8.5 Effects Of Alternatives On Essential Fish Habitat (L. McGee, D. Boelke)

Since it has been determined that there are potentially adverse effects to EFH from bottom tending mobile gear, the Council has identified a range of alternatives to minimize adverse impacts to EFH pursuant to Section 600.815(a)2ii of the Magnuson Act. Those alternatives are described in Section 5.3

8.5.1 Methods and Analytical Results of Habitat Closed Area Alternatives.

The alternatives in Amendment 10 contain measures designed to satisfy multiple objectives such as improving scallop yield, reducing bycatch and minimizing impacts on EFH. Analyses of these alternatives frequently rely on common metrics and methods of analysis. Analysis of long-term area closures for the purpose of minimizing impacts on EFH, for example, utilize different metrics and methods than do the analysis of alternatives for improving scallop yield. Section 8.5.1.2 describes the methods used for analyzing the habitat closed area alternatives, while Section 8.5.3.2 describes the methods and results used for analysis of the non-closed area habitat alternatives. See Appendix IV for a complete description of the methods used in the habitat analysis.

NEPA requires that the potential impacts of an action on the environment be described. The habitat metric analysis does just that; it describes the sediment type, EFH, and biomass contained within each of the closed area alternatives, as well as the no action alternative. Therefore, based on the best available sediment, EFH, and biomass data, the impacts of closing certain areas can be evaluated. However, the Sustainable Fisheries Act requires that if fishing activities have been determined to have adverse impacts on EFH then measures should be taken to minimize these impacts when practicable. Therefore, when comparing the overall EFH benefits of the range of habitat closed area alternatives, it is appropriate to focus on the EFH component of this analysis. Thus, the EFH component of this metric analysis has been extracted from the overall matrix, and Section 8.5.3.1.1 highlights the alternatives that contain the most essential fish habitat for species that have been identified to have EFH vulnerable to bottom tending gear. In summary, the habitat metric analysis describes the areas from a NEPA standpoint, and the EFH evaluation in Section 8.5.3.1.1 provides a decision making tool to help identify which alternatives contain the most EFH area for species identified as having EFH vulnerable to bottom tending gear.

8.5.1.1 Level of closure analysis for habitat alternatives 3-9

Four levels of Habitat Closures were approved by the Council as a basis for determining appropriate gear types for habitat closure areas. These levels apply to the closed area alternatives that follow. It is possible that a closure level could be applied to all closed areas, or that closure levels be assigned specifically to each habitat closed area.

Level 1 Habitat Closure: The area will be closed indefinitely on a year round basis to <u>all</u> fishing gear.

This is the most restrictive option. This level would essentially establish a no-take marine protected area and would prohibit the use of all types of fishing gear in these closures. This level of closure would close the area to all fishing gear, both commercial and recreational.

Level 2 Habitat Closure: The area will be closed indefinitely on a year round basis to all bottom tending gear (static and mobile).

This option is slightly less restrictive than the Level 1 closure because it allows non-bottom-tending gear to operate in the habitat closures (for example, longlines and pelagic gear). Because is does prohibit all bottom tending gear, it will protect EFH for benthic species and life stages to the same degree as a Level 1 closure. The differences between Level 1 and Level 2 closures are primarily social and economic. Refer to Section 7.2.6.2 for a discussion of the impacts of both mobile and static gear on benthic habitats.

Level 3 Habitat Closure: The area will be closed indefinitely on a year round basis to all bottom tending mobile gear.

This level of closure is less restrictive because it allows static bottom tending gear to operate in these closures, but prohibits bottom tending mobile gears. Although less restrictive than Levels 1 and 2, the effects of this level of closure on benthic habitats do not differ significantly from the effects of Level 1 or 2 closures since static gear is generally considered to have minimal adverse impacts on benthic habitat (Section 7.2.6.2).

Level 4 Habitat Closure: The area will be open indefinitely on a year round basis only to gear defined as "reduced impact" gear.

Currently there are no reduced impact gear types defined by the Council. The identification of "reduced impact gear" would begin by first defining the ecological function served by the closure, with the advice from the Habitat Technical Team.

The analysis of this option is difficult because it requires knowledge of the individual ecological functions or features that the Council intends to protect. It is feasible that a Level 4 closure could apply to subsets of habitat closures depending on the intention of the closure. The implementation of this option will require a scientific and technical review procedure that includes, at a minimum, the Habitat Committee and the EFH Technical Team. If this level of closure is recommended, a process similar to the Council's HAPC designation process (See the Council's Habitat Annual Review and Report of 2000 for details) is recommended.

Summary of Level of Closures:

Because the effects of fishing on benthic habitats are caused primarily by mobile bottom-tending gears (bottom trawls and dredges), much less so by static bottom-tending gear (*e.g.*, pots, bottom longlines and gill nets), and not at all by pelagic gears (*e.g.*, mid-water trawls), the habitat metric analyses performed in this amendment/DEIS would apply equally well to Level 1 and Level 2 closures and nearly as well to Level 3 closures. Analysis of Level 4 closures would have to be tailored to the effects of specific "reduced impact" gears on specific habitat types. Economic and social impact assessments that were performed as part of the Practicability Analysis (Section 5.6), as well as assessments of enforcement feasibility and cumulative impacts were conducted for Level 1 and Level 3 closures in order to better distinguish between the impacts of these two closure levels.

None of the proposed habitat closures in this amendment specify which gear types would be prohibited. In implementing a habitat closed area alternative, the Council could prohibit the use of mobile, bottom-tending gear types while allowing the use of pelagic gears (Level 2) or pelagic and fixed bottom-tending gear (Level 3) based on practicability issues. If future closure alternatives are proposed for reasons other than the minimization of fishing impacts identified in this document (e.g. research areas, coral protection, etc.), other closure levels may be appropriate.

8.5.1.2 Habitat metrics

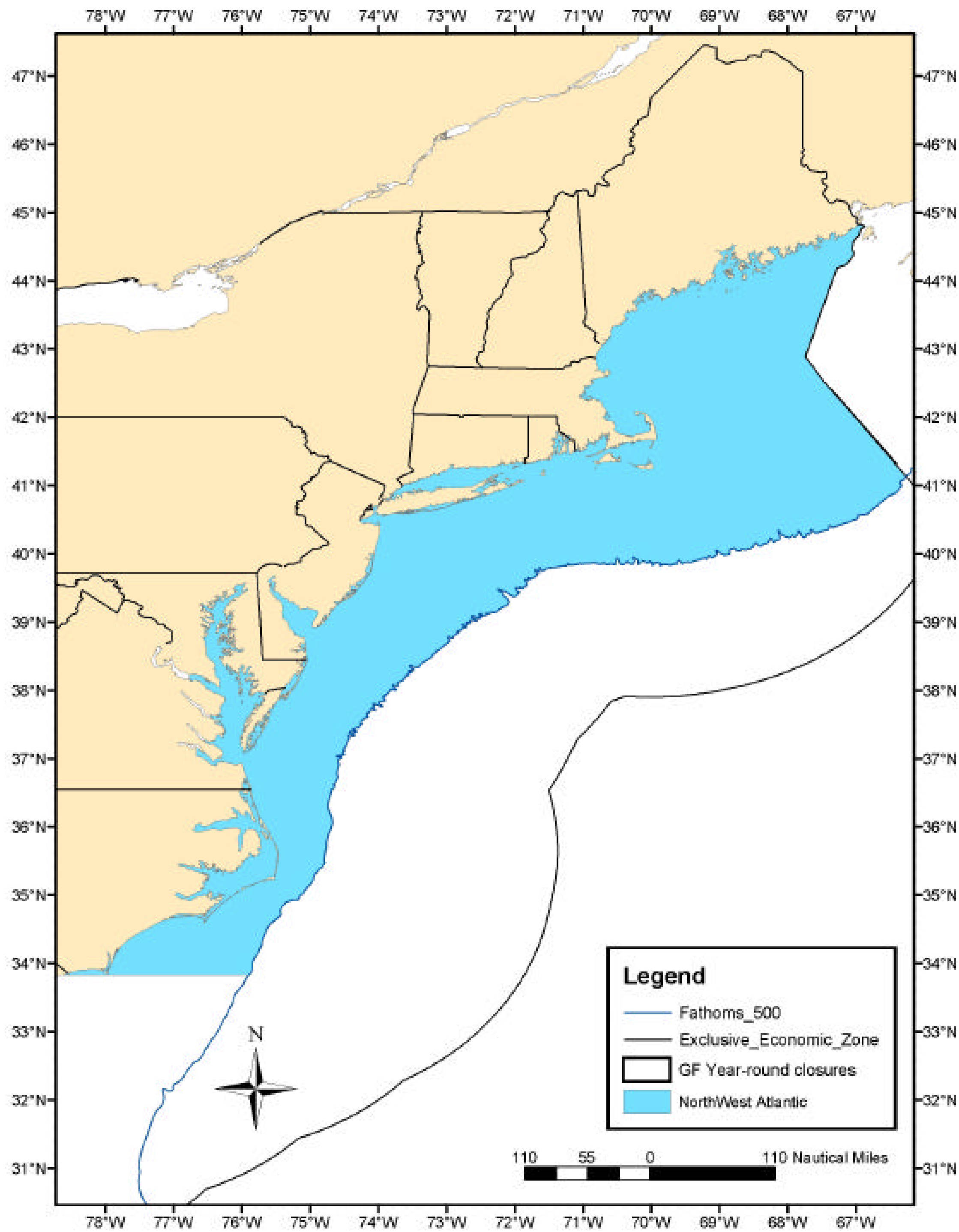
This analysis focuses on a comparison of the Habitat year-round closure scenarios from a habitat perspective. The primary purpose of this metric is to describe the areas quantitatively and enable decision makers and the public to compare the environments of each proposed closure. The analysis includes five metrics to describe the alternatives. The EFH evaluation (Section 8.5.3.1.1) determines the relative success of the alternatives in minimizing adverse impacts as defined in the adverse impact determination section of Amendment 10. The metrics include:

1) SEDIMENT – Area of each sediment type contained within each proposed closure.
2) EFH – The amount of vulnerable species' EFH encompassed by each proposed closure.
3) TROPHIC GUILD – Biomass encompassed by each closure for five guilds: planktivores, amphipod eaters, shrimp and fish eaters, benthivores, and piscivores.
4) SPECIES ASSEMBLAGE - Biomass encompassed by each closure for three species aggregations: elasmobranchs, demersal species, and pelagic species.
5) BENTHIC SPECIES - Biomass encompassed by each closure for six species (longhorn sculpin, sea raven, redfish, ocean pout, jonah crab and American lobster) with high levels of association to benthic habitats.

The Habitat Technical Team made no decisions regarding the relative importance or effectiveness of habitat protection for each of the metrics. Therefore, the variables within each metric have been weighted equally; for example, the percentages of bedrock, gravel, sand, and mud contained within each alternative each receive equal importance. No decisions have been made about which sediment types, guilds, or species' EFH are more critical to protect. However, a more detailed analysis has been completed to highlight some components of the metric analysis that may be more important to evaluate when analyzing the impacts of alternatives on EFH (see Section 8.5.2). Please refer to Appendix 4 for a complete description of the methods used for analysis of the habitat closed area alternatives.

In order to determine the percent of sediment, EFH, or biomass contained within an alternative, a denominator had to be identified. For this analysis, the Northwest Atlantic Analysis Area was defined as the area within the 500 fathom line to the East, the coastline (including internal waters) to the West, the Hague line to the North, and the North Carolina/ South Carolina border to the South. Although this fishery management plan does not have the jurisdiction to close areas in internal waters, it is important to describe the sediments and species that live in these areas and identify their importance in EFH protection. Map 52 depicts what the spatial areas defined as the Northwest Atlantic Analysis Area (NAAA). Note these areas have been determined for analysis purposes only. Within these boundaries, the total area of the Northwest Atlantic Analysis Area was determined to be 83,550 nm².

The EFH area values for each closed area alternative were adjusted to account for differences in closed area size. This was done by dividing EFH area values for each species and life stage with EFH that was determined to be vulnerable to mobile bottom tending gear (See Section 7.2.6.2.2) and total EFH area for all species and life stages encompassed by the area of each closure.



Map 52 – Boundaries of the Northwest Atlantic Analysis Area used in the habitat metric analysis

8.5.2 Results Of Closed Area Habitat Metric Analysis

The size of each closed area habitat alternative is described in Table 200 for reference. The percent of the total Northwest Atlantic Analysis Area is provided as well. The size of the habitat closed area alternatives range from 186 square nautical miles to 65,503 square nautical miles.

Table 200 - **Area of each habitat closed area alternative in square nautical miles, as well as the percent of the total Northwest Atlantic Analysis Area closed under each option**

	AREA in nm2	Percent of NAAA Closed
Total NAAA	83550	
NoAction	5853	7.0%
3(a)	2913	3.5%
3(b)	2821	3.4%
4	2241	2.7%
5(a)	3032	3.6%
5(b)	3073	3.7%
5(c)	3022	3.6%
5(d)	3098	3.7%
6	4041	4.8%
7	65503	78.4%
8a	186	0.2%
8b	732	0.9%
9	6254	7.5%

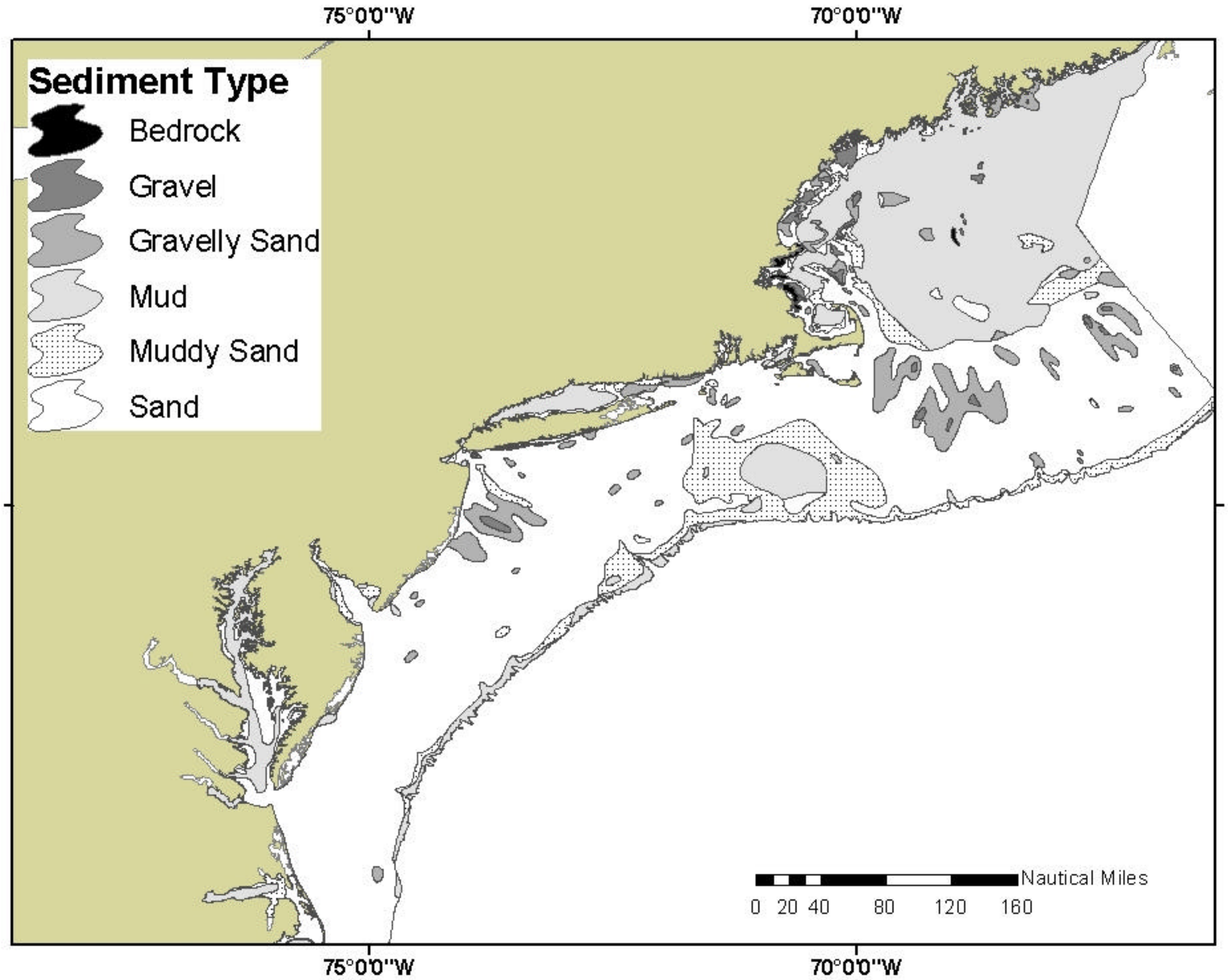
8.5.2.1 Sediment analysis

Methodology

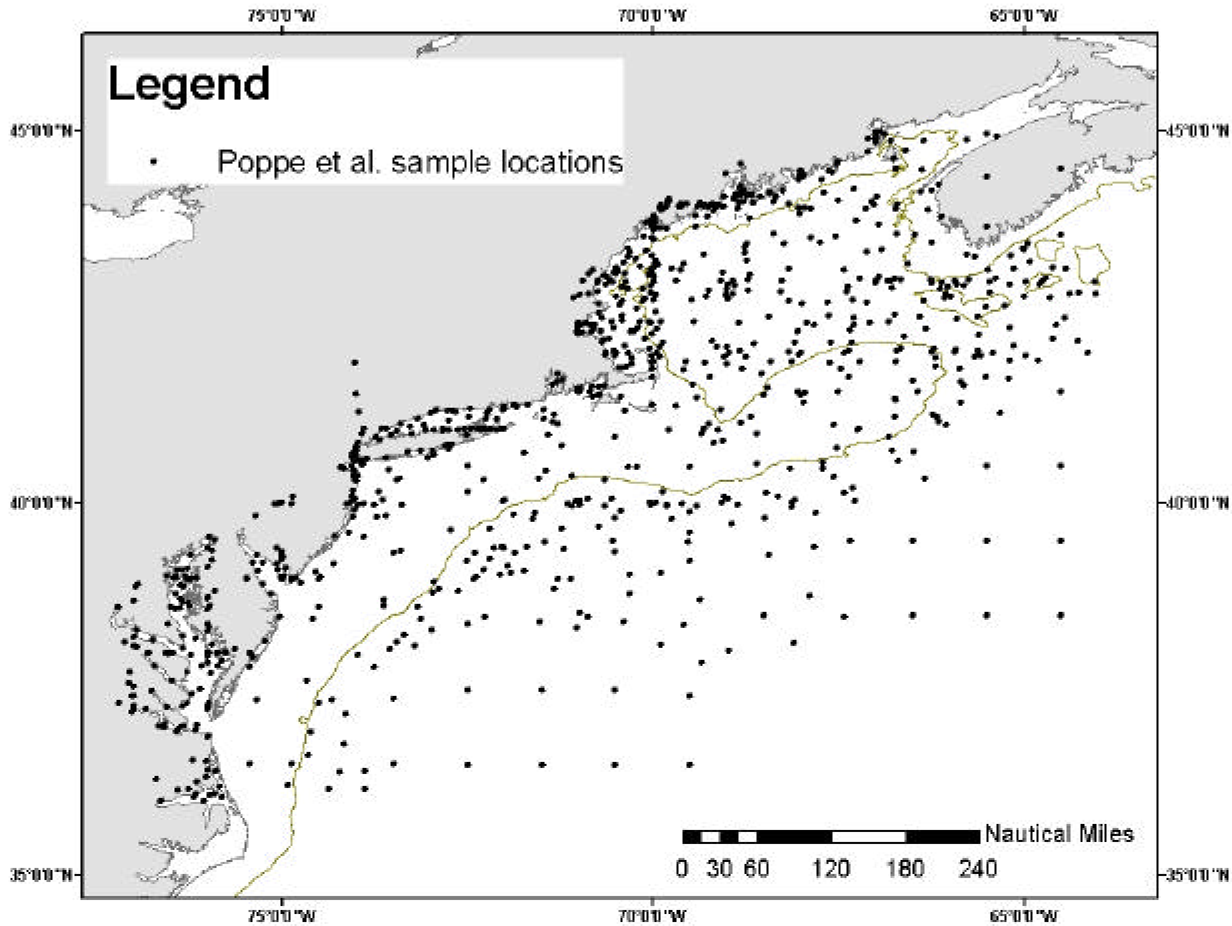
To establish the sedimentary composition of the various closure options, the Poppe *et al.* 1989 dataset is used (Map 53). (For more information, see Appendix IV). This dataset contains sediment data for a large portion of the Northwest Atlantic, based on 975 sampling locations (Map 54). Higher-resolution data sets, such as that based on the work of Stokesbury and Harris (Substrate in the sea scallop beds on Georges Bank 1999-2002, Stokesbury and Harris 2002), have been made available to the Council but do not cover a sufficiently large geographic area to be useful for a comprehensive evaluation of closure options. These high-resolution data do, however, point out the limitations of the Poppe *et al.* dataset when employed at a small scale. Map 55 demonstrates that, at small scales, the Poppe *et al.* maps fail to capture the variety of substrates on a scale at which changes in substrates tend to occur. In the absence of similar datasets covering the range of the Northwest Atlantic Analysis Area (NAAA), however, the Poppe *et al.* substrate maps will serve as the best available data for the purposes of description and analysis. The area of each sediment type that is contained within each alternative is presented in **Table 201**.

The term “gravel”, as used in substrate maps and analyses, is collective and comprises granules, pebbles, cobbles, and boulders in order of increasing size. Therefore, the term “gravel” refers to particles larger than sand. Granules are slightly coarser than coarse sand and are only 2mm in diameter maximum. Granules are difficult to identify from video imagery and occur mixed with sand and/or with larger gravel. Granule/pebble bottom may be mostly pebbles. Pebbles range in size from granules up to 64mm (2.5 inches) in diameter. Cobbles range in size from pebbles up to 256mm (10 inches) in diameter. Boulders are larger than cobbles. Common gravel bottom types occurring offshore are pebble gravel (pebble pavements); pebble/cobble gravel; and pebble/cobble/boulder mixtures. They all can support attached epifauna and can be vulnerable to disturbance by mobile bottom gear. Pebble gravel and pebble/cobble gravel often overlie sand, and if the gravel has been disturbed, the sand will be visible between pebbles and cobbles.

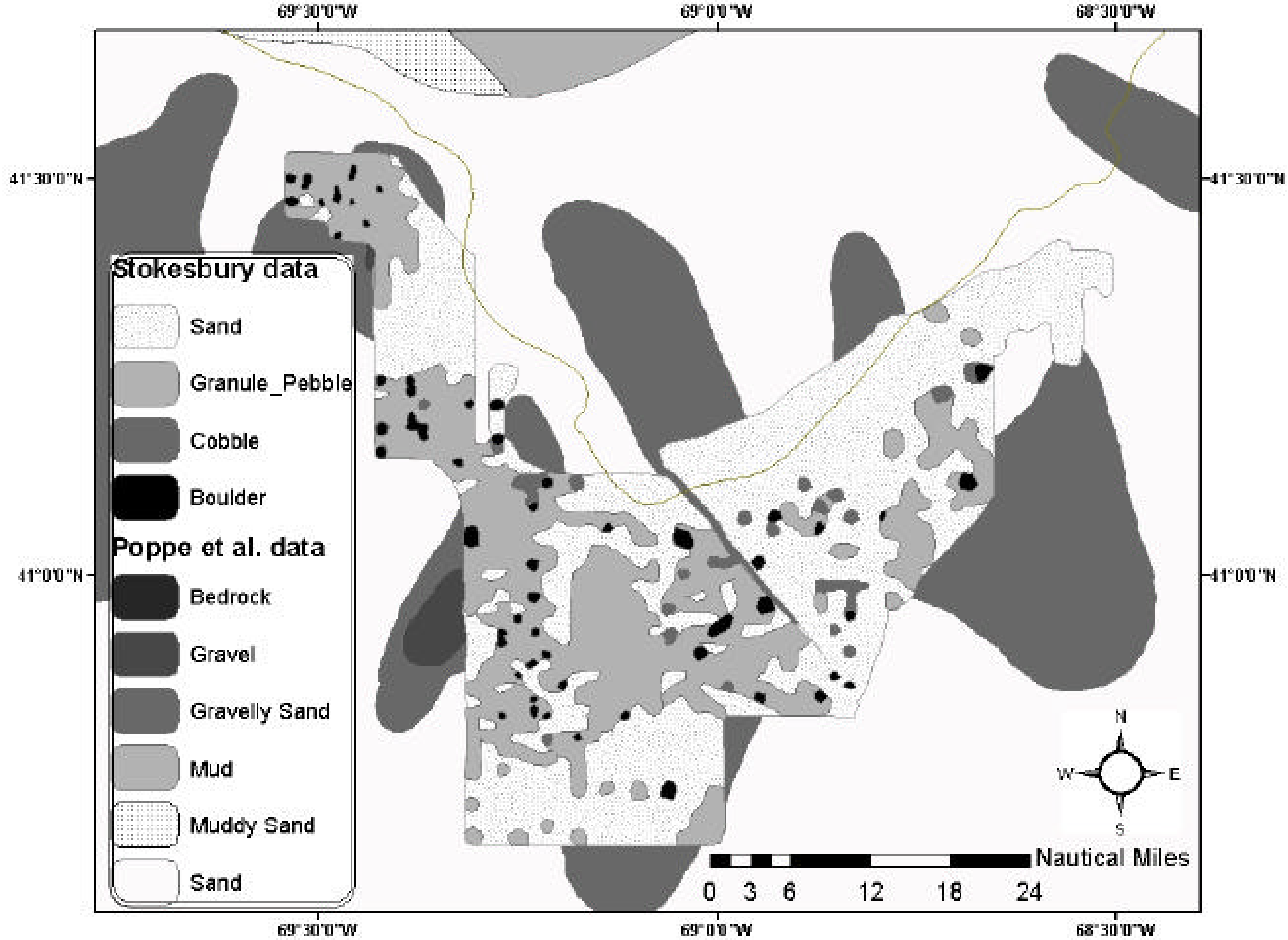
Map 53 – **Sediment map of the Northwest Atlantic Analysis Area (NAAA) based on Poppe *et al.* data (1989)**



Map 54 – **Poppe *et al.* (1989) sampling locations**



Map 55 **– Stokesbury and Harris (2002) substrate data for areas on Nantucket Shoals from Asia Rip north to Davis Bank and extending west into Closed Area I.**



Results

The first aspect of the sediment analysis describes the distribution of sediment types within an alternative in square nautical miles (nmi²) and as a percentage of the total NAAA (**Table 201**). The total Northwest Atlantic Analysis Area was defined as the portion of the continental shelf between the NC/SC border and the US/Canada border in the Gulf of Maine was calculated to be 83,550 square nautical miles (See **Map 52**). The percent composition data in Table 202 is incorporated into the EFH specific habitat metric analysis in Section 8.5.3.1.1.3.

