 2007 are eliminated.

Table 66. Percentage share of costs, profits and crew income in gross stock

Year	Data	Scenario A Out of boat share	Scenario B Out of Gross stock
1999 (Crew share=55% of gross stock)	Net Crew income	296,478	274,322
	Profits	44,071	66,227
	% of Gross Stock (Scallop revenue)		
	Trip costs	13%	13%
	Shared costs	6%	6%
	Fixed costs	34%	34%
	Profits	5%	9%
	Net Crew income	42%	39%
	Total	100%	100%
2007 (Crew share=52% of gross stock)	Net Crew income	403,748	372,992
	Profits	210,104	240,862
	Trip costs	15%	15%
	Shared costs	6%	6%
	Fixed costs	24%	24%
	Profits	19%	22%
	Net Crew income	37%	34%
	Total	100%	100%

1.7.9 Consumer surplus

Consumer surplus measures the area below the demand curve and above the equilibrium price. For simplicity, consumer surplus is estimated here by approximating the demand curve between the intercept and the estimated price with a linear line as follows:

CS= (PINT*SCLAN-EXPR*SCLAN)/2

$$PVCS = \sum_{t=2000}^{t=2008} (CS_t / (1+r)^t)$$

Where: r=Discount rate.

CS_t= Consumer surplus at year "t" in 1996 dollars.

PVCS= Present value of the consumer surplus in 1996 dollars.

EXPR= Ex-vessel price corresponding to landings for each policy option.
PINT=Price intercept i.e., estimated price when domestic landings are zero.
SCLAN= Sea scallop landings for each policy option.

Although this method may overestimate consumer surplus slightly, it does not affect the ranking of alternatives in terms of highest consumer benefits or net economic benefits.

1.7.10 Producer surplus

The producer surplus (PS) is defined as the area above the supply curve and the below the price line of the corresponding firm and industry (Just, Hueth & Schmitz (JHS)-1982). The supply curve in the short-run coincides with the short-run MC above the minimum average variable cost (for a competitive industry). This area between price and the supply curve can then be approximated by various methods depending on the shapes of the MC and AVC cost curves. The economic analysis presented in this section used the most straightforward approximation and estimated PS as the excess of total revenue (TR) over the total variable costs (TVC). It was assumed that the number of vessels and the fixed inputs would stay constant over the time period of analysis. In other words, the fixed costs were not deducted from the producer surplus since the producer surplus is equal to profits plus the rent to the fixed inputs. Here fixed costs include various costs associated with a vessel such as depreciation, interest, insurance, half of the repairs (other half was included in the variable costs), office expenses and so on. It is assumed that these costs will not change from one scenario to another.

PS=EXPR*SCLAN- ΣOPC
ΣOPC = Sum of operating costs for the fleet.

$$PVPS = \sum_{t=2000}^{t=2008} (PS_t /(1+r)^t)$$

Where: r=Discount rate.

PS_t= Producer surplus at year “t” in 1996 dollars.
PVPS= Present value of the producer surplus in 1996 dollars.
SCALN= Sea scallop landings for each policy option.
EXPR= Price of scallops at the ex-vessel level corresponding to landings for each policy option in 1996 dollars.

Producer Surplus also equals to sum of rent to vessels and rent to labor. Therefore, rent to vessels can be estimated as:

RENTVES=PS – CREWSH

Rentves= Quasi rent to vessels
Crewsh= Crew Shares

1.7.11 Total economic benefits

Total economic benefits (TOTBEN) is estimated as a sum of producer and consumer surpluses and its value net of status quo is employed to measure the impact of the management alternatives on the national economy.

TOTBEN=PS+CS

Present value of the total benefits= PVTOTBEN= PVPS+PVCS

1.7.12 REFERENCES

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