Table 201. Total and percent of total sediment type contained inside each closed area alterantive, as compared to the total Northwest Atlantic Analysis Area.

	AREA		Bedrock		Gravel		Gravelly Sand		Sand		Muddy Sand		Mud	
Total	**83550**		**150**		**556**		**4263**		**49620**		**7141**		**20378**	
No Action	5853	7.0%	0	0%	106	19%	1041	25%	3875	8%	413	6%	413	2%
3(a)	2913	3.5%	19	13%	177	32%	915	22%	985	2%	90	1%	540	3%

3(b)	2821	3.4%	19	13%	177	32%	916	22%	958	2%	88	1%	479	2%
4	2241	2.7%	15	10%	139	25%	778	18%	885	2%	83	1%	342	2%
5(a)	3032	3.6%	0	0%	21	4%	126	3%	1226	2%	507	7%	991	5%
5(b)	3073	3.7%	0	0%	15	3%	313	7%	1879	4%	188	3%	576	3%
5(c)	3022	3.6%	5	3%	27	5%	107	3%	1526	3%	356	5%	783	4%
5(d)	3098	3.7%	0	0%	38	7%	101	2%	1049	2%	668	9%	511	3%
6	4041	4.8%	0	0%	92	17%	666	16%	2454	5%	413	6%	413	2%
7	65503	78.4%	139	93%	403	72%	2580	61%	35243	71%	6704	94%	19250	94%
8a	186	0.2%	0	0%	0	0%	62	1%	124	0%	0	0%	0	0%
8b	732	0.9%	0	0%	35	6%	204	5%	495	1%	0	0%	0	0%
9	6254	7.5%	15	10%	114	21%	1077	25%	3872	8%	413	6%	753	4%

Table 202. Sediment composition of each closed area alternative (Note: percents of each sediment type add up to approximately 100% for each alternative).

	Bedrock	Gravel	Gravelly Sand	Sand	Muddy Sand	Mud
NoAction	0%	2%	18%	66%	7%	7%
3(a)	1%	6%	34%	36%	3%	20%
3(b)	1%	7%	35%	36%	3%	18%
4	1%	6%	35%	39%	4%	15%
5(a)	0%	1%	4%	43%	18%	35%
5(b)	0%	1%	11%	63%	6%	19%
5(c)	0%	1%	4%	54%	13%	28%
5(d)	0%	2%	4%	44%	28%	22%
6	0%	2%	16%	61%	10%	10%
7	0%	1%	4%	55%	10%	30%
8a	0%	0%	33%	67%	0%	0%
8b	0%	5%	28%	67%	0%	0%
9	0%	2%	17%	62%	7%	12%

Alternatives 3 (a), 3(b), 4, 5c, 7 and 9 are the only alternatives to contain areas of bedrock as defined by the Poppe *et al.* data. Alternatives 3a, 3b, 4, 6, 7, and 9 contain a significant amount of gravel and gravelly sand. For example, 16% of the gravelly sand in the NAAA and 17% of the gravel in the NAAA are contained within Alternative 6. Most of the alternatives are primarily made up of sandy bottom, and a significant portion of Alternatives 5a, 5c, and 7 are mud.

8.5.2.2 Essential Fish Habitat analysis

Methodology

A list of 23 species have been identified as having EFH for at least one life stage moderately or highly vulnerable to the effects of bottom-tending mobile gear (see Gear Effects Evaluation and Adverse Impact Determination Section 7.2.6.3). Closed areas provide habitat protection for these species and life stages. The EFH area contained in a closure is calculated by summing the geographic area (in square nautical miles) of the ten minute squares of latitude and longitude (or portions thereof) that are designated as EFH for each species and life stages that is bounded by each proposed closure. Geographic EFH designations are contained in the Omnibus EFH Amendment (NEFMC 1998) and in several species FMPs adopted by the NEFMC and MAFMC. **Table 203** is a summary of the total and percent-of-total EFH area in the Northwest Atlantic Analysis Area. The total EFH area for each of the vulnerable species and life stages (A= Adults, J=Juveniles and E= Eggs) is in column one. The sum and percent of EFH area values for all species and life stages with vulnerable EFH is shown at the bottom of the table for each closed area alternative.

Description of EFH components of proposed area closures

Table 203 is a summary of the total and percent-of-total EFH for each of the vulnerable species encompassed by each of the closed area alternatives and can be used to evaluate how the different alternatives rank in terms of EFH protection for the species that are moderately or highly vulnerable to bottom tending gear. The total EFH area contained in each option is in boldface, and the percent of EFH contained in each area is expressed as a percentage. The percent of EFH for each species and life stage with vulnerable EFH contained in an area is calculated by dividing the amount of EFH in that area by the total EFH in the region. The summed EFH areas for each alternative were divided by the total vulnerable EFH in the NAAA, to describe the overall EFH value for each closure option.

Table 203. Total and percent of total EFH area for species with EFH identified as vulnerable to bottom-tending mobile gear. (Note the total EFH value for the entire species is provided as well in column 1). ***Values are NOT scaled for area.*

Total EFH	SPECIES	No Action		3a		3b		4		5a		5b		5c		5d	
AREA		5853		2913		2821		2241		3032		3073		3022		3098	
nm2		nm2	%	nm2	%	nm2	%	nm2	%	nm2	%	nm2	%	nm2	%	nm2	%
13449	Black sea bass_A	150	1.1	0	0.0	0	0.0	0	0.0	547	4.1	306	2.3	695	5.2	346	2.6
13503	Black sea bass_J	154	1.1	0	0.0	0	0.0	0	0.0	1199	8.9	823	6.1	1188	8.8	957	7.1
22076	Cod_A	3874	17.5	2688	12.2	2598	11.8	2203	10.0	1641	7.4	1992	9.0	1773	8.0	1197	5.4
12968	Cod_J	2974	22.9	2163	16.7	2072	16.0	1706	13.2	821	6.3	1318	10.2	1026	7.9	1048	8.1
15664	Haddock_A	3717	23.7	2421	15.5	2337	14.9	1940	12.4	1388	8.9	1269	8.1	1095	7.0	1093	7.0
13746	Haddock_J	3135	22.8	2127	15.5	2044	14.9	1667	12.1	827	6.0	1408	10.2	959	7.0	1206	8.8
5625	Halibut_A	1048	18.6	1059	18.8	1061	18.9	958	17.0	424	7.5	374	6.7	424	7.5	274	4.9
5625	Halibut_J	1048	18.6	1059	18.8	1061	18.9	958	17.0	424	7.5	374	6.7	424	7.5	274	4.9
17891	American plaice_A	1820	10.2	1209	6.8	1120	6.3	921	5.1	1707	9.5	1465	8.2	1688	9.4	1112	6.2
15427	American plaice_J	1440	9.3	1149	7.4	1060	6.9	861	5.6	1707	11.1	1465	9.5	1688	10.9	1112	7.2
14624	Pollock_A	1533	10.5	1469	10.0	1392	9.5	1129	7.7	1411	9.6	1271	8.7	1044	7.1	741	5.1
28685	Ocean Pout A	4618	16.1	1919	6.7	1827	6.4	1582	5.5	2173	7.6	2614	9.1	2298	8.0	2262	7.9
32867	Ocean pout_E	2	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0	1	0.0
18435	Ocean pout_J	1820	9.9	1070	5.8	979	5.3	845	4.6	1870	10.1	1864	10.1	1997	10.8	1506	8.2
21241	Redfish_A	1757	8.3	1610	7.6	1522	7.2	1322	6.2	1715	8.1	1465	6.9	1696	8.0	1194	5.6
22009	Redfish_J	1759	8.0	1559	7.1	1468	6.7	1258	5.7	1758	8.0	1465	6.7	1739	7.9	1163	5.3
37038	Red hake_A	3274	8.8	1418	3.8	1330	3.6	1130	3.1	2474	6.7	2536	6.8	2378	6.4	2189	5.9
43285	Red hake_J	4653	10.7	2318	5.4	2259	5.2	1898	4.4	2917	6.7	2458	5.7	2969	6.9	2426	5.6
15906	Scup_J	523	3.3	0	0.0	0	0.0	0	0.0	1206	7.6	1031	6.5	1555	9.8	871	5.5
2345	SkateBarndoor_A	522	22.3	178	7.6	178	7.6	105	4.5	0	0.0	75	3.2	0	0.0	76	3.2
11264	SkateBarndoor_J	3026	26.9	851	7.6	848	7.5	759	6.7	377	3.3	679	6.0	450	4.0	835	7.4
14232	SkateClearnose_A	332	2.3	0	0.0	0	0.0	0	0.0	436	3.1	225	1.6	436	3.1	491	3.5
16449	SkateClearnose_J	540	3.3	274	1.7	231	1.4	231	1.4	656	4.0	521	3.2	730	4.4	788	4.8
36449	SkateLittle_A	4702	12.9	1810	5.0	1805	5.0	1523	4.2	1356	3.7	2171	6.0	1702	4.7	1448	4.0
50044	SkateLittle_J	5086	10.2	1837	3.7	1837	3.7	1641	3.3	1951	3.9	2395	4.8	1929	3.9	1596	3.2
624	SkateRosette_A	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
7903	SkateRosette_J	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	327	4.1
11039	SkateSmooth_A	1588	14.4	1249	11.3	1157	10.5	1062	9.6	1558	14.1	1185	10.7	1407	12.7	1037	9.4
20929	SkateSmooth_J	1947	9.3	1667	8.0	1575	7.5	1374	6.6	1683	8.0	1633	7.8	1682	8.0	1163	5.6
18193	SkateThorny_A	1660	9.1	1528	8.4	1468	8.1	1200	6.6	1716	9.4	1690	9.3	1770	9.7	1196	6.6
26586	SkateThorny_J	3444	13.0	2328	8.8	2237	8.4	1891	7.1	1866	7.0	1916	7.2	1846	6.9	1498	5.6
25769	SkateWinter_A	4345	16.9	1993	7.7	1959	7.6	1689	6.6	1501	5.8	1723	6.7	1866	7.2	1136	4.4
39452	SkateWinter_J	5283	13.4	2063	5.2	2058	5.2	1822	4.6	2027	5.1	2841	7.2	2450	6.2	1901	4.8
1466	Tilefish_A	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

2852	Tilefish_J	**0**	0.0	**0**	0.0	**0**	0.0	**0**	0.0	**0**	0.0	**0**	0.0	**0**	0.0	**0**	0.0
47268	Silver hake_J	**4750**	10.0	**2134**	4.5	**2044**	4.3	**1772**	3.7	**2990**	6.3	**2535**	5.4	**2969**	6.3	**2506**	5.3
21884	White hake_J	**2616**	12.0	**1464**	6.7	**1406**	6.4	**1163**	5.3	**1643**	7.5	**1621**	7.4	**1697**	7.8	**1656**	7.6
19285	Winter flounder_A	**2977**	15.4	**1750**	9.1	**1701**	8.8	**1392**	7.2	**1424**	7.4	**1701**	8.8	**1851**	9.6	**830**	4.3
19847	Witch flounder_A	**1442**	7.3	**993**	5.0	**904**	4.6	**705**	3.5	**1785**	9.0	**1108**	5.6	**1556**	7.8	**1417**	7.1
15489	Witch flounder_J	**440**	2.8	**592**	3.8	**545**	3.5	**382**	2.5	**963**	6.2	**717**	4.6	**1091**	7.0	**756**	4.9
23102	Yellowtail flounder_A	**4629**	20.0	**1476**	6.4	**1461**	6.3	**1224**	5.3	**1518**	6.6	**2017**	8.7	**1792**	7.8	**1667**	7.2
20199	Yellowtail flounder_J	**3584**	17.7	**1028**	5.1	**1015**	5.0	**825**	4.1	**990**	4.9	**1795**	8.9	**1488**	7.4	**1139**	5.6
822734	SUM of vul. EFH	**92211**		**50455**		**48556**		**41135**		**52651**		**54050**		**55350**		**44435**	
	Sum of Vul. EFH in closure / sum of total Vul. EFH	**11.2%**		**6.1%**		**5.9%**		**5.0%**		**6.4%**		**6.6%**		**6.7%**		**5.4%**	

Table Continued: Total and percent of total EFH area for species with EFH identified as vulnerable to bottom-tending mobile gear. (Note the total EFH value for the entire species is provided as well in column 1). ***Values are NOT scaled for area.*

Total EFH	SPECIES	6		7		8a		8b		9	
AREA		4041		65503		186		732		6254	
nm2		nm2	%	nm2	%	nm2	%	nm2	%	nm2	%
13449	Black sea bass_A	**152**	1.1	**8948**	66.5	**0**	0.0	**0**	0.0	**151**	1.1
13503	Black sea bass_J	**154**	1.1	**9666**	71.6	**0**	0.0	**0**	0.0	**154**	1.1
22076	Cod_A	**2545**	11.5	**16696**	75.6	**186**	0.8	**733**	3.3	**4270**	19.3
12968	Cod_J	**2254**	17.4	**8699**	67.1	**186**	1.4	**658**	5.1	**3064**	23.6
15664	Haddock_A	**2339**	14.9	**11933**	76.2	**186**	1.2	**658**	4.2	**3843**	24.5
13746	Haddock_J	**1661**	12.1	**7327**	53.3	**186**	1.4	**621**	4.5	**3365**	24.5
5625	Halibut_A	**862**	15.3	**3394**	60.3	**112**	2.0	**371**	6.6	**1105**	19.6
5625	Halibut_J	**862**	15.3	**3394**	60.3	**112**	2.0	**371**	6.6	**1105**	19.6
17891	American plaice_A	**1545**	8.6	**16074**	89.8	**0**	0.0	**84**	0.5	**2221**	12.4
15427	American plaice_J	**1240**	8.0	**13633**	88.4	**0**	0.0	**46**	0.3	**1840**	11.9
14624	Pollock_A	**1255**	8.6	**13030**	89.1	**37**	0.3	**222**	1.5	**1822**	12.5
28685	Ocean Pout A	**3174**	11.1	**17136**	59.7	**112**	0.4	**434**	1.5	**4724**	**16.5**
32867	**Ocean pout_E**	**1**	**0.0**	**20587**	**62.6**	**112**	**0.3**	**434**	**1.3**	**2**	**0.0**
18435	**Ocean pout_J**	**1427**	**7.7**	**10907**	**59.2**	**0**	**0.0**	**35**	**0.2**	**2009**	**10.9**
21241	**Redfish_A**	**1465**	**6.9**	**18426**	**86.7**	**75**	**0.4**	**335**	**1.6**	**2157**	**10.2**
22009	**Redfish_J**	**1593**	**7.2**	**18672**	**84.8**	**112**	0.5	**296**	1.3	**2160**	9.8
37038	Red hake_A	**2431**	6.6	**27612**	74.6	**0**	0.0	**112**	0.3	**3675**	9.9
43285	Red hake_J	**3324**	7.7	**29563**	68.3	**186**	0.4	**632**	1.5	**4984**	11.5
15906	Scup_J	**523**	3.3	**12157**	76.4	**0**	0.0	**0**	0.0	**523**	3.3
2345	SkateBarndoor_A	**331**	14.1	**1887**	80.5	**75**	3.2	**74**	3.2	**522**	22.3
11264	SkateBarndoor_J	**1823**	16.2	**7302**	64.8	**112**	1.0	**311**	2.8	**3027**	26.9

14232	SkateClearnose_A	**244**	1.7	**11999**	84.3	**0**	0.0	**0**	0.0	**332**	2.3
16449	SkateClearnose_J	**452**	2.7	**13240**	80.5	**0**	0.0	**0**	0.0	**548**	3.3
36449	SkateLittle_A	**2900**	8.0	**23240**	63.8	**186**	0.5	**733**	2.0	**4711**	12.9
50044	SkateLittle_J	**3286**	6.6	**32628**	65.2	**186**	0.4	**733**	1.5	**5087**	10.2
624	SkateRosette_A	**0**	0.0	**624**	100.0	**0**	0.0	**0**	0.0	**0**	0.0
7903	SkateRosette_J	**0**	0.0	**4708**	59.6	**0**	0.0	**0**	0.0	**0**	0.0
11039	SkateSmooth_A	**1252**	11.3	**9197**	83.3	**112**	1.0	**248**	2.2	**1864**	16.9
20929	SkateSmooth_J	**1551**	7.4	**17786**	85.0	**112**	0.5	**248**	1.2	**2339**	11.2
18193	SkateThorny_A	**1333**	7.3	**15517**	85.3	**112**	0.6	**221**	1.2	**2060**	11.3
26586	SkateThorny_J	**2453**	9.2	**21259**	80.0	**186**	0.7	**546**	2.1	**3845**	14.5
25769	SkateWinter_A	**2572**	10.0	**16145**	62.7	**186**	0.7	**733**	2.8	**4444**	17.2
39452	SkateWinter_J	**3475**	8.8	**26292**	66.6	**186**	0.5	**733**	1.9	**5336**	13.5
1466	Tilefish_A	**0**	0.0	**1412**	96.3	**0**	0.0	**0**	0.0	**0**	0.0
2852	Tilefish_J	**0**	0.0	**2631**	92.3	**0**	0.0	**0**	0.0	**0**	0.0
47268	Silver hake_J	**3336**	7.1	**33739**	71.4	**186**	0.4	**696**	1.5	**5151**	10.9
21884	White hake_J	**1815**	8.3	**17932**	81.9	**0**	0.0	**296**	1.4	**2967**	13.6
19285	Winter flounder_A	**2361**	12.2	**12224**	63.4	**186**	1.0	**621**	3.2	**2978**	15.4
19847	Witch flounder_A	**1445**	7.3	**17616**	88.8	**0**	0.0	**46**	0.2	**1842**	9.3
15489	Witch flounder_J	**440**	2.8	**13300**	85.9	**0**	0.0	**0**	0.0	**835**	5.4
23102	Yellowtail flounder_A	**2838**	12.3	**12075**	52.3	**37**	0.2	**322**	1.4	**4630**	20.0
20199	Yellowtail flounder_J	**1945**	9.6	**9172**	45.4	**0**	0.0	**140**	0.7	**3585**	17.7
822734	SUM of Vul. EFH	**64661**		**589778**		**3464**		**12745**		**99274**	
	Sum of Vul. EFH in closure / sum of total Vul. EFH	**7.9%**		**71.7%**		**0.4%**		**1.5%**		**12.1%**	

Results of EFH Component

Table 203 describes the area of vulnerable EFH contained in each habitat closed area in square nautical miles and percent. For example, of the 12,968 square nautical miles that are designated as juvenile Cod EFH in the region, 2,254 or 17.4% is contained within alternative 6, while only 821 square nautical miles or 6.3% is contained within alternative 5a. Since the amount of EFH in each alternative varies depending on the size of the closure, the EFH values for each alternative have been further divided by the area of each option. This value is an indicator of the amount of vulnerable EFH per nautical mile (See Section 8.5.3.1.1 for the EFH analysis that incorporates the size of each habitat closed area alternative). Aside from Alternative 7 that would close a substantially large portion of the NAAA (78%), the summed EFH values for the remaining alternatives range from 0.4% (Alternative 8a) to 12.1% (Alternative 9), with most values between 5.0% (Alternative 4) and 7.9% (Alternative 6). Overall, less than ten percent of the total EFH for the majority of species and life stages with vulnerable EFH are within the habitat closures. Species with high percentages of EFH area are cod (A, J), haddock (A,J), and halibut (A,J). Alternatives 3, 4, 6, and 9 contain relatively high percentages of EFH area for these species (10-25%). For example, Alternative 9 contains 23.6% of juvenile cod EFH and 24.5% of juvenile haddock EFH. Note, because Alternative 7 is so much larger than the other alternatives, it contains the most EFH area for all species with vulnerable EFH (over 50%).

8.5.2.3 Trophic guild analysis

Methodology

Cluster analysis (based on Garrison 2000) was used to define trophic guilds found in the Northwest Atlantic Analysis Area (NAAA) analysis area. The general guild structure and levels of dietary overlap are consistent across both temporal and spatial scales. Complimentary analyses to the current study within the Georges Bank region identified similar trophic guilds and general stability in the trophic guild structure over the last three decades. Despite the notable changes in species composition in the Northeast shelf fish community, the patterns of trophic resource use and guild structure have remained remarkably consistent. Five trophic guilds were identified for this analysis: benthivores, amphipod eaters, planktivores, piscivores, and shrimp and fish eaters. The species and size ranges used to define these guilds are identified in Appendix IV.

Results

Table 204 describes the biomass and percent of total biomass for each guild that is contained within each closure alternative. Biomass is measured as the sum of the mean wt (kg) per tow from the 1995-2001 bottom trawl surveys for each ten minute square (or fraction thereof) included within each closure area. Table 205 describes the composition of each closure.

Table 204. **Total and percent-of-total biomass for each guild within each closed area scenarios.** ***Benthic = benthivore; Ampshr = amphipod-shrimp eater; Plankt = planktivore; Pisc = piscivore; Shrfis = shrimp/fish eater(based on a mean wt per tow value from the bottom trawl survey, 1995-2001).***

	Benthic		Ampshr		Plankt		Pisc		Shrfis	
Total	9,128		2,681		11,836		4,921		6,509	
No Action	**2,423**	26.5%	**1,052**	39.2%	**1,204**	10.2%	**492**	10.0%	**1,206**	18.5%
3(a)	**976**	10.7%	**254**	9.5%	**413**	3.5%	**125**	2.5%	**549**	8.4%
3(b)	**908**	9.9%	**245**	9.1%	**407**	3.4%	**121**	2.4%	**498**	7.6%
4	**859**	9.4%	**223**	8.3%	**356**	3.0%	**104**	2.1%	**464**	7.1%

5(a)	**541**	5.9%	**284**	10.6%	**708**	6.0%	**156**	3.2%	**354**	5.4%
5(b)	**778**	8.5%	**333**	12.4%	**947**	8.0%	**178**	3.6%	**152**	2.3%
5(c)	**634**	6.9%	**291**	10.8%	**731**	6.2%	**148**	3.0%	**189**	2.9%
5(d)	**589**	6.5%	**168**	6.3%	**933**	7.9%	**162**	3.3%	**247**	3.8%
6	**1,296**	14.2%	**489**	18.2%	**653**	5.5%	**190**	3.9%	**935**	14.4%
7	**6086**	66%	**1657**	62%	**8444**	71%	**3599**	73%	**6023**	93%
8a	**58**	1%	**20**	1%	**25**	0%	**19**	0%	**2**	0%
8b	**171**	6%	**77**	6%	**101**	8%	**39**	3%	**7**	4%
9	**1953**	21%	**860**	32%	**980**	8%	**294**	6%	**1305**	20%

Table 205 **- Guild composition of each closure alternative**
Benthic = benthivore; Ampshr = amphipod-shrimp eater; Plankt = planktivore; Pisc = piscivore; Shrfis = shrimp/fish eater(based on a mean wt per tow value from the bottom trawl survey, 1995-2001).

	Benthic	Ampshr	Plankt	Pisc	Shrfis
NoAction	38%	17%	19%	6%	19%
3(a)	42%	11%	18%	5%	24%
3(b)	42%	11%	19%	6%	23%
4	43%	11%	18%	5%	23%
5(a)	26%	14%	35%	8%	17%
5(b)	33%	14%	40%	7%	6%
5(c)	32%	15%	37%	7%	9%
5(d)	28%	8%	44%	8%	12%
6	36%	14%	18%	5%	26%
7	24%	6%	33%	14%	23%
8a	46%	16%	20%	15%	2%
8b	43%	19%	26%	10%	2%
9	36%	16%	18%	5%	24%

Closed area alternatives 7, 9 and 6 contain the highest biomass values for benthivores and shrimp-and-fish eaters, followed closely by 3a, 3b and 4. A significant portion of amphipod-eaters biomass is contained in alternatives 7, 9, and 6 as well. Alternatives 5a, 5b, and 5c contain a larger percentage of biomass of the amphipod-shrimp guild than the other guilds. Planktivores and piscivores are most abundant in alternatives 7, 9, 5b and 5d. Alternatives 3a, 3b, 4, 6, and 9 guild biomass is dominated by benthivores and shrimp-fish-eaters, while alternatives 5a-5d are more dominated by the planktivore guild.

8.5.2.4 Species assemblages

Methodology

Cluster analysis (based on Garrison 2000, Gabriel 1992) was used to define spatial-temporal assemblages for major taxonomic aggregates (i.e., principal groundfish, principal pelagics, demersals, pelagics and elasmobranchs) found in the NAAA analysis area. Species that were assigned to these assemblages are identified in Appendix IV.

Results

Results of the habitat closed area alternatives in their stand-alone form are summarized below. Table 206 contains the biomass of each assemblage contained within each alternative, and describes the percent of each assemblage biomass that is contained within each alternative as compared to the total Northwest Atlantic Analysis Area. Biomass is measured in mean wt (kg) per tow from the 1995-2001 bottom trawl surveys. Table 207 describes the species composition of each closure option.

Table 206 - Total and percent-of-total biomass for each assemblage within each closed area alternative.

	Elasmo		**Pringrd**		**Prinpel**		**Demersal**		**Pelagic**	
Total	**92,990**		**22,140**		**6,742**		**129,171**		**13,841**	
NoAction	**12,539**	13.5%	**6,192**	28.0%	**763**	11.3%	**20,117**	15.6%	**1,262**	9.1%
3(a)	**2,264**	2.4%	**2,242**	10.1%	**216**	3.2%	**4,968**	3.8%	**441**	3.2%
3(b)	**2,257**	2.4%	**2,089**	9.4%	**210**	3.1%	**4,784**	3.7%	**435**	3.1%
4	**1,990**	2.1%	**1,932**	8.7%	**181**	2.7%	**4,309**	3.3%	**378**	2.7%
5(a)	**3,880**	4.2%	**1,413**	6.4%	**522**	7.7%	**5,965**	4.6%	**800**	5.8%
5(b)	**6,133**	6.6%	**1,567**	7.1%	**680**	10.1%	**8,404**	6.5%	**1,004**	7.3%
5(c)	**3,801**	4.1%	**1,306**	5.9%	**525**	7.8%	**5,807**	4.5%	**825**	6.0%
5(d)	**3,478**	3.7%	**1,298**	5.9%	**784**	11.6%	**5,325**	4.1%	**952**	6.9%
6	**6,529**	7.0%	**3,243**	14.6%	**416**	6.2%	**10,374**	8.0%	**687**	5.0%
7	**54681**	59%	**16615**	75%	**4758**	71%	**81267**	63%	**10080**	73%
8a	**184**	0%	**93**	0%	**14**	0%	**311**	0%	**30**	0%
8b	**457**	4%	**286**	6%	**22**	12%	**856**	4%	**107**	7%
9	**9002**	10%	**5329**	24%	**619**	9%	**15309**	12%	**1027**	7%

Table 207 – **Species Assemblage composition of each closure alternative**

	Elasmo	**Pringrd**	**Prinpel**	**Demersal**	**Pelagic**
NoAction	30%	16%	2%	49%	3%
3(a)	22%	22%	2%	49%	4%
3(b)	23%	21%	2%	49%	4%
4	23%	22%	2%	49%	4%
5(a)	31%	11%	4%	47%	6%
5(b)	34%	9%	4%	47%	6%
5(c)	31%	11%	4%	47%	7%
5(d)	29%	11%	7%	45%	8%
6	31%	15%	2%	49%	3%
7	33%	10%	3%	49%	6%
8a	29%	15%	2%	49%	5%
8b	26%	17%	1%	50%	6%
9	29%	17%	2%	49%	3%

High elasmobranch biomass values occur in alternatives 7, 9, 6, and 5b. Relative to the size of the alternatives, alternatives 8b, 5d, and 5b contain a significant amount of pelagic biomass. Alternatives 7, 9, and 6 contain significantly more demersal finfish biomass than the other alternatives; the same is true for the principal groundfish assemblage. The most abundant species assemblage in all twelve closed area alternatives is the demersal finfish group (See Table 207).

8.5.2.5 Individual benthic species

Methodology

Six species (longhorn sculpin, sea raven, redfish, ocean pout, jonah crab and American lobster) were chosen for their close association with benthic habitats for both feeding and protection from predators (see Appendix IV for spatial distribution of these species).

Results

Table 208 describes the total and percent-of-total biomass for each species that is contained within each closure alternative. Biomass is measured as the sum of the mean wt (kg) per tow from the 1995-2001 bottom trawl surveys for each ten minute square (or fraction there) included within each closure area. Table 209 shows the percent composition of individual benthic species by closure.

Table 208 - **Total and Percentage of total biomass for each species within each closed area alternative. (LhnScpn= longhorn sculpin, SeaRvn= Sea raven, Redfish= Redfish, OcPout= Ocean pout, JonCrab= Jonah crab, and Lobster= Lobster)**

	LhnScpn		SeaRvn		Redfish		OcPout		JonCrab		Lobster	
Total	1504.2		533.4		5870.6		1527.9		199.7		1179.8	
NoAction	**558**	37.1%	**162**	30.3%	**1,077**	18.3%	**173**	11.3%	**18**	9.2%	**103**	8.7%
3(a)	**187**	12.4%	**75**	14.1%	**452**	7.7%	**52**	3.4%	**3**	1.4%	**39**	3.3%
3(b)	**177**	11.8%	**72**	13.5%	**418**	7.1%	**48**	3.2%	**3**	1.3%	**37**	3.1%
4	**165**	11.0%	**67**	12.5%	**391**	6.7%	**39**	2.5%	**1**	0.6%	**34**	2.9%
5(a)	**239**	15.9%	**50**	9.4%	**266**	4.5%	**156**	10.2%	**15**	7.4%	**42**	3.5%
5(b)	**317**	21.1%	**78**	14.5%	**93**	1.6%	**88**	5.7%	**3**	1.6%	**90**	7.7%
5(c)	**271**	18.0%	**54**	10.0%	**116**	2.0%	**172**	11.3%	**3**	1.7%	**100**	8.5%
5(d)	**95**	6.3%	**61**	11.4%	**177**	3.0%	**209**	13.7%	**14**	7.1%	**28**	2.3%
6	**245**	16.3%	**73**	13.6%	**835**	14.2%	**63**	4.1%	**11**	5.3%	**47**	3.9%
7	**829**	55%	**294**	55%	**5437**	93%	**542**	35%	**175**	87%	**822**	70%
8a	**15**	1%	**16**	3%	**0**	0%	**1**	0%	**0**	0%	**5**	0%
8b	**60**	6%	**30**	11%	**1**	3%	**5**	14%	**0**	7%	**18**	2%
9	**384**	26%	**133**	25%	**1183**	20%	**143**	9%	**12**	6%	**75**	6%

Table 209 – **Percent composition of each species within each closed area alternative**

	LhnScpn	SeaRvn	Redfish	OcPout	JonCrab	Lobster
NoAction	24%	8%	53%	9%	1%	5%
3(a)	23%	9%	56%	6%	0%	5%
3(b)	23%	10%	55%	6%	0%	5%
4	24%	10%	56%	6%	0%	5%
5(a)	31%	7%	35%	20%	2%	5%
5(b)	47%	12%	14%	13%	0%	14%
5(c)	38%	7%	16%	24%	0%	14%
5(d)	16%	10%	30%	36%	2%	5%
6	19%	6%	66%	5%	1%	4%
7	10%	4%	67%	7%	2%	10%
8a	42%	42%	0%	2%	0%	14%

8b	53%	26%	1%	5%	0%	16%
9	20%	7%	61%	7%	1%	4%

This metric is particularly sensitive to the spatial distribution of the individual species. For example, there is no area closed in the central Gulf of Maine for Habitat Alternatives 5(a-d) and, therefore, these alternatives contain very small percentages of redfish biomass. On the other hand, Alternatives 5a and 5d contain a much higher percentage of Jonah crab than the other alternatives. Alternative 7 contains a large proportion of each species, but it is important to keep in mind that Alternative 7 is much larger in size than all the other alternatives. Longhorn sculpin biomass is high in alternatives 9, 5b and 5c; sea ravens in 9, 3a, 5b, and 6; redfish in 9 and 6; ocean pout in 8b, 5d, 5a, 5c and 5d; jonah crab in 5a and 5d; and lobsters in 5b and 5c.

8.5.3 EFH benefits of habitat alternatives

8.5.3.1 Closed area habitat alternatives (1, 3a, 3b, 4, 5a-d, 6, 7, 8a, 8b,9)

The previous sections (Sections 8.5.2.1 through 8.5.2.5) describe the results of the habitat metric analysis that was designed to comply with the requirement of NEPA to describe and analyze the potential impacts of an action on the environment. However, when comparing alternatives for EFH benefit it is important to focus primarily on EFH and the benthic communities. Therefore, the overall EFH analysis of the closed area habitat alternatives is based on two parts: 1) Section8.5.3.1.1.1, which focuses on the EFH component of the habitat metric analysis for species with vulnerable EFH, and 2) Section 8.5.3.1.1.3 prioritizes the habitat analysis to focus only on the components that support the species with EFH vulnerable to bottom tending gear (i.e. focus the assemblage analysis only on demersal species because this group of species is the primary assemblage that species with vulnerable EFH belong to). The first part of the EFH evaluation provides a mechanism to compare alternatives based on which ones potentially provide the most "protection" for species with the most vulnerable EFH to bottom tending gear. The second part helps to focus the metric analysis to incorporate other aspects of the metric analysis, but only those components that support the species with EFH vulnerable to bottom tending gear.

8.5.3.1.1 Summary of the EFH component of the habitat metric analysis

The M-S Act states that Councils are required to minimize, to the extent practicable, the adverse effects of fishing on EFH. It was concluded in Gear Effects Evaluation and Adverse Impacts Determination Section that mobile bottom tending gears (otter trawls, scallop dredges and clam dredges) potentially had a moderate or high adverse impact on the essential fish habitat of 23 species at various life stages. The purpose of this section is to present the results of an EFH-specific analyses for each of the twelve area closure alternatives that indicates how well each closure option will benefit EFH for these species. It also includes a summary of the substrate, trophic guild, and species assemblage characteristics of these species and life stages in each closed area alternative. The analyses are applied to the moderately and highly vulnerable species, to the highly vulnerable species, the highly vulnerable and overfished species, and the highly vulnerable species that are managed by the New England Fishery Management Council.

8.5.3.1.1.1 Evaluation of EFH highly or moderately impacted from bottom tending gear

The following three sections summarize results of habitat metric analyses in more detail for those species that have been defined as adversely impacted by mobile, bottom tending gears, i.e., in a manner than is more than minimal and not temporary in nature (Gear Effects Evaluation and Adverse Impact Determination Section). This analysis begins with a list of the species and life stages with EFH that has been determined to be either moderately or highly vulnerable to mobile, bottom tending gears (Table 210). The analysis evaluates the EFH protection afforded from each alternative on a per-unit-area basis (relative effectiveness indices) (See Table 211 and Table 214).

Table 210 **- Species and life stages with EFH that is moderately or highly vulnerable to mobile, bottom-tending gears.**

Species	Lifestage	Otter Trawl Vuln.	Scallop Dredge Vuln.	Clam Dredge Vuln.
American Plaice	A	High	High	None
American Plaice	J	Mod	Mod	None
Atlantic Cod	A	Mod	Mod	Mod
Atlantic Cod	J	High	High	None
Atlantic Halibut	A	Mod	Mod	None
Atlantic Halibut	J	Mod	Mod	None
Barndoor Skate	A	Mod	Mod	Low
Barndoor Skate	J	Mod	Mod	Low
Black Sea Bass	A	High	High	High
Black Sea Bass	J	High	High	High
Clearnose Skate	A	Mod	Mod	Mod
Clearnose Skate	J	Mod	Mod	Mod
Haddock	A	High	High	Low
Haddock	J	High	High	Low
Little Skate	A	Mod	Mod	Mod
Little Skate	J	Mod	Mod	Mod
Ocean Pout	A	High	High	High
Ocean Pout	J	High	High	High
Ocean Pout	L	High	High	High
Ocean Pout	E	High	High	High
Pollock	A	Mod	Mod	Low
Red Hake	A	Mod	Mod	Low
Red Hake	J	High	High	High
Redfish	A	Mod	Mod	None
Redfish	J	High	High	None
Rosette Skate	A	Mod	Mod	Mod
Rosette Skate	J	Mod	Mod	Mod
Scup	J	Mod	Mod	Mod
Silver Hake	J	Mod	Mod	Mod
Smooth Skate	A	High	High	None
Smooth Skate	J	Mod	Mod	None
Thorny Skate	A	Mod	Mod	None
Thorny Skate	J	Mod	Mod	None
Tilefish	A	High	Low	None
Tilefish	J	High	Low	None
White Hake	J	Mod	Mod	None
Winter Flounder	A	Mod	Mod	Mod
Winter Skate	A	Mod	Mod	Mod
Winter Skate	J	Mod	Mod	Mod
Witch Flounder	A	Mod	Low	Low
Witch Flounder	J	Mod	Low	None
Yellowtail Flounder	A	Mod	Mod	Mod

Yellowtail Flounder	J	Mod	Mod	Mod

Table 211 **– Relative Effectiveness of Habitat Closed Area Alternatives in Protecting EFH for Two Categories of Species and Life Stages**
**Values are EFH area (in square nautical miles) per 100 square nautical miles in each closed area summed for all species and life stages with moderately and highly vulnerable EFH, and for the species and life stages with only highly vulnerable EFH.*

Alternatives	Species with Medium/Highly Vulnerable EFH	Species with Highly Vulnerable EFH
	Sum*	**Sum***
NoAction	15.8	4.4
3a	17.3	5.3
3b	17.2	5.3
4	18.4	5.6
5a	17.4	5.2
5b	17.6	4.9
5c	18.3	5.2
5d	14.3	4.1
6	16.0	4.4
7	9.0	2.6
8a	18.6	6.4
8b	17.4	5.7
9	15.9	4.4

All of the alternatives with the exception of alternatives 7 are relatively effective at protecting moderately and highly vulnerable EFH on a per-unit-area basis. Alternative 4, 5c and 8a score slightly higher than some of the other alternatives in this category. Alternative 8a scores the highest when comparing the alternatives effectiveness of protecting highly vulnerable EFH. Alternative 7 ranks the lowest for both categories.

8.5.3.1.1.2 EFH-specific analysis: highly vulnerable New England-managed and overfished species

This analysis highlights area scaled EFH values for all species and life stages with EFH that is highly vulnerable to mobile bottom-tending gears that are managed by the New England Council, and for species and life stages with vulnerable EFH that are also overfished.

Table 212 – Summary of those species managed by the New England Fishery Management Council with EFH deemed highly vulnerable to mobile bottom tending gears.

Species	Lifestage	OT Vuln.	SD Vuln.
American Plaice	A	High	High
Atlantic Cod	J	High	High
Haddock	A	High	High
Haddock	J	High	High
Ocean Pout	A	High	High
Ocean Pout	J	High	High

Ocean Pout	L	High	High
Ocean Pout	E	High	High
Red Hake	J	High	High
Redfish	J	High	High
Smooth Skate	A	High	High

Table 213 – Summary of overfished species in the Northeast region with EFH that is highly vulnerable to mobile bottom tending gears.

Species	Lifestage	OT Vuln.	SD Vuln.
Atlantic Cod	J	High	High
Black Sea Bass	A	High	High
Black Sea Bass	J	High	High
Tilefish	A	High	Low
Tilefish	J	High	Low

Table 214 - **Relative Effectiveness of Habitat Closed Area Alternatives in Protecting EFH for Two Categories of Species and Life Stages.**

*Values are EFH area (in square nautical miles) per 100 square nautical miles in each closed area summed for all New England species and life stages with highly vulnerable EFH, and for overfished species and life stages in the Northeast region with highly vulnerable EFH.

Alternatives	New England species with Highly Vulnerable EFH	Overfished Species with Highly Vulnerable EFH
	Sum*	Sum*
NoAction	4.5	0.6
3a	5.5	0.7
3b	5.4	0.7
4	5.7	0.8
5a	5.0	0.8
5b	4.9	0.8
5c	5.0	1.0
5d	4.1	0.8
6	4.6	0.6
7	2.3	0.5
8a	6.4	1.0
8b	5.6	0.9
9	4.5	0.5

Alternative 8a ranks the highest in terms of relative effectiveness of protecting New England species with highly vulnerable EFH, alternatives 3, 4, and 8b also score relatively high. The rest score between four and five percent, except Alternative 7 ranks much lower (2.3%). Alternatives 8a and 5c rank the highest for protecting overfished speices and life stages with highly vulnerable EFH with the rest of the alternatives scoring between 0.5 and 0.9.

8.5.3.1.1.3 Metric components indicated by analysis

Table 215 summarizes the ecological characteristics of all species with EFH determined to have been highly vulnerable to mobile bottom tending gears. Based upon the analysis contained in the Gear Effects Evaluation / Types of Gear Effects, metric components may be targeted to identify those species with impacted EFH where the affects are likely to be not minimal or temporary in nature.

Table 215 – Summary of habitat and ecological characteristics of species/lifestages with EFH that is highly vulnerable to mobile, bottom-tending gear.

Species	Lifestage	OT Vuln.	SD Vuln.	Depth	Sediments	Guild it belongs to	Assemblage it belongs to
American Plaice	A	High	High	45-150	sand or gravel	Benthivore	Principle groundfish, Demersal
Atlantic Cod	J	High	High	10-150	rocks, pebble, gravel	Amphipod eater	Principle groundfish, Demersal
Black Sea Bass	A	High	High	20-50	structures, sand and shell		Demersal
Black Sea Bass	J	High	High	1-38	rough bottom, shell and eelgrass beds, structures and offshore clam beds in winter		Demersal
Haddock	A	High	High	35-100	pebble gravel	Benthivore	Principle groundfish, Demersal
Haddock	J	High	High	40-150	broken ground, pebbles, smooth hard sand, smooth areas between rocky patches	Benthivore	Principle groundfish, Demersal
Ocean Pout	A	High	High	<110	soft sediments	Benthivore	Demersal
Ocean Pout	J	High	High	<80	smooth bottom near rocks or algae	Benthivore	Demersal
Ocean Pout	L	High	High	<50	close to hard bottom nesting areas	Benthivore	Demersal
Ocean Pout	E	High	High	<50	hard bottom, sheltered holes	Benthivore	Demersal
Red Hake	J	High	High	<100	shell and live scallops	Amphipod eater	Demersal
Redfish	J	High	High	25-400	silt, mud, or hard bottom	Shrimp and Fish eater	Principle groundfish, Demersal
Smooth Skate	A	High	High	31-874 mostly 110-457	soft mud, sand, broken shells, gravel and pebbles	Shrimp and Fish eater	Elasmobranch, Demersal

Tilefish	A	High	Low	76-365	rough, sheltered bottom		Demersal
Tilefish	J	High	Low	76-365	rough, sheltered bottom		Demersal

Of the 15 species and life stages listed above, 12 are associated with rough, sheltered, hard, pebbled or broken bottom. The list includes 7 benthivores, 2 shrimp-fish eaters and 2 amphipod eaters. Every species and life stages listed falls under the demersal and, in five cases, also the principle groundfish assemblage. These groupings allow for an analysis of other metric components (Table 216 through Table 218).

Sediment

Table 216 – Percent composition of sediment types associated with species with highly vulnerable EFH within each closed area

	Bedrock	Gravel	Gravelly Sand	Sum
3(a)	1%	6%	34%	41%
3(b)	1%	7%	35%	43%
4	1%	6%	35%	42%
5(a)	0%	1%	4%	5%
5(b)	0%	1%	11%	12%
5(c)	0%	1%	4%	5%
5(d)	0%	2%	4%	6%
6	0%	2%	16%	18%
7	0%	1%	4%	5%
8a	0%	0%	33%	33%
8b	0%	5%	28%	33%
9	0%	2%	17%	19%

Guild

Table 217 – Percent composition of trophic guilds associated with species with highly vulnerable EFH within each closed area

	Benthic	Ampshr	Shrfis	Sum
3(a)	42%	11%	24%	77%
3(b)	42%	11%	23%	76%
4	43%	11%	23%	77%
5(a)	26%	14%	17%	58%
5(b)	33%	14%	6%	53%
5(c)	32%	15%	9%	56%
5(d)	28%	8%	12%	48%
6	36%	14%	26%	76%
7	24%	6%	23%	53%
8a	46%	16%	2%	64%
8b	43%	19%	2%	65%
9	36%	16%	24%	76%

Assemblage

Table 218 – Percent composition of species assemblages associated with species with highly vulnerable EFH within each closed area

	Pringrd	Demersal	Sum
3(a)	22%	49%	71%
3(b)	21%	49%	70%
4	22%	49%	71%
5(a)	11%	47%	59%
5(b)	9%	47%	56%
5(c)	11%	47%	58%
5(d)	11%	45%	56%
6*	15%	49%	64%
7	10%	49%	58%
8a	15%	49%	64%
8b	17%	50%	66%
9	17%	49%	66%

8.5.3.2 Non-closed area habitat alternatives (10,11,12,and 13)

The following table summarizes the potential habitat impacts of Alternatives 10-13. The Alternatives are ranked on a scale from 2 to –2, with 2/-2 representing a serious impact (positive or negative) to habitats, 1/-1 a minimal impact and zero a neutral impact anticipated.

Table 219. Potential habitat impacts of non-area closure alternatives

	Potential Impact
Alternative 10 (Restrictions on rock chains)	0
Alternative 11 (Option 1 - 4in dredge rings everywhere)	1
Alternative 11 (Option 2 - 4in dredge rings in recently re-opened areas)	1
Alternative 12 (Habitat research funded through TAC set-aside)	N/A
Alternative 13 (Area-based management/habitat protection)	1

Alternative 10 was determined to have a neutral impact, as it was not anticipated to reduce the footprint of the scallop fishery. Alternative 11 (both incarnations) had a modest benefit to habitat through reductions in bycatch and epifaunal displacement, and in the case of Option 2, reductions in area swept by the fishery. Option 1 may result in increases in area swept, particularly within the first year of implementation, as dredge efficiency decreases and previously recruitable scallops are no longer retained. This is only expected to last approximately one year, at which point those same scallops will be recruitable and, as the average size of recruited scallops increases, area swept is projected to decrease due to the increased efficiency of 4-in. dredge rings on large scallops. Alternative 12 had no specific mechanism for evaluating or even proposing research and therefore no conclusions may be reached on potential habitat impacts. Alternative 13 is likely to reduce the area swept by the scallop fishery as the resource density in fished areas increases. Areas of potentially sensitive habitat, though not identified, will be provided with longer closed periods through which they are assumed to recover. This alternative applies only to scallop gears, and the periodic area closures will have no impact whatsoever on trawl or clam dredge fishing activities.

8.5.4 Environmental Consequences of Habitat Alternatives Under Consideration

8.5.4.1 Habitat Alternative 1

The differences between the No Action and Status Quo are described in Section 5.2. The year-round closures for both alternatives are the same because future area access through *ad hoc* framework adjustment under status quo cannot be predicted. Since the habitat metric analysis focuses on year-round closures only, the assumptions and results for No Action and Status Quo analysis are therefore identical. Under status quo, the scallop fleet may have future access to portions of the closed areas, but this access cannot be quantitatively analyzed. Therefore, it is important to note that if the scallop fleet is given access the habitat impacts will be greater in these areas.

Furthermore, it is important to note that the groundfish closures were not established to protect habitat. They were established to reduce fishing mortality rates on groundfish species regulated under the NEFMC Multi-Species FMP and prohibit the use of all gears capable of catching groundfish, either as targeted species or by-catch. Therefore, not all gears that could potentially affect benthic habitat have been excluded from these areas during the past 5-8 years (Closed Area I, Closed Area II, and the Nantucket Lightship Closed Area were established in December 1994, and the Western Gulf of Maine Closed Area in May 1998). Clam dredges and shrimp otter trawls are used in some closed areas and scallop dredge vessels have been given temporary access to portions of the Georges Bank closed areas in recent years. A variety of bottom-tending fixed gear types are used in all four areas. Even though this makes it difficult to assess to what degree benthic habitat quality in the groundfish closed areas has improved during the last 5-8 years, bottom habitats have been well protected from mobile, bottom-tending gear in the 80% of the Georges Bank closed areas that wasn't opened to scallop dredging in 1999 and 2000, and in the WGOM closed area. It's also true that a lot of the area on Georges Bank is a high-energy sand environment that is less vulnerable to the effects of trawling and dredging than deeper areas with immobile sand substrates, gravel or rocky bottom, or mud bottom (see Gear Effects Evaluation, **Section 7.2.6.2**).

Despite the fact that the quality of some benthic habitats in the four groundfish closed areas that constitute the NAA has probably improved since these closures were implemented, there is no guarantee that these areas, as currently defined, will remain in place once groundfish stocks improve. They were intended to be temporary closures. Therefore, if the Council fails to adopt any of the habitat management alternatives and defaults to the NAA, any incidental habitat benefits that have accrued within the groundfish closed areas would be reduced or lost all together, depending on how much of the existing closed area is opened up to mobile, bottom-tending gear.

Information on the abundance and distribution of sediment types, EFH area, and three biomass indices contained within the no action/status quo alternative is described in Section 8.5.2. Because the features of the groundfish closed areas have not been, and would not be protected as effectively as the features of the proposed habitat closed areas (see above), results of the metric analyses for the NoAction Alternative are shown in the tables for comparison, but should not be included in the evaluation of closed area alternatives for habitat. Therefore, the results are not discussed further in this document.

Within the Status quo alternative there is the potential to add, adjust, or remove *ad hoc* area closures to protect small scallops and harvest large ones. For example, the Hudson Canyon and Virginia Beach closures could be implemented, adjusted, or removed through supplemental framework action.

Since the future status of these areas is not defined, the potential habitat benefits that would be achieved by closing these areas cannot be analyzed. For descriptive purposes only, Table 220 characterizes the sediment types within the areas. They are composed almost entirely of sand.

Table 220. Distribution of sediment type within the two scallop closures in the Mid-Atlantic region

	Area	Bedrock	Gravel	Gravelly Sand	Sand	Sandy Mud	Mud
Hudson Canyon	*1,478*	0%	0%	0%	98.0%	2.0%	0%
Virginia Beach	*424*	0%	0%	0%	91.5%	4.8%	3.7%

8.5.4.2 Habitat Alternative 2

There may be some benefits to essential fish habitat resulting from the measures considered by the Council under Amendment 10. This alternative identifies and assesses the habitat benefits that are attributed to non-habitat-specific measures in Amendment 10 and relies on these benefits to comply with the EFH provisions of the Magnuson-Stevens Act. **Table 221** describes the impacts to habitat of Amendment 10 non-habitat alternatives, see Section 8.5.4.14 for a more detailed discussion of the habitat impacts of Alternative 2.

Table 221 Characterization and summary of potential impacts of Amendment 10 management measures on EFH.

Management Measure	Impact[86]	Explanation
Status quo overfishing definition	– w/o access + with access	Use of SQ definition will increase scallop fishing effort in open access areas, which could lead to resource depletion, reduced catch rates and increase in bottom time, but not if fleet has access to closed areas; with access, total bottom time will probably decrease because of high catch rates in clos ed areas.
Flexible boundary (adaptive) area rotation based on survey data	unk	Opening and closing criteria are based solely on scallop biomass and growth parameters, not habitat values. Impacts of area rotation will vary depending on the type and vulnerability of habitat types present in the area, its size, the intensity of scallop fishing prior to closure, recovery times for critical habitat features, etc. Habitat impacts will have to be evaluated on a case-by-case basis.
Controlled access to Framework 13 areas in Closed Area I and Nantucket Lightship Area in 2004 and Closed Area II in 2005-2007[87]	–	These areas were closed to groundfish gear (including scallop dredges) in 1995 and opened to scallop dredging on a limited basis in 1999 and 2000. Opening them to scallop dredging will negatively affect EFH, particularly in Closed Area I because hard bottom habitat in this area is more vulnerable to fishing than sandy bottom in other areas. [3]
Continue controlled access to Hudson Canyon Area in 2004/2005	0 (-)	On one hand, continuing controlled access in the Hudson Canyon Area will reduce bottom contact time and allow fishing effort to be more concentrated than outside the area. This may reduce EFH impacts where EFH is more complex outside of the Hudson Canyon Area. Relative to the no action alternative where the Hudson Canyon Area would open to general scallop fishing, however, this action decreases scallop fishing effort. Effort therefore would be higher elsewhere than without controlled access, potentially increasing effort where more complex EFH exists.

86 Impacts are evaluated for juvenile scallops and other federally-managed species relative to the status quo as positive (+), negative (-), none (0), or unknown (unk). Ranks in parentheses indicate impacts relative to the no action alternative, i.e., the provisions of Amendment 7 to the Scallop FMP, which was implemented in 1998.

87 Georges Bank area access alternatives will be implemented in a later management action (Framework Adjustment 16/39).

Open VA/NC Area closed area to regular scallop fishing in 2004	0 (-)	This area has been open to controlled access scallop fishing since 2001; Amendment 10 will open it to regular scallop fishing in 2004. Relative to the status quo, this change in status will have no habitat impact because scallops are not currently being harvested there. Relative to no action, the impacts, may be positive if the effort would have occurred in areas with more complex EFH.
Initial area rotation area closure in Mid-Atlantic in 2004 for three years	0	Closure will benefit EFH in this area, but benefits will be negligible due to high energy nature of the environment and because effort will be displaced into other areas[88]
Area-specific DAS allocations	unk	Effects may be both positive or negative, depending on the area. Positive impacts occur when the result is to reduce fishing effort by lower bottom contact time, while negative impacts may occur from access in areas with more sensitive habitat.
Exchange of DAS and trips between vessels	0	No predictable effect on EFH.
Broken trip DAS and trip adjustments	+	Could reduce effort in controlled access areas. Under a broken trip adjustment, vessels will actually loose some controlled access DAS allocations as part of the penalty. They would not be able to finish the trip, unless they had sufficient days remaining.
Four inch rings and 10 inch twine tops	+	Four inch rings will slightly increase dredge efficiency for larger scallops, thus reducing bottom contact time in recently-opened areas where large scallops are abundant, but will reduce catch rates and increase bottom time in areas where medium-small sized scallops are prevalent. Ten-inch twine tops will reduce by-catch, but have no direct habitat effects.
Reduced possession limit for limited access vessels fishing outside of scallop DAS	+	Vessels with limited access permits are currently allowed to possess and land up to 400 lbs per trip of shucked scallop meats when not required to use allocated DAS; this measure will reduce possession limit to 40 lbs/trip) and reduce fishing effort by vessels that have been targeting scallops under the higher general category possession limit. Scallops harvested under this provision cannot be sold.
Access for general category vessels to controlled access areas	0	General category vessels will be allowed to fish in controlled access areas, subject to a 400 lbs/trip possession limit. Previously, the limit was 100 lbs. for the Hudson Canyon and VA/NC Areas and zero for the Georges Bank area access programs in past framework actions. This measure will increase fishing effort in certain areas that are accessible to general category vessels, but the incremental effect on EFH will probably be negligible given much higher effort by limited access vessels.
Framework measures for controlled access	0	Do not include adjustable habitat management measures.
2% set-aside from TAC and/or DAS allocations to fund research and surveys	+	Could indirectly benefit habitat when habitat research is funded and provides better information for future management decisions
Mandatory observer coverage on a suitable number of trips	0	Objective is to monitor by-catch and capture of protected resources, not assess or monitor habitat effects that would be difficult to do without special expensive equipment.
Bi-annual framework mechanism for setting DAS allocations and making other management adjustments	0	No habitat effects; Council can take action under a framework action to protect EFH.

88 There is no analysis of habitat attributes in the EIS to support a quantitative evaluation of the habitat impacts of this management measure.

8.5.4.3 Habitat Alternative 3

Alternative 3 was intended to protect complex hard-bottom and other sensitive and complex habitats. This alternative was approved by the Council with two versions of the Western Gulf of Maine closed area. Therefore this alternative contains two closed area scenarios: 1) Alternative 3(a) with a larger extension of the WGOM to the west, and 2) Alternative 3(b) which has a smaller extension of the WGOM closure to the west (See Map 16 and Map 17). The extensions of the western boundary of the WGOM Closed Area is the predominate difference between these two alternatives. These extensions were explicitly designed by the EFH Tech team in 1999 to capture additional seafloor habitats inside the closed area. Alternative 3(b) includes two angular extensions from the western boundary to encompass additional gravel habitat on Stellwagen Bank as well as piled boulder features on Tillies Bank to the North. Alternative 3(a) extends the entire southwestern boundary of the closed area to include the aforementioned features as well as the deep mud basins east, west and north of Tillies Bank. These alternatives originate from an analysis of the USGS multibeam map of the area (using ROVs, occupied submersibles, and video bottom cameras), as well as the accumulated field experience of the Tech Team members.

Alternative 3(a) is slightly larger than Alternative 3(b) and both closed area options are intermediate in size compared to the other closed area alternatives (Table 200). The sediment compositions of the two alternatives are essentially the same. Relative to the total amount of each sediment type in the NAAA, this alternative – like alternative 4 – would close a higher percentage of bedrock, gravel, and gravelly sand than the other proposed habitat closures, but not much sand or mud (**Table 201**). **Table 203** shows that the percent of total vulnerable EFH in Alternatives 3a and 3b score slightly lower than most of the other alternatives (6.1% and 5.9%). Because the footprints of these two alternatives are so similar, the percentages of EFH area inside them are also very similar for virtually all species analyzed. Species and life stages with vulnerable EFH with high amounts of EFH (over 10 percent), in this area are: cod (A, J), haddock (A,J), halibut (A,J), pollock (A), and smooth skate (A) (**Table 203**). After scaling for area, the EFH values do not rank very high for Alternatives 3a and 3b (Table 211). However, they do rank higher than the larger alternatives, Alternatives 6, 7, and 9. However, for New England species with highly vulnerable EFH, Alternatives 3a and 3b rank higher than most of the other alternatives (Table 214).

Considering that Alternatives 3a and 3b are smaller than Alternative 6 and 9, 3a and 3b contain a high percentage of total benthivore guild biomass, and principle groundfish (Table 204 and **Table 206**). Alternatives 3a and 3b also scored high for redfish biomass (still lower than Alternatives 6, 7 and 9).

8.5.4.4 Habitat Alternative 4

Alternative 4 identifies habitat subsets contained within a proposed (but rejected) groundfish rebuilding closed area option in Amendment 13 (Rebuilding Alternative 1). This alternative was included in Amendment 10 primarily to remain consistent with habitat alternatives proposed in Amendment 13. Much of the habitat closed area specified in Alternative 3 would be included in this alternative. However, this alternative excludes an area between Closed Area I and the Nantucket Lightship Closed Area that was recommended by the Habitat Technical Team for habitat protection purposes (Map 18). Also, an area in the northern Gulf of Maine (Jeffreys Bank) and areas west of the existing Western Gulf of Maine Closed Area that are included in Alternative 3 are not included in Alternative 4. The proposed Cashes Ledge Closed Area is also shaped a little differently.

The total area included in Habitat Alternative 4 comprises 2,241 nm² slightly less that alternatives 3a and b (Table 200). In fact, the only habitat closure that would close less area is the Georges Bank

HAPC Alternative 8. Relative to the total amount of each sediment type in the NAAA, this alternative – like alternative 3 – would close a higher percentage of bedrock, gravel, and gravelly sand than the other proposed habitat closures, but not much sand or mud (**Table 201**). Because the total area that would be closed is fairly small, the total EFH value of this alternative is lower than the other habitat alternatives (**Table 203**). But after the EFH data are scaled for differences in area, this alternative ranks high in terms of EFH value for the species and life stages identified as having EFH vulnerable to bottom tending gear (Table 211). Species and life stages with vulnerable EFH with high amounts of EFH (over 10 percent), in this area are: cod (A, J), haddock (A,J), halibut (A,J), pollock (A), and smooth skate (A) (**Table 203**). For New England species with highly vulnerable EFH, Alternative 4 ranks higher than all the other alternatives except for Alternative 8a (Table 214). Therefore, this alternative is very effective for protecting EFH for species in New England that have EFH highly vulnerable to bottom tending gear, as compared to the other closed area alterantives.

The distribution of biomass among trophic guilds in Alternative 4 is very similar to Alternatives 3a and 4, i.e., >40% benthivores and about 20% shrimp and fish-eating fish and planktivores (Table 204). Alternative 4 contains a slightly lower percentage of total benthivore and shrimp and fish-eaters biomass in the NAAA than Alternatives 3a/b (Table 204). The biomass values and percentages for the other three trophic guilds were fairly low in Alternatives 3a/b and 4 compared to the other alternatives.

The composition of the five species assemblages in Alternative 4 is also very similar to what it is in Alternatives 3a and b. The demersal finfish assemblage accounts for almost 50% of the total assemblage biomass in Alternative 4, with principal groundfish and elasmobranchs each making up >20% (Table 206). As is the case in Alternatives 3a and 3b, redfish accounted for >50% of the total individual species biomass in Alternative 4, and longhorn sculpins for >20% (Table 209). The percentage of total redfish biomass in Alternative 4 (and 3a/b) is higher than in most of the alternatives, but lower than 6, 7, and 9 (Table 208).

Alternatives 3a and 3b and 4 rank high in terms of all the environmental characteristics that are associated with the 15 species and life stages with EFH that were determined to be highly (H) vulnerable to the adverse effects of mobile, bottom-tending fishing gear (see Section 7.2.6.2.5). This conclusion is based on the high rankings for hard bottom and coarse sediments (Table 216), the benthivore, amphipod-eating, and shrimp and fish-eating trophic guilds (Table 217), and the principal groundfish and demersal finfish species assemblages (Table 218).

8.5.4.5 Habitat Alternative 5

Alternative 5A: EFH/Productivity tradeoffs using the original working group species EFH weights with equal emphasis given to scallop productivity and the combined weighted productivity of 37 other managed species (Appendix IV).

Alternative 5B: Total EFH value only, using revised species EFH weights (omitting relative importance to the fishery as a factor), with no productivity tradeoff.

Alternative 5C. EFH/Productivity tradeoffs using the revised species EFH weights with equal emphasis given to scallop productivity and the combined weighted productivity of the other 37 managed species.

Alternative 5D. EFH/Productivity tradeoffs using the revised species EFH weights and productivity for each of the 37 managed species, considered individually.

A distinguishing characteristic of the proposed habitat closed areas in Alternative 5 is the fact that they are empirically derived from 30 years of trawl survey data for a large number of species (37) throughout the Northwest Atlantic Analysis Area (see Appendix IV). Each alternative proposes to close five areas of similar size, one in each of five "eco-regions" (see Appendix IV). The total area that would be closed is very similar, ranging from 3,022 to 3,098 nmi². Because these four closure options were developed without any reference to existing closed areas, only a small fraction of these proposed closed areas overlap with the existing groundfish closed areas. All four alternatives include a closed area in the Mid-Atlantic Bight: all of the other habitat closed area alternatives (except 7) are restricted to Georges Bank and the Gulf of Maine.

The sediment compositions of the four alternatives vary to some extent, although none of them include very much coarse sediment. The predominant sediment types in all four options are sand and mud (Table 202). Alternative 5(b) would close two areas in southern New England and the Mid-Atlantic and contains more gravelly sand and sand while Alternatives 5(c) and 5(d) contain slightly more gravel than Alternatives 5(a) and 5(b).

The total (unscaled) EFH values of these four alternatives range from 5.4% to 6.7% (Table 203). Species and life stages with vulnerable EFH with high amounts of EFH (over 10 percent), in this area are: cod (A, J), haddock (A,J), halibut (A,J), pollock (A), and smooth skate (A) (Table 203). Alternatives 5a-d do not contain as much EFH area for these species as most of the other alternatives under consideration. Total EFH values for Alternatives 5a,b, and 5c are higher than for Alternatives 3 and 4 (5.9 – 6.1%). After scaling for area, the EFH value of 5c is slightly higher than 5a, 5b, and 5d ranks lower than all the alternatives, except for Alternative 7(Table 211). The results are very similar for the H vulnerable species/life stages (Table 211). For species with highly vulnerable EFH in New England only, total scaled EFH values rank fairly high in Alternatives 5a, 5b, and 5c, but lower in 5d (Table 214). For overfished species with highly vulnerable EFH, all the Alternative 5 options rank higher than the other alternatives, especially 5(c).

The dominant trophic guilds in the four Alternative 5 options are benthivores and planktivores (Table 205). Planktivore biomass in these four alternatives is higher than in the other closed area options. Shrimp and fish-eater biomass is very low. Relative to the total biomass of each trophic guild in the NAAA analysis area, the Alternative 5 options contain higher percentages of planktivore biomass than most of the other alternatives (Table 204). Percent-of-total biomass values are also relatively high for amphipod-eaters in 5a-c and for piscivores in 5b.

Elasmobranchs and demersal finfish species account for most of the species assemblage biomass in the four Alternative 5 closed area options (Table 207). Principal groundfish species only make up 9-11% of the total assemblage biomass (compared to 21-22% in Alternatives 3). Pelagic species are more abundant in the Alternative 5 area closures.

Of the six individual benthic species that were analyzed, redfish, ocean pout, and longhorn sculpins account for most of the total biomass in Alternative 5(a), sculpins in 5(b), sculpins, and ocean pout in 5(c), and redfish and ocean pout in 5(d) (Table 209). Lobsters were more abundant in 5b and c than in any of the other alternatives, except for 8a and 8b. Relative to total biomass of each species in the NAAA analysis area, the biomass of sculpins in 5b and 5c is higher than in any of the other alternatives, after alternatives 7 and 9.

None of the Alternative 5 closed area options rank as high as the other habitat closed area alternatives in terms of the environmental characteristics that are associated with the 15 species and life stages that have EFH highly (H) vulnerable to the adverse effects of mobile, bottom-tending fishing gear (See Gear Effects Evaluation and Adverse Impacts Determination Sections). Alternative 5(b) ranks higher for sediments and slightly less than 5(a) for guilds and assemblages (**Table 216 - Table 218**). Assemblage scores for all four Alternative 5 options were very similar.

8.5.4.6 Habitat Alternative 6

This alternative is consistent with the controlled area access program under Framework 13 to the Scallop FMP. Since these areas have already been identified as bottom where scallop gear was permitted under Framework 13 to the Scallop FMP the impacts to habitat have already been analyzed and considered non-significant. However, since the analysis of Framework 13 was completed, habitat studies have been conducted in these access areas and preliminary results show that these areas contain more complex habitat than originally thought. By including these areas as a management alternative, the Council will be able to integrate scallop and groundfish management more effectively. However, these areas were not originally identified as areas with high habitat importance, thus they may minimize the habitat effects of fishing as effectively as other habitat closure alternatives.

This alternative is larger (4,041 nm²) than any of the other habitat alternatives except #7 and #9 (Table 200). Alternative 6 is defined to be the portion of the three groundfish closures (five discrete areas) on Georges Bank that have remained closed to scallop dredging since December 1994. However, these closures would be temporary, only lasting as long as they remain in place as groundfish closures. Over 60% of this area is sand. Even though only 2.3% of this area is made up of gravel, 17% of all the gravel in the Northwest Atlantic Analysis Area is contained within this alternative (**Table 201**). However, since this proposed closed area is fairly large and contains so much sand, the proportion of coarse sediment in this area is less than in alternatives 3, 4, or 9 (**Table 202**). According to **Table 203**, the percent of total vulnerable EFH in this alternative ranks high compared to the other alternatives. The sum of vulnerable EFH area inside Alterantive 6 is 7.9% of the total; only Alternatives 7 and 9 rank higher. When the total EFH value for vulnerable species is scaled for area, this Alternative ranks lower, *i.e.*, less than alternatives 3, 4, 8, and 5a-c, much higher than alternative 7, and about the same as alternatives 5d and 9 (Table 211). According to Table 214, this alternative is not as effective at protecting EFH for New England species with EFH highly vulnerable to bottom tending gear.

The amphipod-eaters guild is well represented in the proposed Alternative 6 closed area (Table 204). The percent-of-total biomass values for the piscivore and shrimp/fish eater's biomass is slightly higher than in any of the other alternatives, and benthivore biomass is high in Alternative 6 (Table 204).

Elasmobranchs and demersal finfish species account for most of the species assemblage biomass in Alternative 6 (Table 207). Principal groundfish species make up 15% of the total assemblage biomass (compared to 21-22% in Alternatives 3 and 4) and pelagic species are not abundant. Again, due to its large size, this alternative accounts for the highest percent-of-total biomass values for the elasmobranchs, principal groundfish, and demersal finfish species (**Table 206**).

Of the six individual benthic species that were analyzed, redfish account for 66% of the total biomass in Alternative 6 (Table 209). Relative to the total biomass of each species in the Northwest Atlantic analysis area, the biomass values for redfish, longhorn sculpins, and sea ravens are fairly high (Table 208).

The Alternative 6 closed area option ranks below Alternatives 3, 4 and 8 in terms of the substrates that are associated with the 15 species and life stages with EFH that are highly (H) vulnerable to the adverse effects of mobile, bottom-tending fishing gear (**Table 216**). This alternative ranks fairly high for trophic guilds (**Table 217**), and an intermediate rank for species assemblages (**Table 218**).

This alternative ranks high for biomass of the three bottom-feeding trophic guilds and low for planktivores and piscivores (Table 217). This alternative also ranks high for three of the five species assemblages – elasmobranchs, principal groundfish, and demersal finfish (Table 218). The only one of the six benthic species that were analyzed separately that scores high is redfish (Table 209).

8.5.4.7 Habitat Alternative 7

Potential habitat closures were identified from the 1) the prevalence of EFH designations, and 2) areas with low scallop productivity. This alternative specifically states where scallop fishing can and cannot occur. Scallop fishing would be prohibited in areas with low scallop productivity and high EFH importance as defined by the same model that was used to generate closed area alternatives 5a-d. Other types of fishing would be allowed to continue in these areas.

Alternative 7 is very large and would close 65,503 nmi² or 78% of the total Northwest Atlantic Analysis Area (Map 24). Most of the sediment in Alternative 7 is sand and mud (Table 201). Because this area is so large, the percentage of EFH area for all 23 vulnerable species that it contains is very high (Table 203), but the total scaled EFH value is very low (Table 211). Because this is the only alternative that would close deep water habitats along the edge of the continental shelf, it is also the only proposed closure that includes EFH for tilefish and rosette skates – two deep-water species. This alternative ranks last in all the scaled for area EFH values (Table 211 and Table 214). Alternative 7 ranks last in the percent composition of sediment types associated with highly vulnerable EFH (Table 216). It is lower that most of the other alternatives for the guild and assemblage values associated with species with highly vulnerable EFH as well (Table 217 and Table 218).

8.5.4.8 Habitat Alternative 8

Alternative 8(a) - Current Cod HAPC on George's Bank

The Cod HAPC on Georges Bank (Map 25) would be closed to all gear capable of catching scallops that are identified through the Scallop FMP that are determined to adversely affect scallop EFH, or EFH for other federally-managed species in the Northeast region. This area is deemed critical to the sustainability of the Georges Bank cod stock. Significant portions of the area contain gravel pavement and cobble bottom, believed to be the most sensitive to the effects of scallop dredging and bottom trawling because it provides structured, three-dimensional habitat for juvenile cod. The Cod HAPC is inside groundfish Closed Area II and was established in 1997.

This area is very small (only 186 nmi^2). It is composed entirely of sand and gravelly sand (**Table 202**) and contains small amounts of EFH area for cod, halibut, scallops, haddock, ocean pout, red hake, redfish, four species of skates, and winter flounder (**Table 203**). The total scaled EFH area value for species with moderately and higly vulnerable EFH is relateively high for this alternative (Table 211). Alterantive 8a does the most effective job of protecting New England managed species with highly vulnerable EFH (Table 214).

Alternative 8(b) -Cod HAPC plus additional area west and inside of CAII

This alternative would create a habitat closed area that includes the existing HAPC on Georges Bank and an area west of the current western boundary of Closed Area II and area within CAII that is contiguous to the HAPC, in all an additional 546 nmi^2 that is not included in alternative 8a (Map 26).

The total area that would be closed is 732 nmi^2 and is the same area that is included as part of habitat closed area alternatives 3 and 4. This alternative would NOT expand the existing HAPC designation. The area is composed primarily of sand and gravelly sand (Table 202) and contains EFH area for the same species that are designated in 8a, plus silver and white hake (Table 203). The scaled EFH values for most of these species are high, but the total scaled EFH value for this alternative is quite a bit lower than for alternative 8a (Table 211). Relative to its size, alternative 8b scores high for planktivore biomass, but not for any of the other guilds (Table 204). The two pelagic species assemblages score high in 8b, but not any of the benthic finfish species groups (Table 206). Ocean pout and jonah crabs also are abundant in this area (Table 208). A significant portion of alternative 8b is comprised of gravelly sand (Table 216).

8.5.4.9 Habitat Alternative 9

The existing year round groundfish closed areas (per the CLF vs. Daley settlement agreement) on Georges Bank and in the Gulf of Maine would continue to be closed to fishing gear that is capable of catching scallops and gear that adversely impacts scallop EFH or EFH of other species. These areas include Closed Area I, Closed Area II, the Western Gulf of Maine Closed Area, the Nantucket Lightship Closed Area and the new Cashes Ledge Closed Area (Map 27). There are three important differences between this alternative and the No Action alternative: 1) the inclusion of the Cashes Ledge closure on a year round basis, and 2) the additional habitat protection that would result from the exclusion of bottom-tending gears that are known to disturb benthic habitats, *i.e.*, gears like shrimp trawls and clam dredges that are currently allowed access to the groundfish closed areas, and 3) the fact that areas that are currently closed to reduce groundfish mortality rates are subject to modification as depleted groundfish stocks recover, but habitat closures would not be.

This alternative would close approximately 6,254 nmi² of ocean bottom, slightly more than is included within the No Action alternative (Table 200). This proposed closure is composed of almost 80% sand and gravelly sand (**Table 202**). A significant proportion (10-25%) of gravelly sand, gravel, and bedrock in the Northwest Atlantic analysis area is contained within the five areas that make up this alternative (**Table 202**).

Species and life stages with vulnerable EFH with high amounts of EFH (over 10 percent), in this area are: cod (A, J), haddock (A,J), halibut (A,J), pollock (A), and smooth skate (A) (**Table 203**). Alternative 9 contains a significant portion of these species EFH as compared to the other alternatives. Total EFH values for Alternative 9 is ranked the highest (12.1%) after Alternative 7. After scaling for area, alternative 9 has a moderately high total EFH value – about the same as alternatives 6 and 5d (Table 211).

Alternative 9, like alternative 6, contains a high biomass value of all three benthic-feeding trophic guilds and a low biomass value of pelagic-feeding species (Table 204). Alternatives 6 and 9 are also similar with regard to the biomass of the five species groups. Alternative 9 scores high for principal groundfish and demersal species, moderate for elasmobranchs, and low for pelagic species (**Table 206**). Sculpins, sea ravens, and redfish were also fairly abundant in this area (Table 208).

8.5.4.10 Habitat Alternative 10

This alternative proposes to limit the amount, and possibly the configuration, of rock chains for limited access and general category scallop vessels. The intention is that such restrictions will prevent scallop vessels from operating in certain high-relief bottom areas where dredges are likely to pick up large rocks.

It is not clear if this will actually be the case. The prohibition of rock chains will not, per se, make rocky bottom areas un-suitable for scallop dredging. Rather, the addition of rock chains decreases to some extent the amount of damage to scallop gear caused by contact with boulders, rocks or other high-relief bottom. Rock chains may also reduce the habitat impact of scallop dredges in these areas by reducing the displacement of rocks and boulders. Damage to bottom habitats caused by dredges without rock chains may be greater than it would otherwise have been.

This alternative will not likely have a positive impact on the habitat of the region. The presence/absence of rock chains (or alterations in their configuration) is not likely to have the intended effect of reducing the amount of bottom that is dredged.

8.5.4.11 Habitat Alternative 11

Option 1: Scallop dredge ring size would be required to be 4-inches everywhere

The impacts of increasing dredge ring size to 4 inches are twofold. First, it has been observed that the bycatch of benthic organisms such as finfish, sponges, crabs, and starfish is reduced in dredges with larger rings. Reduced damage and mortality of bottom dwelling species that are returned to the bottom instead of being crushed in the dredge and brought to the surface enhances biodiversity and reduces the impact of dredging on benthic communities. The magnitude of this bycatch reduction has not been studied and cannot be quantified at this time.

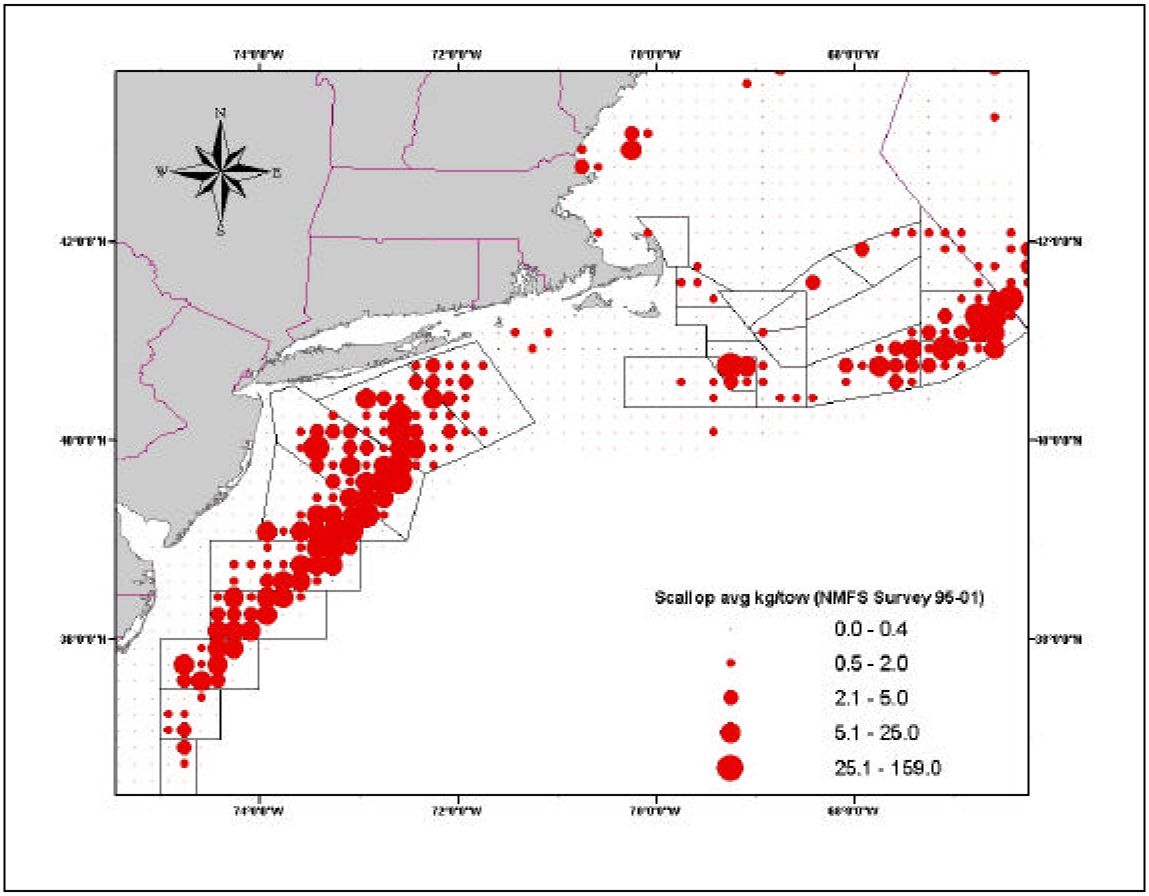
The second impact of increasing dredge ring size to 4 inches is the effect this will have on fishing patterns in general and swept area in particular. 4-inch dredge rings appear to be more efficient harvesters of larger (110+ mm) scallops, on the order of 4 to 5%. Long-term projections (fishing at a constant mortality rate of F = 0.2) translate this improved efficiency into a roughly 15% decrease in swept area (Table 222).

Table 222. Long-term projections of scalloping impacts, 3.5 inch vs. 4 inch dredge rings.

Strategy	Rings	Bms-mean	Ctch-mean	LPUE	DAS	ArSwpt
Non-rotational options	inches	g/tow	MT	lbs/d		nm^2
F=0.2	3.5	13732	14945	2314	14559	2334
F=0.2	4	14237	15561	2397	14267	1996

These are long-term projections. Initially, the 4 inch dredge ring will lead to an unquantified increase in swept area as scallop vessels attempt to compensate for reduced catches of small (90-95 mm) scallops which will escape through the larger rings. The short-term effect is expected to last for one year, the time it takes for scallops of this size to grow large enough to be retained by the dredge. As the average size of scallops throughout the range of the fishery increases, the area swept will decrease. However, depending on management options selected for implementation in Amendment 10, the potential exists that scallop vessels will continue to fish, albeit with reduced efficiency, on beds of smaller scallops. This will lead to an overall increase in swept area and bottom contact time for the fishery. It is not possible to quantify the magnitude of this effect. It will likely be most prominently felt in areas where the density of scallops is lower, and where abundances of smaller scallops occur.

Map 56. Scallop abundance (1995-2001 averaged).



Option 2: Scallop dredge ring size would be required to be 4 inches in a "re-opened" status, including groundfish closed areas if an access program is active

This alternative is highly likely to mitigate any of the potential short-term adverse impacts to habitat associated with an increase in ring size because areas would be re-opened after most of the scallops had grown to larger sizes. The benefits of both the reduction in bycatch and swept area are likely to be felt, without the potential negative impacts associated with fishing on smaller scallops with the larger dredge rings.

8.5.4.12 Habitat Alternative 12

This alternative would directly benefit the habitats of the region. There are large gaps in the understanding of fishery impacts on EFH, and much research is needed. Valuable research that is currently being conducted would also likely benefit from additional funding. This alternative does not quantify the funds available, nor does it provide a mechanism to ensure that available funds are allocated in a manner consistent with the recommendations of the Habitat Technical Team or the Council.

8.5.4.13 Habitat Alternative 13

There are two Alternatives to Improve Scallop Yield which utilize habitat benefits as a criteria for determining the closed, recently re-opened or open status for the RMA's (Alternative 5.2.1.5 – Adaptive closures and re-openings, with fixed boundaries and mortality targets or frequency of access that vary by area; and, Alternative 5.2.1.7 – Area-based management with area-specific fishing mortality targets without formal area rotation). These alternatives propose to include habitat concerns (HAPC areas, areas of "above average sensitivity") as criteria for defining area closure and/or limiting scalloping effort in certain areas based on similar concerns.

Specific areas of "above average sensitivity" are not defined, nor are areas in which reduced area-specific mortality targets would be recommended. The concept of including habitat concerns such as anticipated bottom recovery time for the areas in question is clearly of some benefit to habitat, but this benefit is reduced by the fact that these area closures apply only to scallop gears and not to all gears deemed to adversely affect scallop EFH. Furthermore, no specific procedures for incorporating habitat protection objectives into either of these area rotation alternatives have been proposed, so no analysis of their environmental consequences can be made.

8.5.4.14 Impacts on scallop management and bycatch.

8.5.4.14.1 Effects on future scallop management and potential yield

8.5.4.14.1.1 Movement and other assumptions

Unlike finfish and other mobile living marine resources, management closures tend to have higher costs associated with the Atlantic sea scallop fishery because the adult scallops in the closures do not directly contribute to yield and may not improve productivity through spawning activity when the scallop populations are at the plan's biomass target. Because of these life history characteristics, large area closures to improve habitat quality appear to have fewer benefits for scallop productivity than may occur for other species. Although scallop movements tend to be localized and random, small area closures on the scale of observed scallop movement would be less costly than larger areas.

The scallops that occur in the proposed areas would furthermore become unavailable for harvest, perhaps for the remaining life of the scallop, with little benefit to future spawning success. Also, unlike many other species of marine life, there is no passive fishing technology (e.g. hook and line, longline, traps, gill net) that is capable of catching scallops in areas that might be closed to bottom-tending, mobile fishing gear. Other species, for comparison, grow while residing in a closed area and later swim to areas where they can be caught at a larger size. Depleted stocks of some finfish with moderate or strong stock-recruitment relationships may also benefit from the closure, especially when the species forms seasonal spawning aggregations.

Although scallops 'swim' in response to predation (Baird 1954) and commercial dredging (Caddy 1972), larger scallops (> 110 mm, 5-6 years old) tend to be more sedentary than young pre-recruit scallops (Baird 1954, Dickie 1953, Naidu 1970, Schick 1979). Even though the movements are often localized and random, scallop movement may cause scallops to migrate over time out of areas that have a high perimeter to area ratio. Sometimes these movements can be oriented along the axis of the primary current, like ones that occur around Georges Bank. Posgay (1981) reported that 80 percent of tagged scallops moved less than 3 km when recaptured, while 97 percent had traveled less than 16 km. A few individuals were recaptured more than 48 km from their release locations in two or more years at large. Melvin et al. (1985) reported down current movements of sea scallops along the clockwise gyre around Georges Bank, but 85 percent of the tagged scallops moved less than 15 km. Several recaptured scallops moved more than 50 km. Although individual scallop movement appeared to be random and each swimming movement of adult, large scallops covered short distances, Posgay (1981) and Melvin et al. (1985) thought that the longer migration distances they observed were related to the prevailing direction and strong currents that are uniquely characteristic of their study areas.

In contrast with Posgay (1981) and Melvin *et al.* (1985) , who observed the migration of tagged scallops on Georges Bank over several kilometers, Stokesbury and Himmelman (1996) found tagged scallop movement to be very limited with random orientation. Over a 10 to 51 day period of observations, scallops from 40 – 115 mm shell height moved a mean distance of about a meter at seven out of nine stations in Port Daniel Bay (Gulf of St. Lawrence, CA). Movement seemed to be unrelated to substrate (based on both laboratory experiments and field observations) or scallop density and weakly correlated with only the rock crab, *Cancer irroratus*, even though other predators (Homarus americanus and asteroids) were abundant. At one of the nine stations, mean scallop movement was over 10 m. Scallop movement was slightly greater at two stations characterized by sand substrate, low scallop density, and high *C. irroratus* abundance.

Although conducted in a different area (Port Daniel Bay, Gulf of St. Lawrence, CA), at lower temperatures (5.9 to 9º C), with depths ranging from 16 to 23 m and currents ranging from 6.3 to 10.2 cm/s, Stokesbury and Himmelman (1996) corroborate the generalization that scallop movement is limited and generally random. This experiment was conducted near shore with a general southwestward current. In contrast, the tagged scallop movements observed by Posgay (1981) and Melvin *et al.* (1985) were observed on Georges Bank, where there is a prevailing counterclockwise circulation pattern around Georges Bank.

It appears that sea scallops do not exhibit sustained migratory swimming of even short distances, but scallops probably swim in response to the presence of certain predators (Manuel and Dadswell 1991, Peterson et al. 1982, Barbeau and Scheibling 1994) and other tactile stimulation. Caddy (1968) found that swimming in larger scallops consisted of a rapid ascent at a 30-50º angle for two to three meters, followed by a passive descent. Stokesbury and Himmelman (1996) noted the weak correlation of scallop movement with predator abundance and the presence of re-suspended sand at two stations with the largest observed movements.

If movement is related to suspended sediments settling on scallops, causing a swimming response to the tactile stimulation, it is possible that scallops could randomly move away from areas with sand substrate and move less frequently from areas with gravel or cobble substrates. If true and the habitat closures favor bottom substrates with cobble and gravel bottom, then adult scallop movement away from habitat closure areas is less likely. It would therefore reduce the potential for even smaller habitat closure areas to serve as a source for larger scallops to gradually become available to the scallop fishery. Except in areas with strong currents having a persistent direction, there is a compelling argument that scallop productivity in permanent closure areas would be lost to the fishery, except possibly when scallop abundance is very low and year class strength suffers from insufficient spawning activity.

Relative to other species, sea scallops are highly fecund, producing 1 to 270 million eggs per individual over its lifespan (Langton et al. 1987). By age 4, a female scallop releases about two million eggs. More important to the effects of habitat closures that overlap the scallop resource, the influence of spawning stock biomass to future recruitment success is weak or non-existent. Strong Georges Bank scallop year classes in 1957, 1972, 1977, 1982, and 1989 have contributed to landings of adult scallops, but this year class variability has not been correlated with spawning stock biomass (Naidu 1991). Although recent recruitment has been above average (with a strong year class of Georges Bank scallops in 1996 and 1998) while the groundfish area closures existed, these events may be environmentally driven but have not been studied in detail (Clark and O'Boyle 2001). Preliminary analysis of recruitment effects, NMFS (2001) found little evidence that the Georges Bank closed areas enhanced recruitment within the closed areas, although the high spawning biomass in the closures may have contributed to recruitment success elsewhere. SARC 32 (NMFS 2001b) concluded that, "More years of data, and combination of the U.S. and Canadian Georges Bank data re required to reach definitive conclusions about a stock-recruitment relationship on Georges Bank" [scallops].

Given these considerations and the FMPs target biomass, it seems unlikely that long-term, indefinite habitat closures would be beneficial to scallop recruitment and productivity. The effect of the proposed habitat and groundfish closures on scallop predation is unknown, but closures could increase the biomass of predators (crabs, starfish, yellowtail flounder and American plaice). The practicality of habitat closures is of course the combination of the derived benefits and the accumulated costs. In terms of costs to scallop management, however, it may be more practical to conserve habitat by minimizing and distributing the total amount of bottom contact, while seeking ways to harvest scallops using gear with fewer habitat impacts. The following sections estimate and compare the relative costs to scallop management (i.e. changes in long-term yield), the short term effects and practicality with regard to rotational management, to vessel and permit classes, and to communities that depend on scallop fishing activity and landings.

8.5.4.14.1.2 Long-term, steady state effects on scallop management and yield

The effect of the proposed habitat closures on long-term potential yield and rotation management area can be estimated from the distribution of recruitment in the survey time series. The proportion of recruits by ten-minute square, compared to the average recruitment estimates by rotation management area, was multiplied by the rotation management area long-term potential yield and summed over the proportion of a ten-minute square within the boundaries of the proposed habitat closures. These data, summed over the Georges Bank and Mid-Atlantic shelf and compared with the total long-term potential yield without habitat closures (base run having a 30% biomass closure criteria, a 25% biomass closure maximum, and a 3 year closure duration) estimates the potential reduction in average yield from the resource. Since no scallop displacement or enhanced recruitment is assumed, the total amount of fishing effort (days-at-sea) would have similar reductions.

Even over the long term (presumably when the existing high scallop biomass in the groundfish areas are fished), the alternatives (Alternative 1 and GF Mort1) that would include much of the existing area closures would have the highest impact to the scallop yield (29 and 18 percent, respectively), increasing cost and reducing practicality. This is followed by Alternative 7 (15%), because it would close the greatest amount of area to scallop fishing (over 65,000 nm2). The next most costly choice is Alternative 5b (13%) because one of the blocks includes a very productive scallop area near Hudson Canyon. Less costly, would be Alternatives 3a (7%), and 5a, 5c, and 5d (< 1%). The latter three alternatives have low effects on long-term scallop yield because fishery productivity was included as a factor in determining potential habitat closure areas. Finally, Alternatives 8a and 8b would also have relatively low cost (higher practicality) because of their small size, even though they include parts of the Northern Edge which typically has high scallop catch rates.

Table 223. Proportion of total productivity effected by various habitat alternatives, assuming no displacement. Scallop productivity estimated from recruitment distributions and long-term potential yield estimates; groundfish and monkfish productivity estimated from adult abundance distributions over the survey time series.

Habitat label	Analytic method	Total EFH designations included	EFH Density (designations/nm ^{2})	Number of ten-minute squares	Area (nm ^{2})	Proportion of total productivity: Groundfish	Scallop	Monkfish
Alternative 5c	EFH/Productivity Tradeoff No relative fishery value	959	0.317	41	3,020.6	5.5%	0.4%	6.7%
Alternative 5a	EFH/Productivity Tradeoff Groundfish & Scallop	905	0.299	41	3,030.8	5.3%	0.4%	7.6%
Alternative 3a	Ad hoc - Adjacent complex habitats	701	0.267	71	2,622.9	4.2%	6.7%	2.7%
Alternative 5b	Aggregate EFH value only	814	0.265	41	3,073.4	5.5%	13.0%	5.9%
Alternative 5d	EFH/Productivity Tradeoff Combined Productivity	768	0.249	41	3,087.9	4.0%	0.4%	5.5%
Alternative 1	Ad hoc - Status quo groundfish areas	1,344	0.230	98	5,835.9	8.3%	29.0%	6.0%
Alternative 8b	Ad hoc - Alternative groundfish HAPC	167	0.229	14	730.8	0.8%	3.0%	0.2%
Alternative 8a	Ad hoc - Cod HAPC only	42	0.226	3	186.2	0.1%	1.6%	0.1%
GF Mort1	Ad hoc - Revised groundfish closures	1,154	0.225	98	5,123.7	6.9%	18.7%	4.1%
Alternative 7	Model EFH & low scallop productivity	9,528	0.146	880	65,465.2	78.4%	15.0%	88.6%

If site- and size-specific diffusion coefficients and directional movement estimates were available, it would be possible to decrement the above estimates to estimate the effects of closure location and size on scallop yield. Such estimates would need to account for natural mortality and growth while scallops remain in an area closure, distance from the closure boundary, fine scale fishing effort distributions and dredge efficiency, and seasonal factors. These estimates are beyond the scope of the analysis, however, because site- and size-specific movements have not been measured.

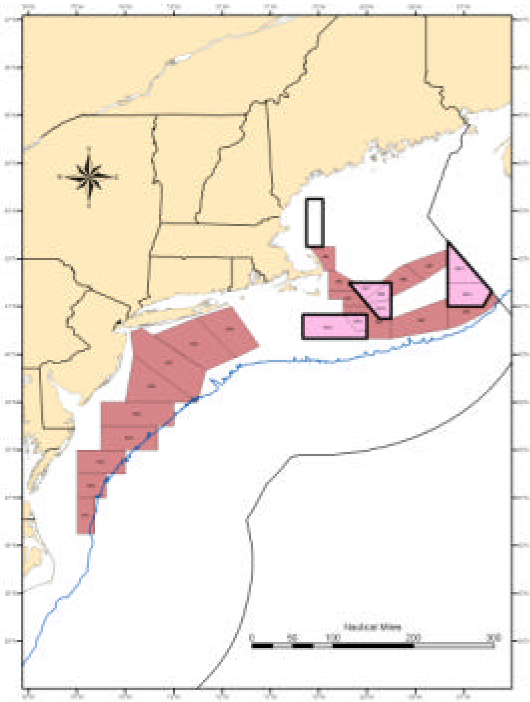
8.5.4.14.1.3 Short-term effects on rotation area management and Georges Bank closed area access alternatives

Short term effects differ from those above, mainly due to the interactions between the proposed habitat closures and Georges Bank area access alternatives. The projected landings and allowable day-at-sea use were reduced by the estimated fraction of scallop biomass within a proposed habitat closure, compared to the amount of scallop biomass in each rotation area that would remain open. Estimates of the fraction of current biomass that would remain available to the fishery (Table 224) were applied to the rotation management area annual projections from 2004 to 2011.

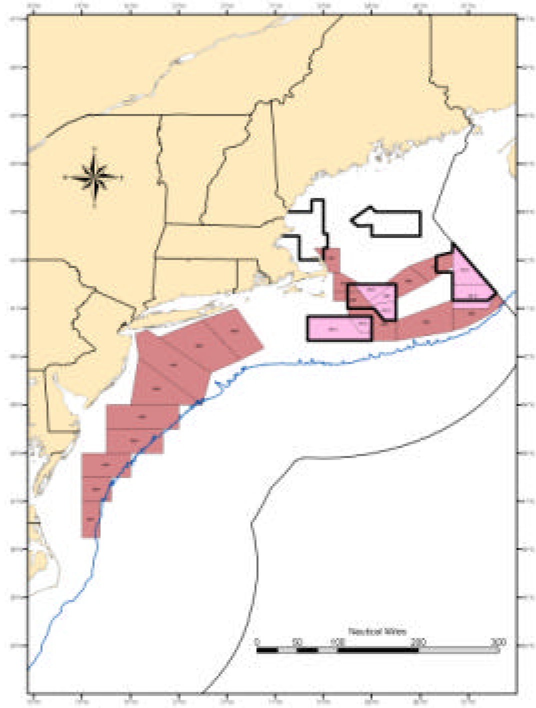
Table 224. Approximate proportion of current rotation management area biomass that would be available for fishing under various habitat alternatives. Shaded table cells represent the rotation management areas whose predicted yield were reduced to account for the inaccessibility of scallops within proposed habitat area closure boundaries.

Habitat alternatives	Rotation management areas (see Figure 111 to Figure 114)																						
	MA01	MA02	MA03	MA04	MA05	MA06	MA07	MA08	MA09	GB01	GB02	GB03	GB04	GB05	GB06	GB07	GB08	GB09	GB10 & GB11	GB12	GB13	GB14	GB15
Alternative 1 (GFMort2 and SQ)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	0%	0%	0%	0%	0%
No habitat closures	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
GFMort 1	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	25%	100%	0%	0%	0%	0%	50%	0%
Habitat alternative 3a	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	25%	50%	100%	100%	25%	100%	33%	25%	33%	100%	100%	0%
Habitat alternative 3b	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	25%	50%	100%	100%	25%	100%	33%	25%	33%	100%	100%	0%
Habitat alternative 4	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	25%	100%	100%	100%	25%	100%	33%	25%	33%	100%	100%	0%
Habitat alternative 5a	100%	100%	100%	100%	100%	100%	90%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Habitat alternative 5b	100%	100%	100%	100%	100%	100%	60%	100%	100%	100%	0%	100%	100%	100%	100%	100%	100%	90%	100%	100%	100%	100%	100%
Habitat alternative 5c	100%	100%	100%	100%	100%	100%	90%	100%	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Habitat alternative 5d	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	100%	100%	90%	70%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Habitat alternative 6	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	100%	30%	100%	100%	100%	100%	100%	0%	100%	0%	100%	0%
Habitat alternative 7	90%	90%	90%	90%	90%	90%	60%	100%	100%	90%	0%	60%	75%	75%	80%	100%	90%	50%	40%	60%	80%	80%	60%
Habitat alternative 8a	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	40%
Habitat alternative 8b	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	25%	100%	100%	100%	100%	100%	100%	0%
Habitat alternative 9	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	0%	0%	0%	0%	0%

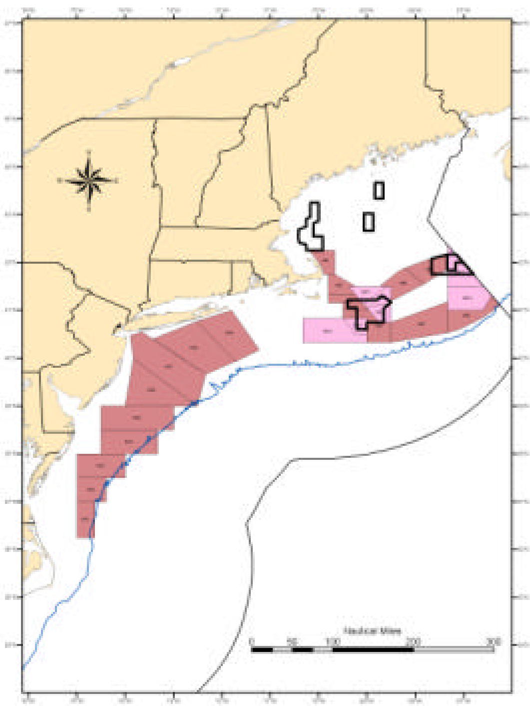
Alternative 1



Multispecies Amendment 13 Mortality Alternative 2



Alternative 3a



Alternative 3b

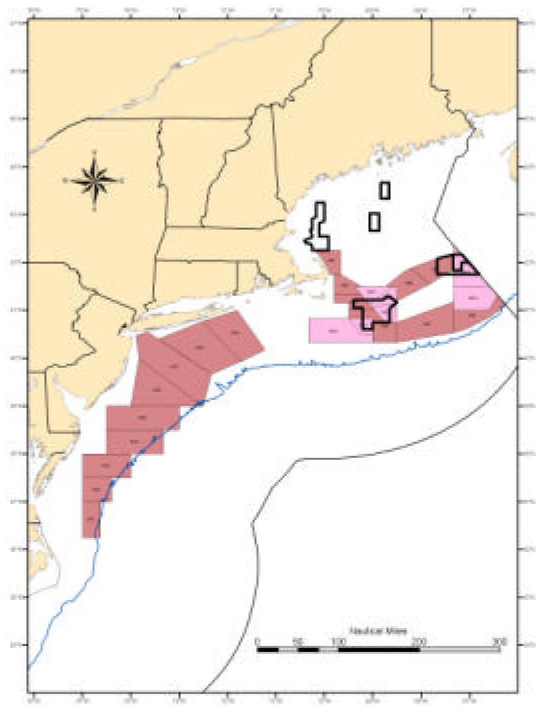
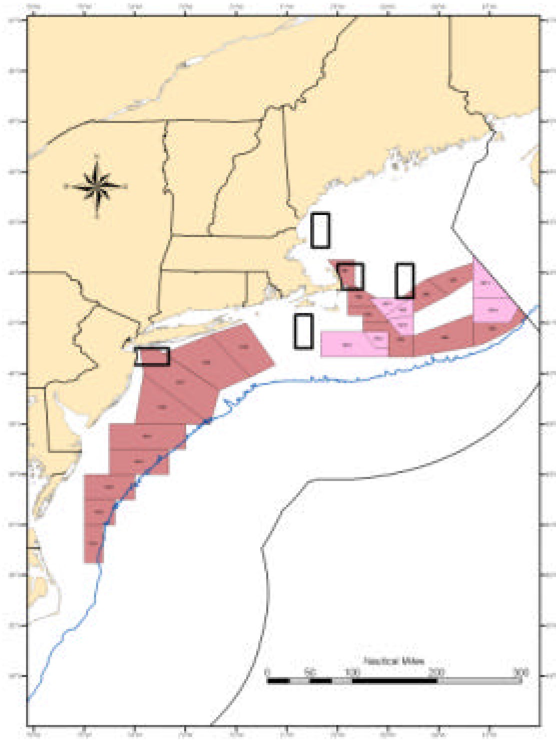
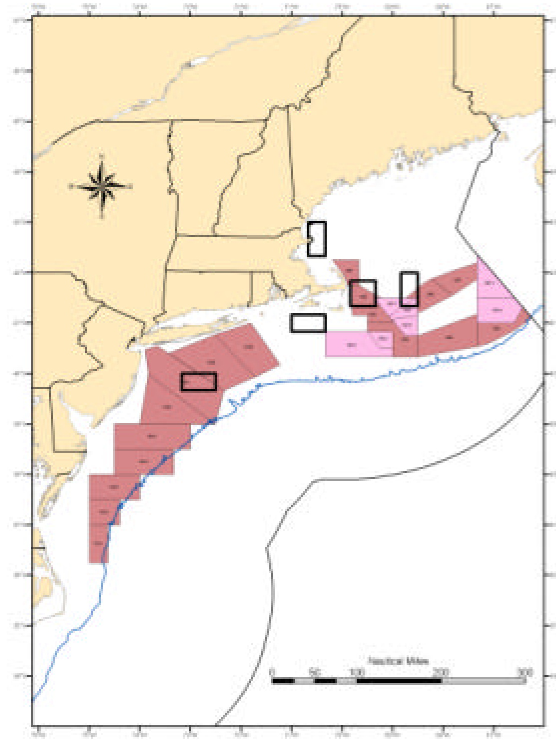


Figure 111. **Comparison of habitat closure alternatives and fixed rotation management area boundaries.**

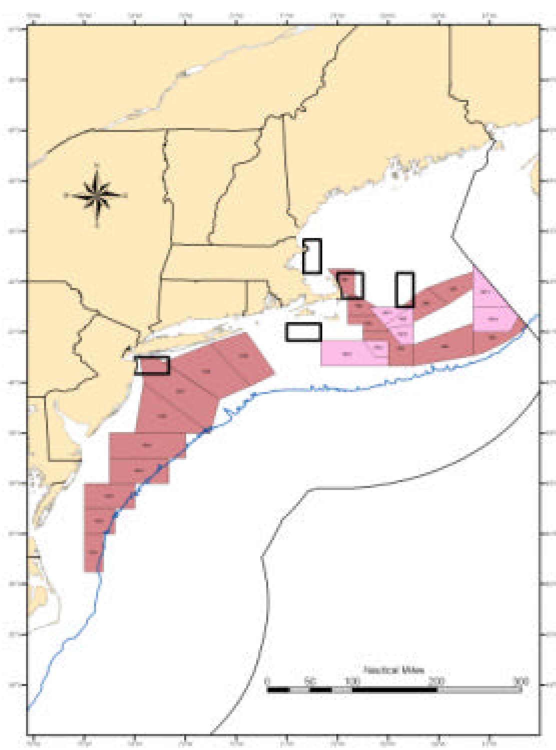
Alternative 5a



Alternative 5b



Alternative 5c



Alternative 5d

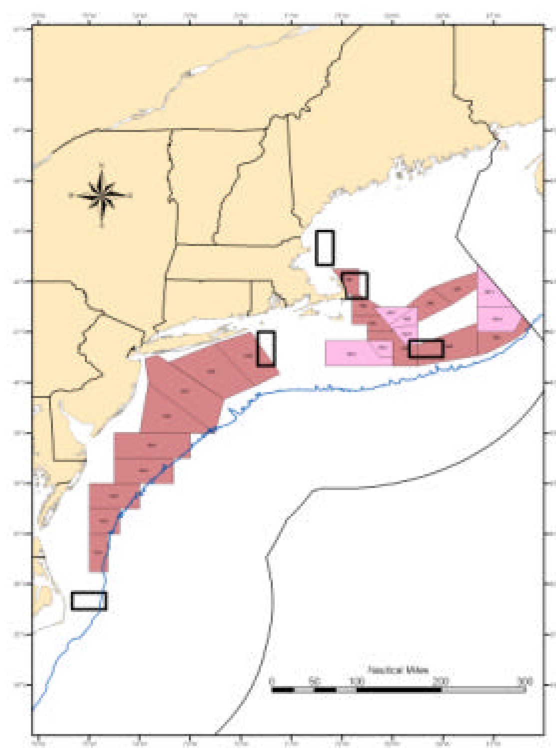


Figure 112. **Comparison of habitat closure alternatives and fixed rotation management area boundaries.**

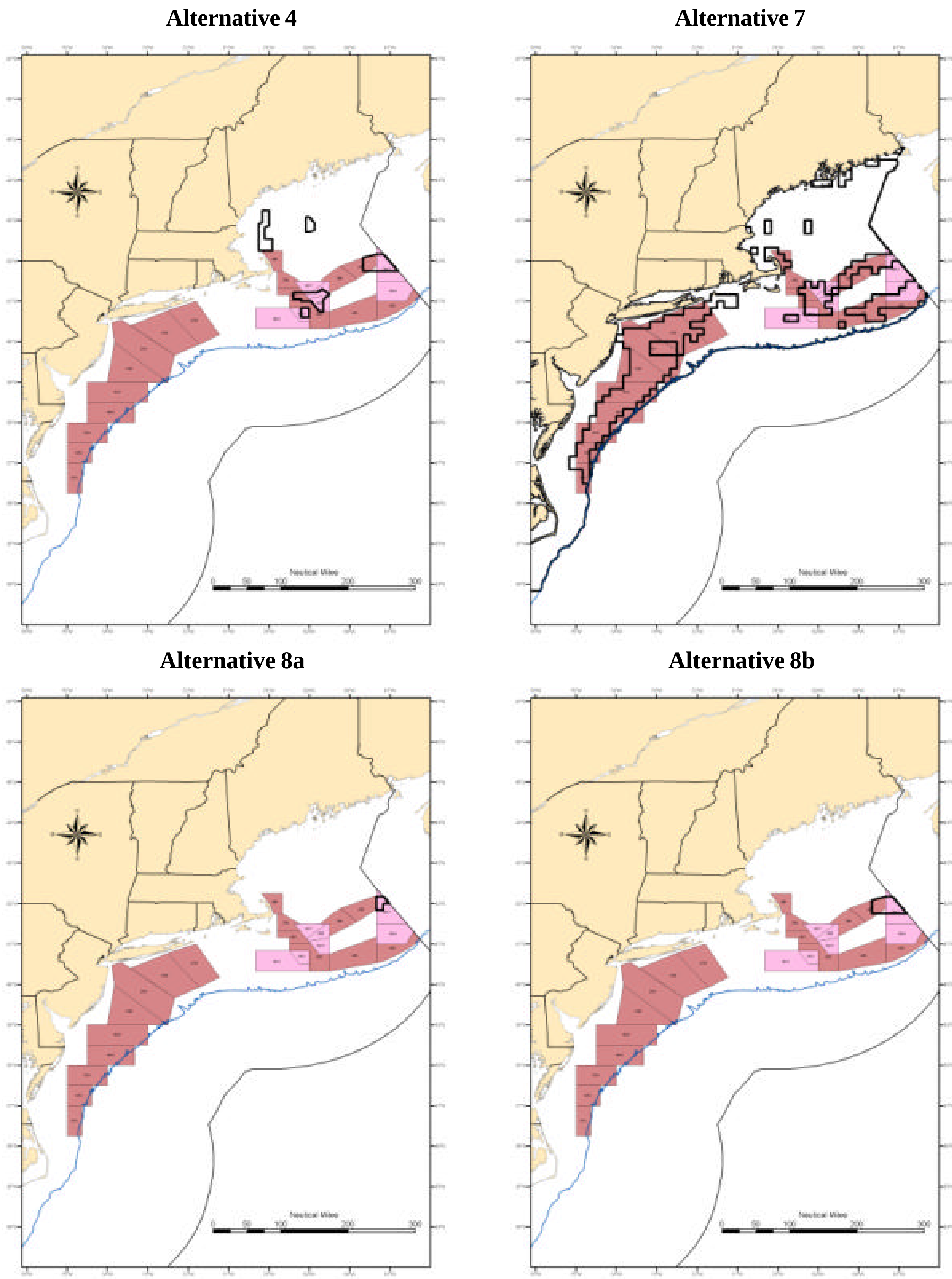


Figure 113. **Comparison of habitat closure alternatives and fixed rotation management area boundaries.**

Alternative 6 **Alternative 9**

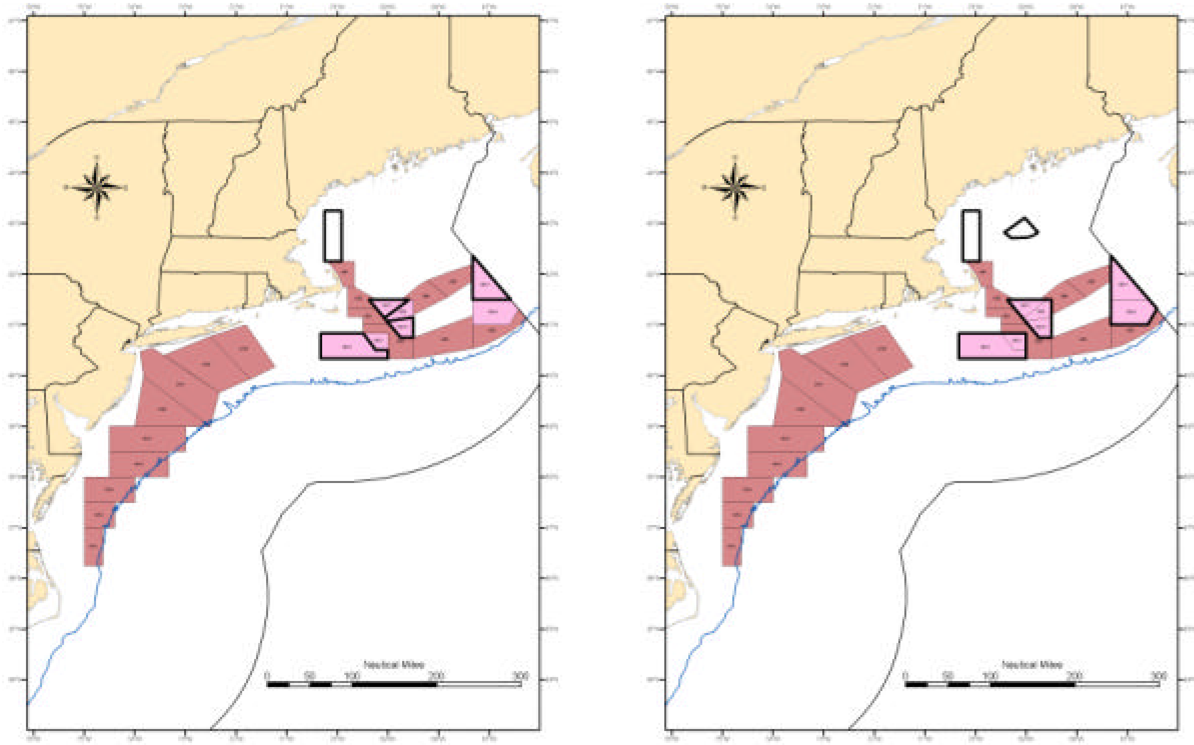


Figure 114. **Comparison of habitat closure alternatives and fixed rotation management area boundaries.**

Estimates of landings and allowable day-at-sea use with effects of habitat closures were made with the four mechanical rotation options for the Georges Bank closed areas, combined projections with and without rotation area management elsewhere. The area access projection with Habitat Alternative 1 is essentially scallop rotation area management with no access to the Georges Bank closed areas, resulting the lowest yield and day-at-sea estimates. Other options suggest landings ranging from 15,000 to 25,000 mt and day-at-sea use ranging from 15,000 to 20,000 days-at-sea used. These results are shown in the tables and figures below.

Table 225. Projected 2004 total landings and allowable limited access day-at-sea use with interim area rotation closures and Georges Bank area access options. PDT Option 1 would set a target 2004 TAC at F=0.4 for the Nantucket Lightship Area and Closed Area I and a target 2005-2006 TAC at F=0.2 for the Closed Area II South. PDT Option 2 would set a target 2004-2006 TAC at F=0.2 for Closed Area II South only.

	PDT Option 1		PDT Option 2	
Habitat alternative	Total landings (mt)	Limited access day-at-sea use.	Total landings (mt)	Limited access day-at-sea use.
Alternative 1 (GFMort2 and SQ)	12,757	11,696	12,757	11,696
GFMort 1	12,509	11,405	16,743	14,695
Habitat alternative 3a	14,251	12,675	20,916	17,899
Habitat alternative 3b	14,251	12,675	20,916	17,899
Habitat alternative 4	14,297	12,737	20,962	17,961
Habitat alternative 5a	15,671	13,817	21,026	18,037
Habitat alternative 5b	14,934	13,017	20,456	17,369
Habitat alternative 5c	15,671	13,817	21,026	18,037
Habitat alternative 5d	15,829	13,981	21,184	18,201
Habitat alternative 6	15,805	13,970	21,160	18,190
Habitat alternative 7	12,672	11,135	17,745	15,115
Habitat alternative 8a	15,870	14,057	21,225	18,276
Habitat alternative 8b	15,622	13,765	20,977	17,985
Habitat alternative 9	12,757	11,696	12,757	11,696
Maximum	15,870	14,057	21,225	18,276
Average	14,492	12,889	19,275	16,647
Minimum	12,509	11,135	12,757	11,696

Table 226. Projected 2004 total landings and allowable limited access day-at-sea use with interim area rotation closures and Georges Bank area access options. PDT Option 3 would set a target 2004 TAC at F=0.2 for portions of the Nantucket Lightship Area, Closed Area I and Closed Area II South that were open to fishing in 2000. PDT Option 4 would set a target 2004-2006 TAC at F=0.2 for all of the Groundfish closed areas that were not otherwise closed to protect sensitive habitat.

	PDT Option 3		PDT Option 4	
Habitat alternative	Total landings (mt)	Limited access day-at-sea use.	Total landings (mt)	Limited access day-at-sea use.
Alternative 1 (GFMort2 and SQ)	12,757	11,696	12,757	11,696
GFMort 1	16,743	14,695	16,743	14,695
Habitat alternative 3a	21,904	18,625	23,487	19,929
Habitat alternative 3b	21,904	18,625	23,487	19,929
Habitat alternative 4	21,950	18,687	23,533	19,991
Habitat alternative 5a	22,732	19,300	26,759	22,616
Habitat alternative 5b	22,070	18,562	26,098	21,878
Habitat alternative 5c	22,732	19,300	26,759	22,616
Habitat alternative 5d	22,890	19,463	26,917	22,780
Habitat alternative 6	22,866	19,453	22,866	19,453
Habitat alternative 7	18,678	15,803	20,906	17,674
Habitat alternative 8a	22,930	19,539	26,399	22,331
Habitat alternative 8b	22,683	19,248	25,779	21,689
Habitat alternative 9	12,757	11,696	12,757	11,696
Maximum	22,930	19,539	26,917	22,780
Average	20,400	17,478	22,518	19,212
Minimum	12,757	11,696	12,757	11,696

Table 227. Projected 2004 total landings and allowable limited access day-at-sea use without area rotation or habitat closures comparing Georges Bank area access options.

Closed area access alternative	Total landings (mt)	Limited access day-at-sea use.
PDT Option 1	18,360	16,804
PDT Option 2	23,715	21,024
PDT Option 3	25,421	22,287
PDT Option 4	29,449	25,603

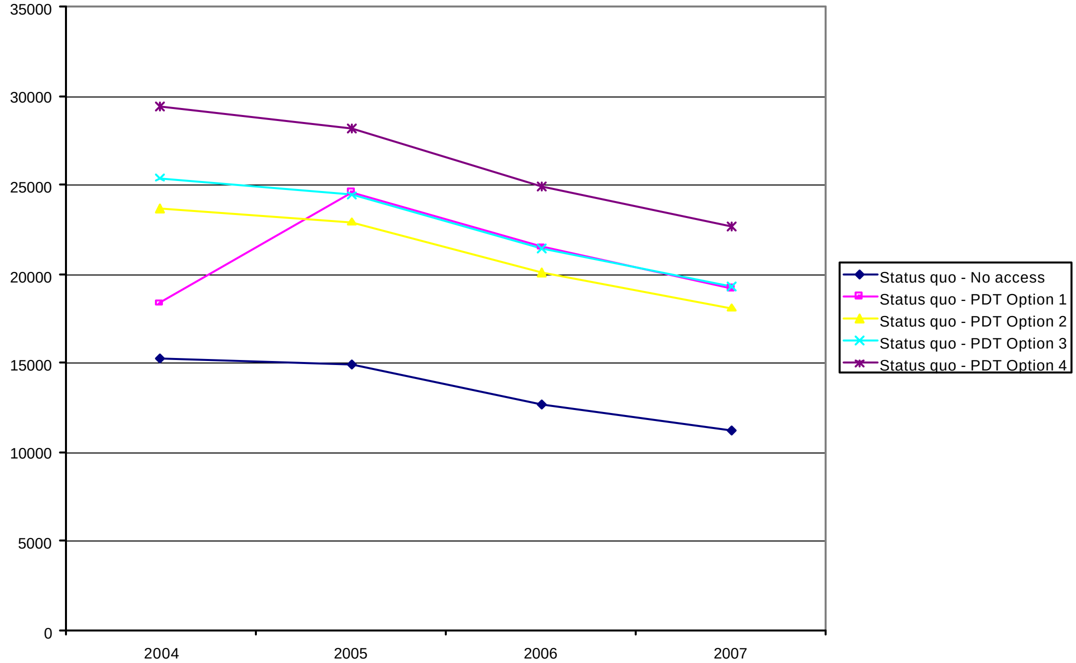


Figure 115. **Comparison of projected landings (mt) versus Georges Bank area access options with no rotation management or habitat closures.**

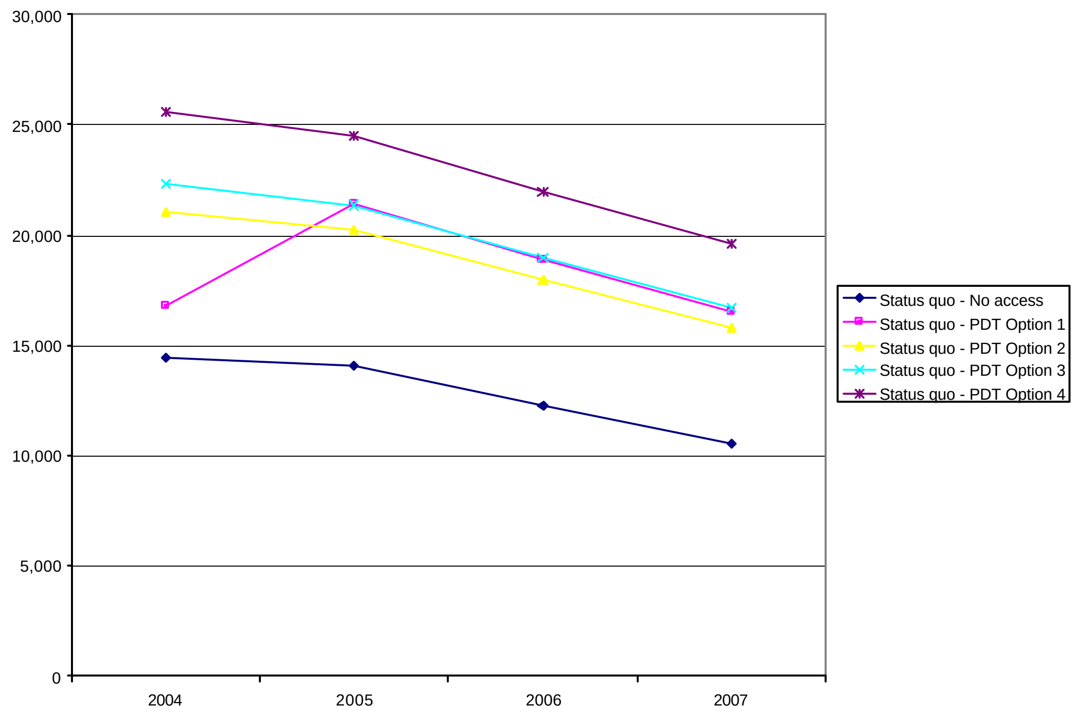


Figure 116. **Comparison of allowable limited access day-at-sea use versus Georges Bank area access options with no rotation management or habitat closures.**

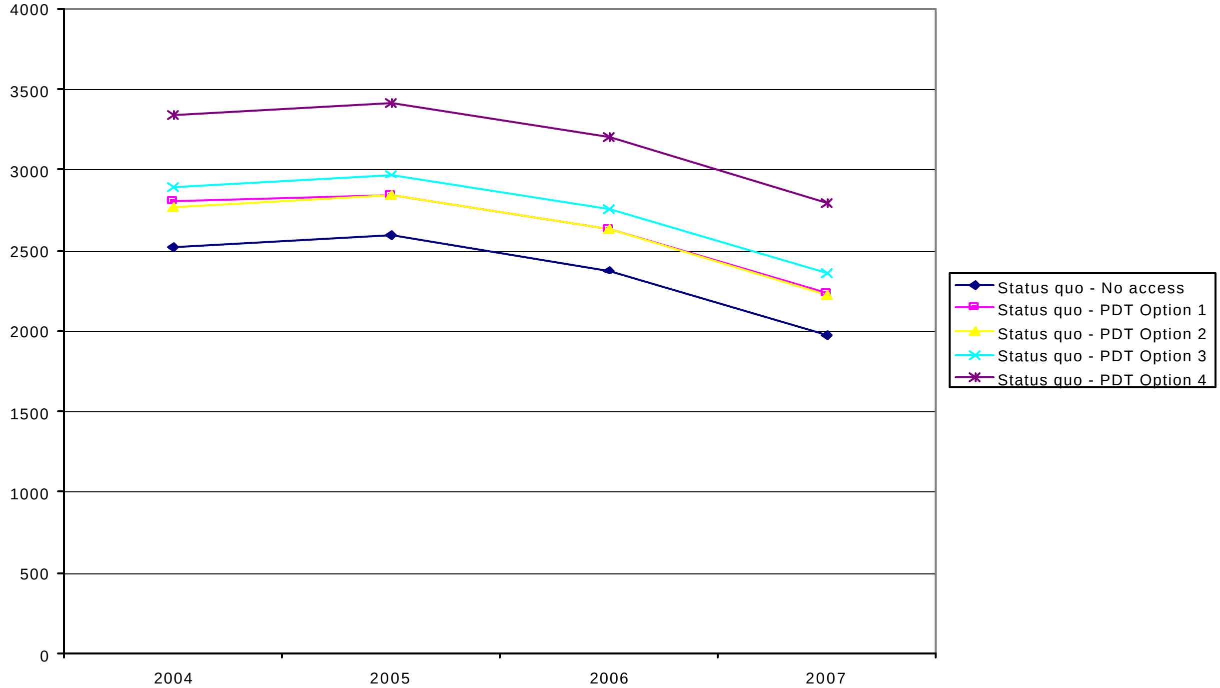


Figure 117. **Comparison of total area swept (nm^2) estimates versus Georges Bank area access options with no rotation management or habitat closures.**

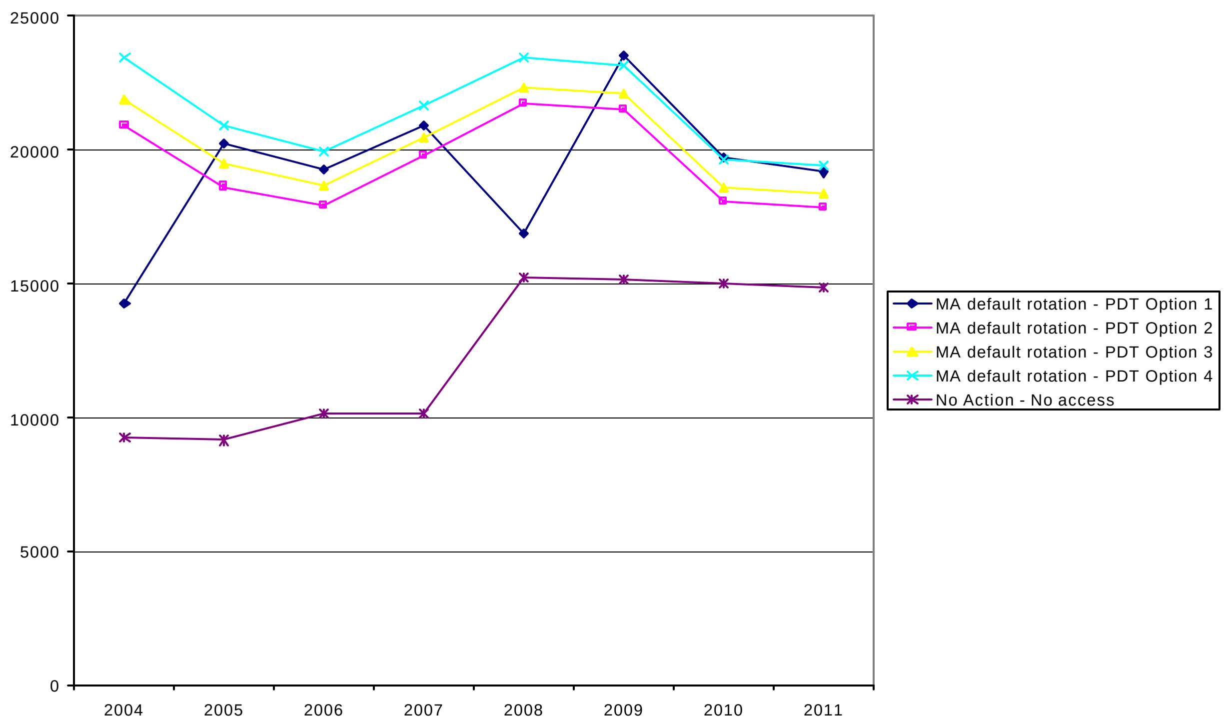


Figure 118. **Comparison of projected landings (mt) versus Georges Bank area access options with rotation management closures and habitat alternative 3a.**

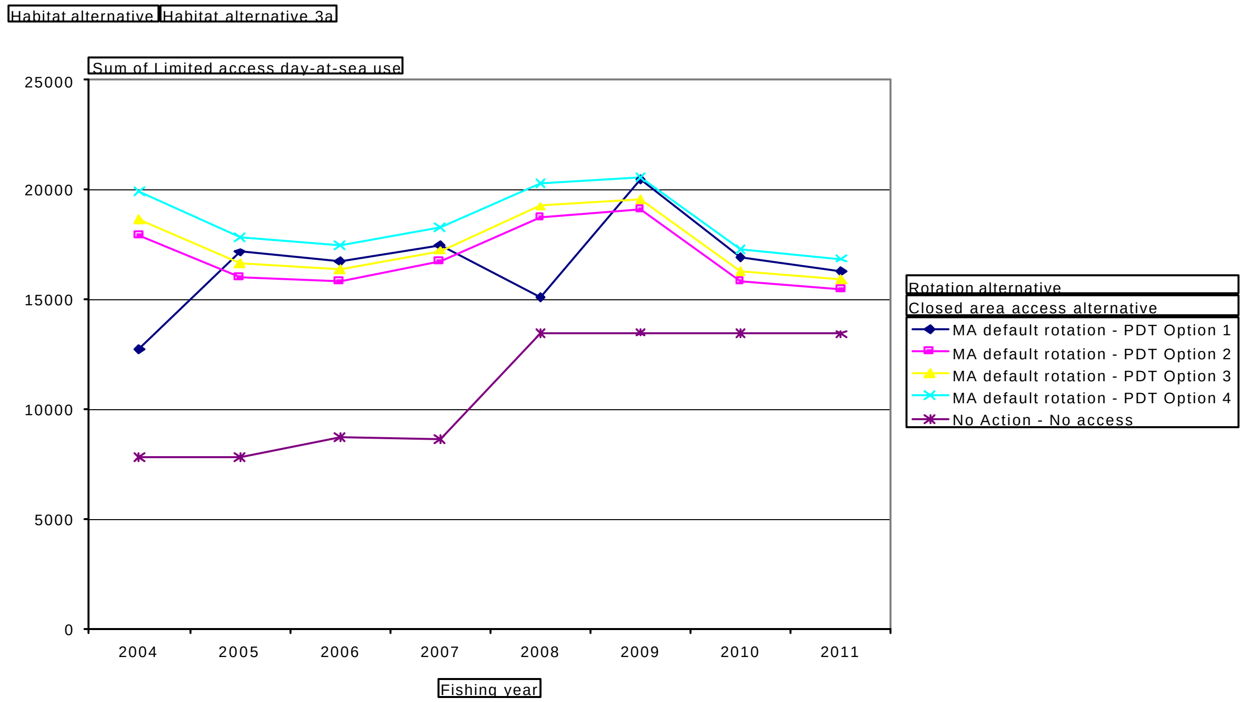


Figure 119. **Comparison of allowable limited access day-at-sea use versus Georges Bank area access options with rotation management closures and habitat alternative 3a.**

Figure 120. **Comparison of total area swept (nm^2) estimates versus Georges Bank area access options with rotation management closures and habitat alternative 3a.**

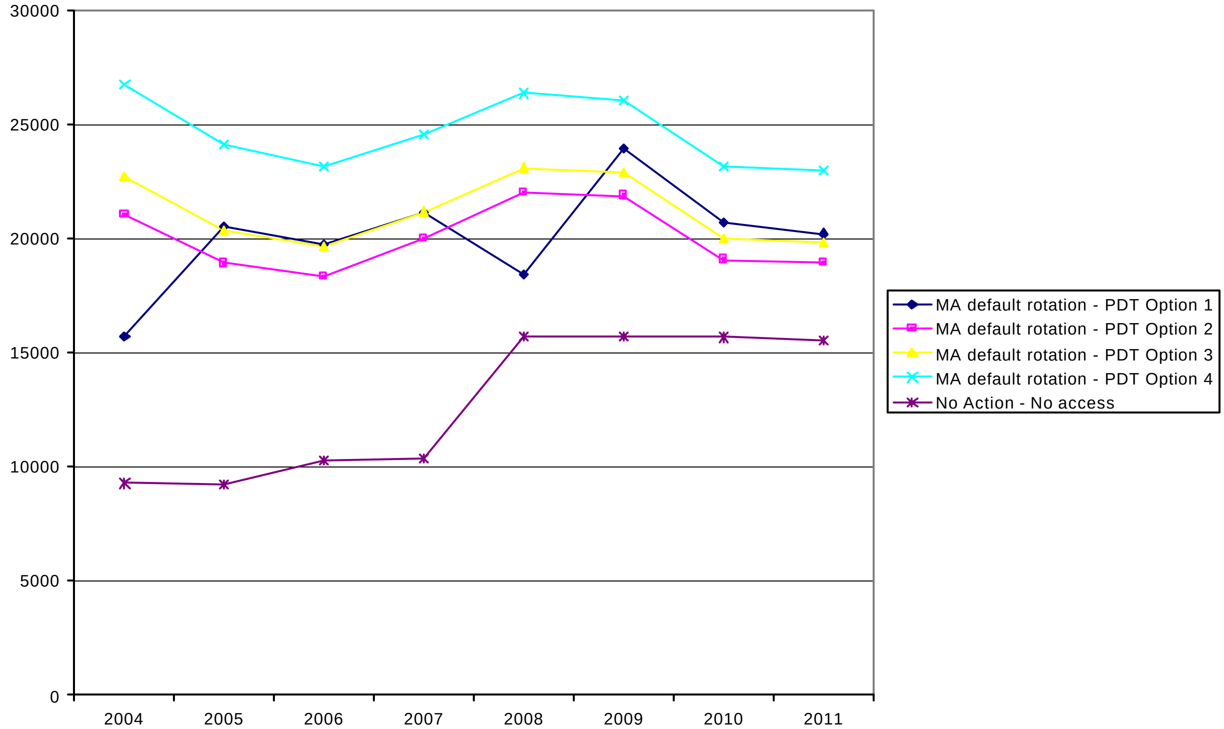


Figure 121. **Comparison of projected landings (mt) versus Georges Bank area access options with rotation management closures and habitat alternative 5a.**

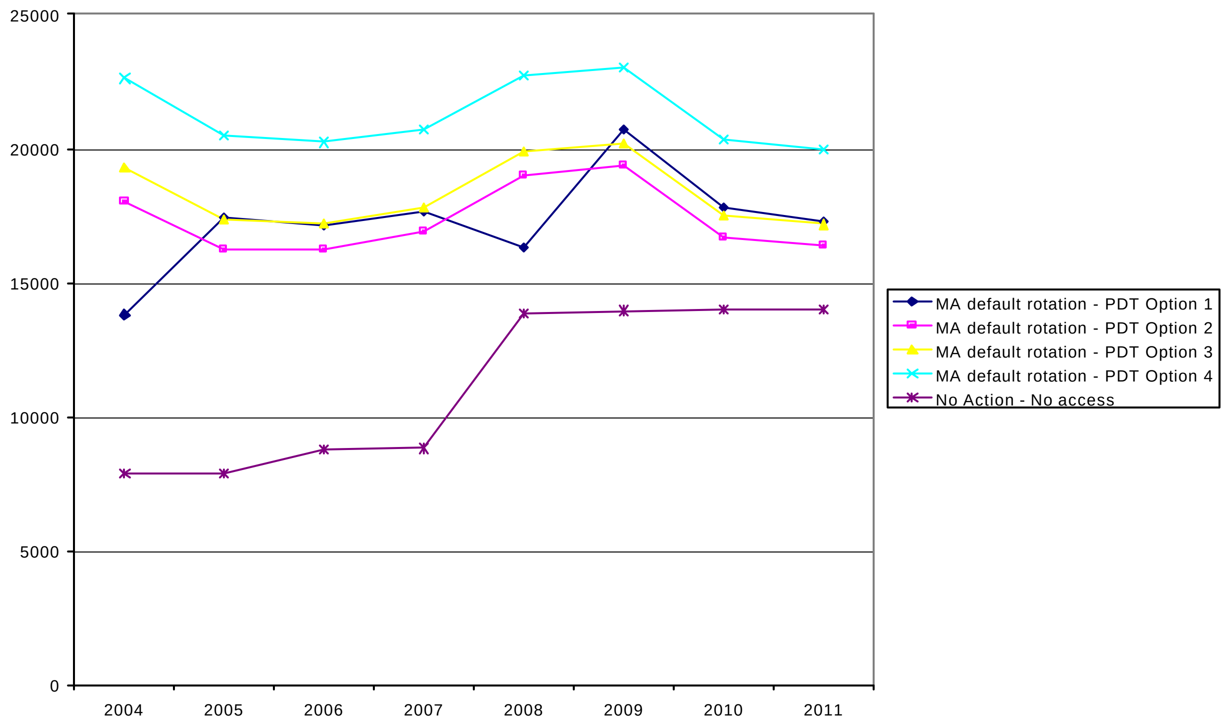


Figure 122. **Comparison of allowable limited access day-at-sea use versus Georges Bank area access options with rotation management closures and habitat alternative 5a.**

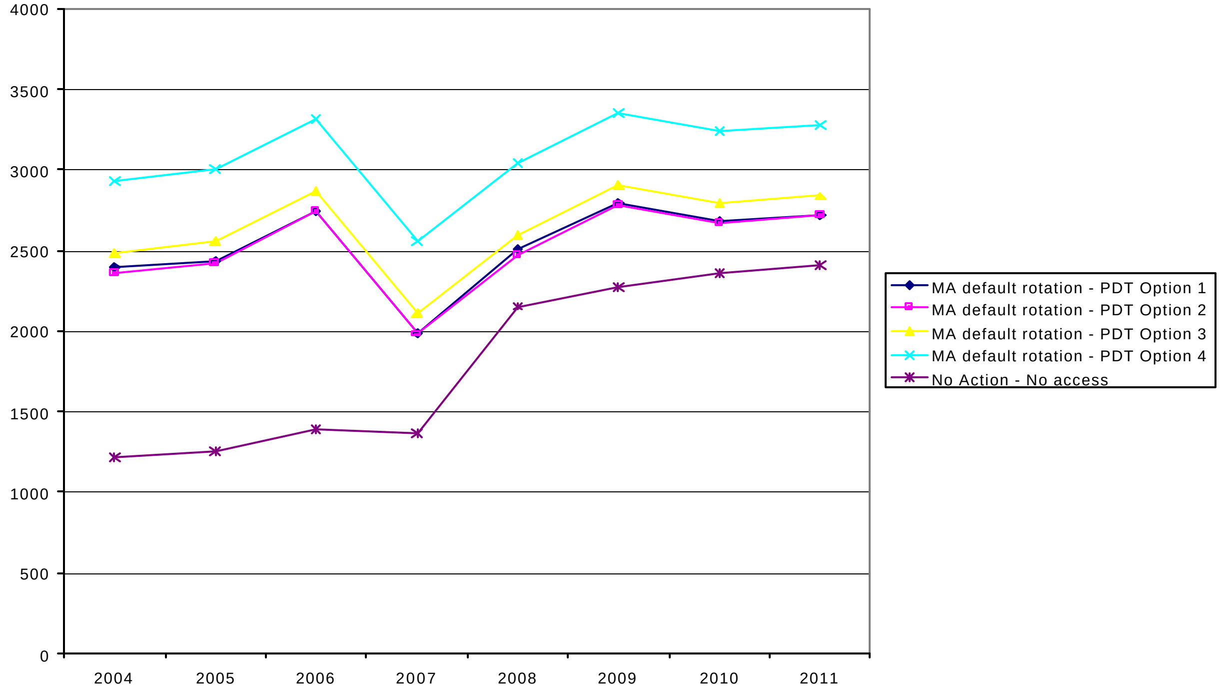


Figure 123. **Comparison of total area swept (nm^2) estimates versus Georges Bank area access options with rotation management closures and habitat alternative 5a.**

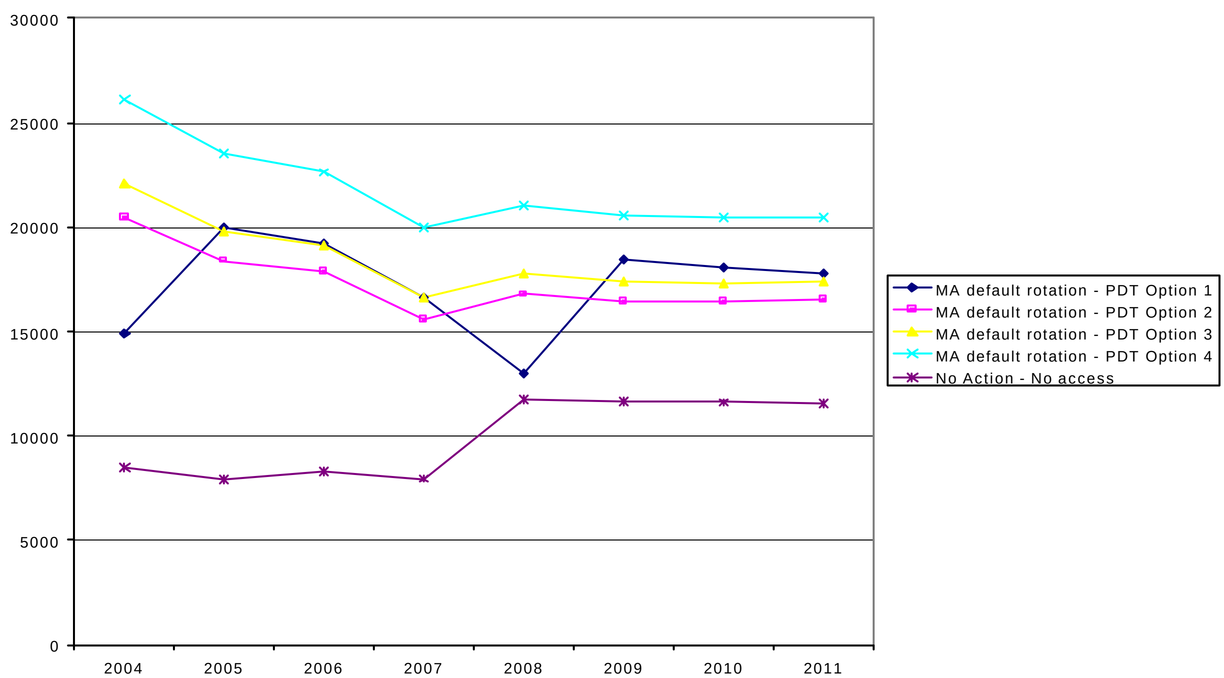


Figure 124. **Comparison of projected landings (mt) versus Georges Bank area access options with rotation management closures and habitat alternative 5b.**

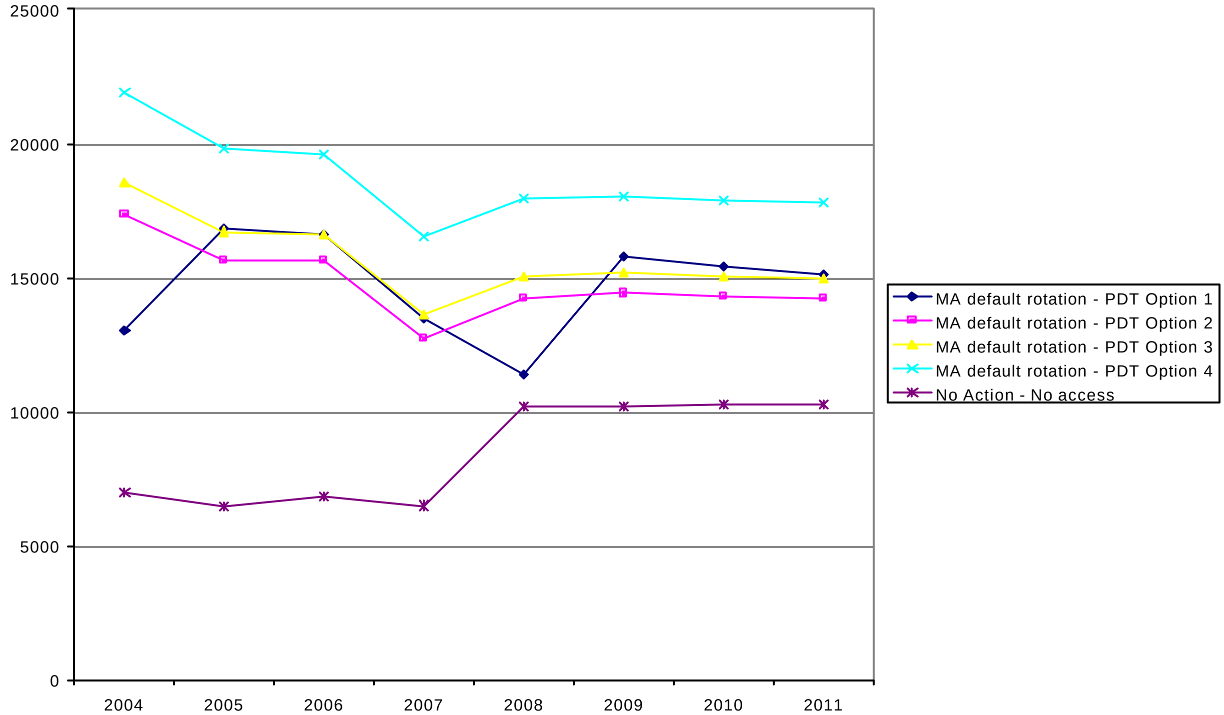


Figure 125. **Comparison of allowable limited access day-at-sea use versus Georges Bank area access options with rotation management closures and habitat alternative 5b.**

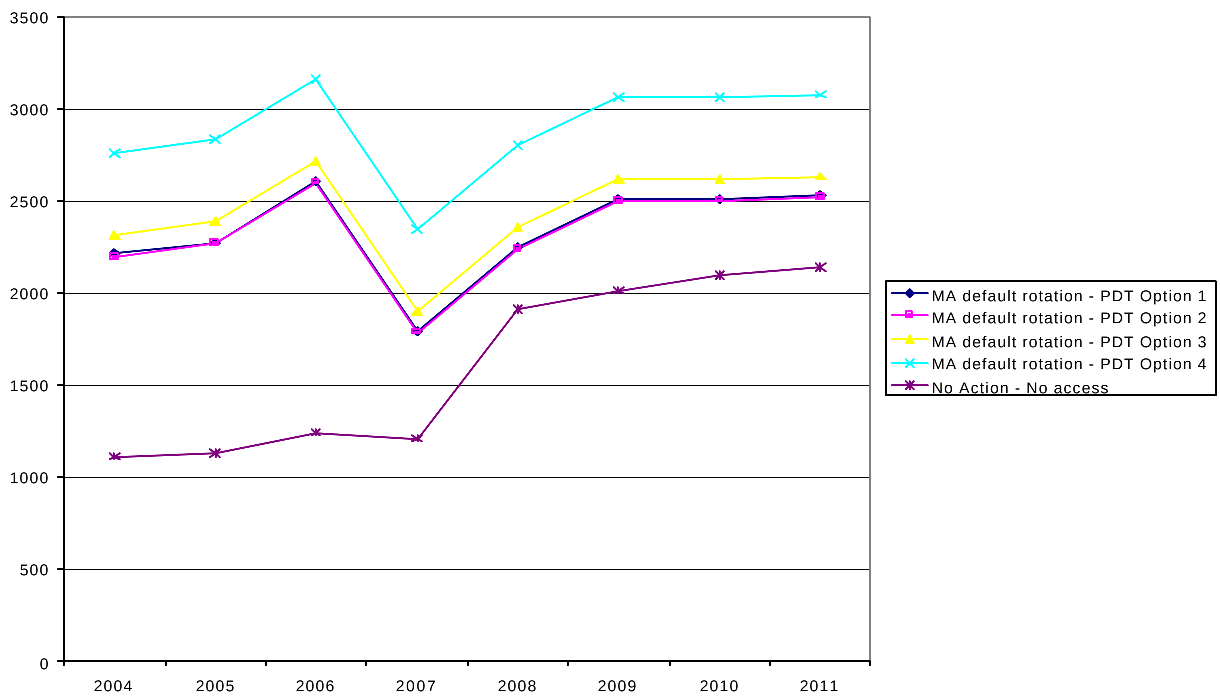


Figure 126. **Comparison of total area swept (nm^2) estimates versus Georges Bank area access options with rotation management closures and habitat alternative 5b.**

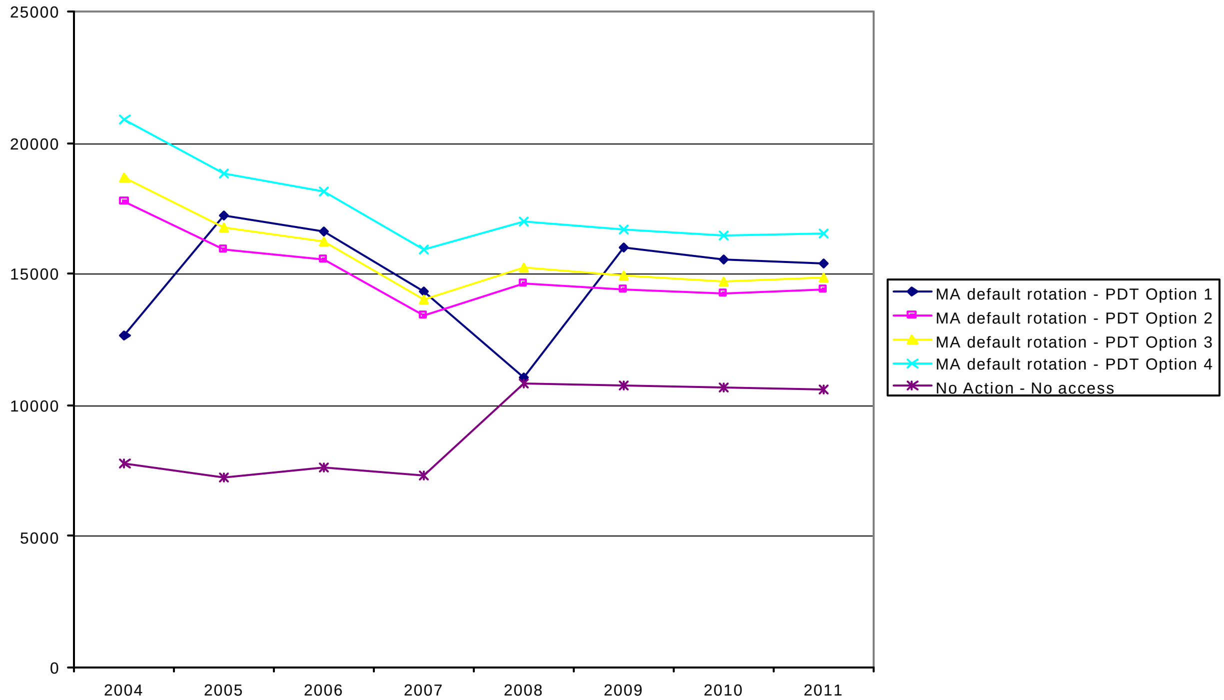


Figure 127. **Comparison of projected landings (mt) versus Georges Bank area access options with rotation management closures and habitat alternative 7.**

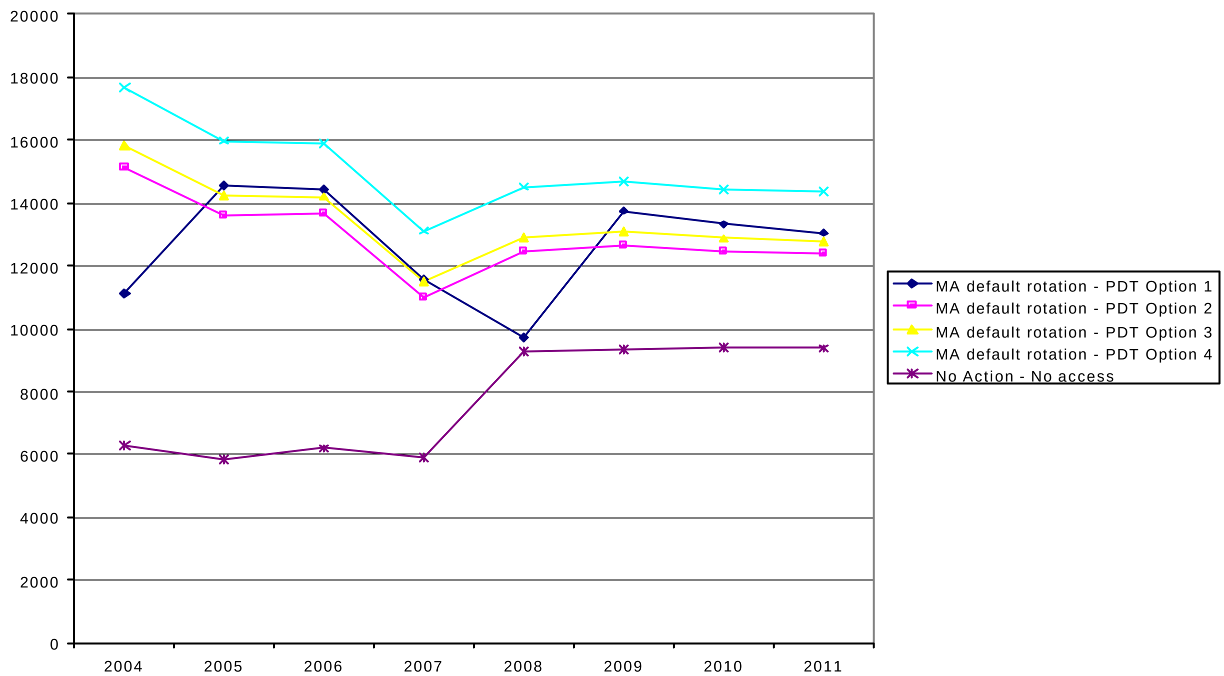


Figure 128. **Comparison of allowable limited access day-at-sea use versus Georges Bank area access options with rotation management closures and habitat alternative 7.**

Figure 129. **Comparison of total area swept (nm^2) estimates versus Georges Bank area access options with rotation management closures and habitat alternative 7.**

8.5.4.14.2 Retrospective analysis

8.5.4.14.2.1 Vessel Monitoring Systems

In addition to the long and short term effects that can be estimated from stock projection models, it is informative to take a retrospective look at the impacts on the scallop fishery had the proposed habitat and groundfish closures been in place. The PDT decided to examine data from three time periods; 1989-1993 (before limited access), 1994-1998 (limited access and groundfish closed areas), 1999 – 2001 (area access programs and rebuilding resource). Three types of data where the location of fishing was reported were available: port interviews, vessel trip reports, vessel monitoring system data.

The VMS data allows us to determine how much fishing time was expended within the proposed closed areas during each year by season. Landings, revenue, bycatch, and port of landing cannot be associated with this aggregate data. The positions and fishing time estimates are from Rago and McSherry (2001), with details down to the one nautical mile and week. The data were treated as point data and it is not clear whether the summarized data are located at the center, edge, or corner of a one nautical mile square, but this detail does not have a significant effect on the comparisons of distributions, substrates, or regions.

Differences in concentration of fishing effort by year, region, or substrate are difficult to identify visually, in part due to unequal amounts of area in each strata. Because of this perception difficulty, a Gini index (Dagnum 1985) was calculated to compare the Lorenz distribution curve (Lorenz 1905, Dagnum 1985). When effort is uniformly distributed throughout the stratum or class, the Gini index is zero because there is no difference between the Lorenz curve and the identity function with which it is compared. At the opposite end of the spectrum, the Gini index approaches one as effort becomes highly concentrated. Originally used for economic analysis of wealth distribution (Dagnum 1985), this method has been applied to northern cod (Myers and Cadigan 1995) and flatfish (Myers et al. 1995) in Newfoundland. The technique was also used by Wigley to examine temporal changes in haddock distribution (NMFS 1996).

Over time, fishing effort became more concentrated in 1999 and 2000 than it was in 1998, presumably because of the intensive fishing effort from the Georges Bank area access program. The Gini index increased from 0.67 in 1998 to 0.73 in 1999 and 2000 (Figure 130). Over the three year period, fishing effort was highly concentrated within Closed Area I and the Nantucket Lightship Area (Figure 131), but more spread out within Closed Area II, compared with average Gini index values of 0.7 for Georges Bank, the Gulf of Maine and Mid-Atlantic regions. Compared to underlying substrate estimates from Poppe et al. (1989), fishing effort was more concentrated on gravelly sand and sand substrates than on other types (Figure 132).

More important for this analysis of potential effectiveness of habitat alternatives to protect sensitive habitats and vulnerable substrates is the amount of fishing time that had occurred in areas proposed as habitat closures. Total fishing time (defined as subsequent VMS pollings that imply a interpolated vessel speed less than five knots) higher from 395,000 hours in 1998 to 408,000 hours in 1999, then declined to 384,000 hours in 2000.

Assuming a fishing speed of 4.5 knots, basic algebra shows that an hour of fishing time equates to two percent of a square nautical mile. Thus it takes at least 50 hours of fishing time to completely sweep a square nautical mile of bottom. Due to overlapping tows, the amount of fishing time to sweep 50 or 75 percent of a square nm is much higher than 50 hours. This compares to the most intensely-fished nautical mile of bottom within Closed Area I experiencing about 1,550 hours of fishing time, a maximum of 750 hours of fishing time on Georges Bank, and a maximum of 850 hours of fishing time on the Mid-Atlantic shelf. While these three square nautical miles indeed were swept rather thoroughly, many areas received less than 50 hours of fishing effort (Figure 131) and could not have been swept completely by scallop dredges, even summed over the three year period.

The scallop rotation management areas include well over 90 percent of the total fishing limited access fishing effort while on a day-at-sea (Table 228). The remaining hours outside the rotation management areas total less than 25,000 hours per year, some of which is due to vessels slowing during transiting or slowing near shore. Table 228 shows the distribution of fishing time by year and fishing region, compared to the areas that might be closed under the various habitat alternatives. At the extreme, habitat alternatives 3a and 3b would effect about 10 to 20 percent of scallop fishing time, followed by alternatives 4 and 5b ranging from 5 to 15 percent. Closures under Amendment 13 groundfish mortality alternative 1 would effect, if they apply to scallop vessels, about 20 to 30 percent of the fishing effort that occurred during 1998-2000.

More important to the evaluation of habitat effects is the distribution of scallop fishing time relative to substrate and habitat closure alternatives in Table 229. Because they were chosen by design to do so, alternatives 3a and 3b would effect 40 to 65 percent of scallop fishing effort that occurs on areas classified as having gravel sediment. At the same time, however, these alternatives would also affect 45 to 60 percent of scallop fishing effort occurring over areas classified as having gravelly sand substrate. Gravelly sand substrate is an important area for sea scallop productivity and catches, because it is well suited for scallop settlement, protection from predation, and filter feeding.

Other features that stand out in this analysis are that alternative 5b would affect a significant amount of scallop fishing effort on sand bottom. While total effort on muddy sand is low, alternatives 5a and 5c would effect about half of the scallop fishing on muddy-sand bottom. Alternative 7 would affect scallop fishing effort over a very wide variety of substrate types, due to the differences in sub-optimal scallop bottoms having silt/sand/clay/mud mixtures.

Table 228. **Summary of VMS sea scallop fishing time estimates by year, region, and habitat alternative.**

Sum of Fishing time (hrs)		3a		3b		4		5a		5b		5c		5d		6		Mort_Alt_1		Mort_Alt_2		Scallop RMA		
Year	Area	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Closed	Open	Included	Not included	Grand Total
1998	Closed Area I	1,888	450	1,888	450	1,888	450		2,338	309	2,029		2,338	1	2,337	2,200	138	2,338		2,338		2,338		2,338
	Closed Area II	1,172	1,918	1,172	1,918	1,172	1,918		3,090		3,090		3,090		3,090	1,200	1,890	1,490	1,600	3,090		3,090		3,090
	Georges Bank	63,404	78,884	63,403	78,885	36,472	105,816	5,508	136,780	22,921	119,367	5,508	136,780	6,534	135,754		142,288	47,177	95,111		142,288	140,274	2,014	142,288
	Gulf of Maine	11	5,205	11	5,205		5,216	7	5,209	162	5,054	407	4,809	49	5,167		5,216	4,762	454	287	4,929	1,910	3,306	5,216
	Mid-Atlantic		189,915		189,915		189,915	2,589	187,326	16,956	172,958	2,589	187,326		189,915		189,915		189,915		189,915	182,448	7,466	189,915
	Nantucket Lightship Area	1		1		1			1		1		1		1		1	1		1		1		1
	Southern New England		51,414		51,414		51,414	214	51,200	580	50,834	580	50,834	1,990	49,424		51,414		51,414		51,414	42,989	8,425	51,414
	Western Gulf of Maine Area	148	1	148	1	148	1	39	111		149		149	39	111	149		149		149			149	149
	#N/A		1,122		1,122		1,122	6	1,116	96	1,027	102	1,021	6	1,116		1,122	207	915		1,122	247	875	1,122
1998 Total		66,624	328,908	66,623	328,909	39,682	355,851	8,362	387,170	41,023	354,509	9,185	386,347	8,618	386,914	3,549	391,983	56,125	339,408	5,865	389,667	373,297	22,236	395,532
1999	Closed Area I	1,728	233	1,728	233	1,728	233		1,960	143	1,817		1,960	1	1,959	1,763	198	1,960		1,960		1,960		1,960
	Closed Area II	463	69,512	463	69,512	463	69,512		69,975		69,975		69,975		69,975	483	69,492	43,994	25,981	69,975		69,975		69,975
	Georges Bank	37,304	55,235	37,306	55,233	19,979	72,560	1,870	90,669	13,138	79,401	1,870	90,669	1,859	90,679		92,539	24,484	68,055		92,539	91,921	618	92,539
	Gulf of Maine		1,115		1,115		1,115	1	1,114	173	942	171	944	52	1,063		1,115	968	147	46	1,069	277	838	1,115
	Mid-Atlantic		221,911		221,911		221,911	1,701	220,210	23,559	198,352	1,701	220,210	34	221,876		221,911		221,911		221,911	218,278	3,632	221,911
	Nantucket Lightship Area	84	47	84	47	84	47		131		131		131		131	36	95	131		131		131		131
	Southern New England		18,890		18,890		18,890	27	18,863	114	18,777	114	18,777	606	18,284		18,890		18,890		18,890	16,738	2,152	18,890
	Western Gulf of Maine Area	6		6		6			6		6		6		6	6		6		6			6	6
	#N/A		1,260		1,260		1,260	8	1,252	31	1,230	39	1,222	8	1,252		1,260	87	1,174		1,260	6	1,254	1,260
1999 Total		39,584	368,202	39,586	368,200	22,259	385,527	3,606	404,180	37,157	370,630	3,893	403,893	2,561	405,225	2,288	405,499	71,629	336,157	72,118	335,669	399,286	8,501	407,787
2000	Closed Area I	19,503	3,045	19,503	3,045	19,503	3,045		22,549	1,111	21,438		22,549		22,549	1,571	20,977	22,549		22,549		22,549		22,549
	Closed Area II	356	22,487	356	22,487	356	22,487		22,842		22,842		22,842		22,842	397	22,445	15,381	7,462	22,842		22,842		22,842
	Georges Bank	23,345	29,938	23,346	29,937	10,833	42,450	1,180	52,103	5,806	47,477	1,180	52,103	1,182	52,101		53,283	13,621	39,662		53,283	51,911	1,372	53,283
	Gulf of Maine	4	1,272	4	1,272		1,275	12	1,263	165	1,110	221	1,054	18	1,257		1,275	944	331	42	1,233	217	1,059	1,275
	Mid-Atlantic		252,263		252,263		252,263	1,117	251,145	27,570	224,693	1,117	251,145	3	252,260		252,263		252,263		252,263	248,382	3,880	252,263
	Nantucket Lightship Area	6,017	2,069	6,017	2,069	6,017	2,069		8,086		8,086		8,086		8,086	15	8,072	8,086		8,086		8,086		8,086
	Southern New England		22,895		22,895		22,895	64	22,831	203	22,692	203	22,692	179	22,716		22,895		22,895		22,895	22,146	750	22,895
	Western Gulf of Maine Area	5		5		5			5		5		5		5	5		5		5			5	5
	#N/A		1,367		1,367		1,367	17	1,350	138	1,229	155	1,212	17	1,350		1,367	139	1,228		1,367	6	1,361	1,367
2000 Total		49,229	335,336	49,230	335,335	36,714	347,851	2,390	382,175	34,993	349,572	2,876	381,689	1,399	383,166	1,988	382,577	60,725	323,841	53,524	331,041	376,139	8,426	384,565

Table 229. **Percent of total VMS sea scallop fishing time estimates by year (1998-2000), bottom substrate (Poppe et al. 1989), and habitat alternative, classified by one nm^2.**

Year	EFH sediment type	Alternative 1	Alternative 3a	Alternative 3b	Alternative 4	Alternative 5a	Alternative 5b	Alternative 5c	Alternative 5d	Alternative 6	Alternative 7	Alternative 8a	Alternative 8b	Alternative 9	GFMort Alternative 1
1998	Bedrock	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	100.00%
	Gravel	3.59%	44.83%	44.83%	23.62%	0.66%	28.14%	3.85%	0.66%	1.86%	33.54%	0.00%	21.76%	3.59%	55.13%
	Gravelly sand	3.65%	60.53%	60.53%	28.74%	0.06%	12.31%	0.06%	0.05%	3.17%	13.56%	1.01%	8.66%	3.89%	41.13%
	Mud	3.85%	3.85%	3.85%	3.85%	4.22%	0.93%	1.12%	4.22%	3.85%	10.93%	0.00%	0.00%	26.25%	27.74%
	Muddy sand	0.06%	0.03%	0.03%	0.03%	56.40%	14.32%	58.66%	22.09%	0.06%	15.82%	0.00%	0.00%	0.06%	0.61%
	Sand	0.91%	7.29%	7.29%	5.96%	2.01%	9.76%	2.22%	2.45%	0.40%	11.62%	0.13%	3.93%	0.91%	8.06%
	Unclassified	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	26.43%	0.00%	0.00%	0.00%	0.00%
	#N/A	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1998 Total		1.41%	16.84%	16.84%	10.03%	2.11%	10.37%	2.32%	2.18%	0.90%	12.17%	0.28%	4.86%	1.48%	14.19%
1999	Bedrock	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	100.00%
	Gravel	34.51%	42.87%	42.87%	17.81%	0.00%	13.95%	0.00%	0.00%	0.18%	14.78%	0.00%	17.57%	34.51%	66.93%
	Gravelly sand	12.54%	46.73%	46.73%	22.60%	0.02%	8.15%	0.02%	0.00%	3.23%	8.50%	0.60%	9.41%	12.58%	36.22%
	Mud	0.00%	0.00%	0.00%	0.00%	0.19%	0.19%	0.00%	0.19%	0.00%	49.50%	0.00%	0.00%	4.56%	4.75%
	Muddy sand	0.03%	0.00%	0.00%	0.00%	55.20%	10.63%	55.72%	10.78%	0.03%	14.74%	0.00%	0.00%	0.03%	1.07%
	Sand	18.49%	3.78%	3.78%	2.75%	0.58%	9.22%	0.65%	0.65%	0.16%	13.54%	0.04%	1.44%	18.49%	14.38%
	Unclassified	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	24.67%	0.00%	0.00%	0.00%	0.00%
	#N/A	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1999 Total		17.67%	9.71%	9.71%	5.46%	0.88%	9.11%	0.95%	0.63%	0.56%	12.95%	0.11%	2.60%	17.69%	17.57%
2000	Gravel	13.93%	65.36%	65.36%	46.65%	0.00%	14.63%	1.33%	0.00%	0.08%	15.46%	0.00%	43.02%	13.93%	71.71%
	Gravelly sand	40.12%	61.35%	61.35%	43.72%	0.02%	3.84%	0.02%	0.01%	2.33%	15.35%	0.40%	4.91%	40.17%	51.77%
	Mud	0.00%	0.00%	0.00%	0.00%	1.91%	2.42%	2.75%	1.91%	0.00%	85.03%	0.00%	0.00%	3.59%	6.12%
	Muddy sand	0.00%	0.00%	0.00%	0.00%	31.76%	4.38%	33.15%	4.72%	0.00%	8.49%	0.00%	0.00%	0.00%	0.00%
	Sand	9.40%	4.04%	4.04%	3.38%	0.50%	10.04%	0.63%	0.39%	0.20%	13.98%	0.04%	0.96%	9.40%	9.25%
	Unclassified	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	42.94%	0.00%	0.00%	0.00%	0.00%
	#N/A	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2000 Total		13.91%	12.80%	12.80%	9.55%	0.62%	9.10%	0.75%	0.36%	0.52%	14.24%	0.09%	1.74%	13.92%	15.79%

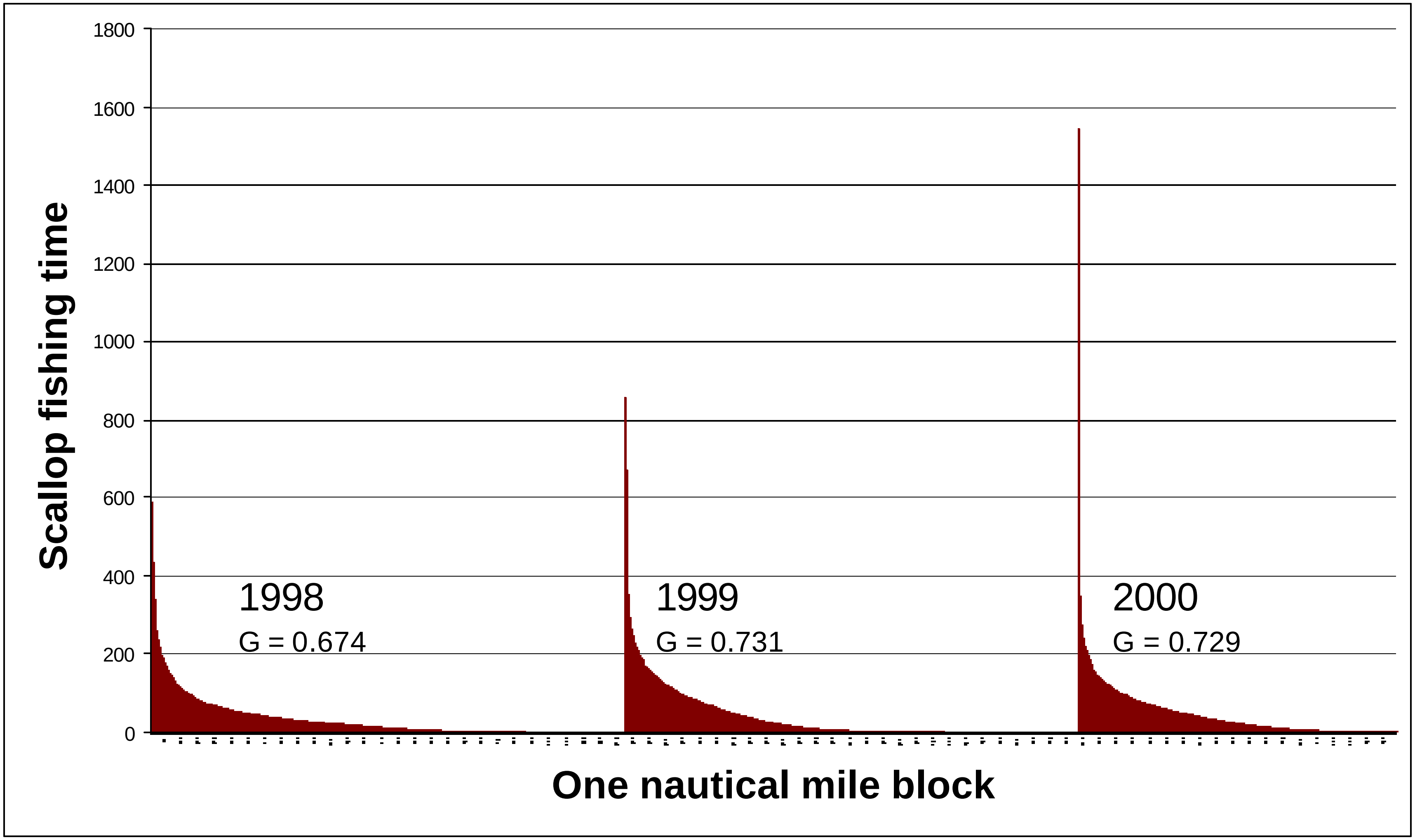


Figure 130. **Cumulative total VMS fishing time (hours) by year. G is the Gini index that ranges from 0 (uniform distribution) to 1 (highly concentrated). 2000 data are truncated on the right due to software limitations.**

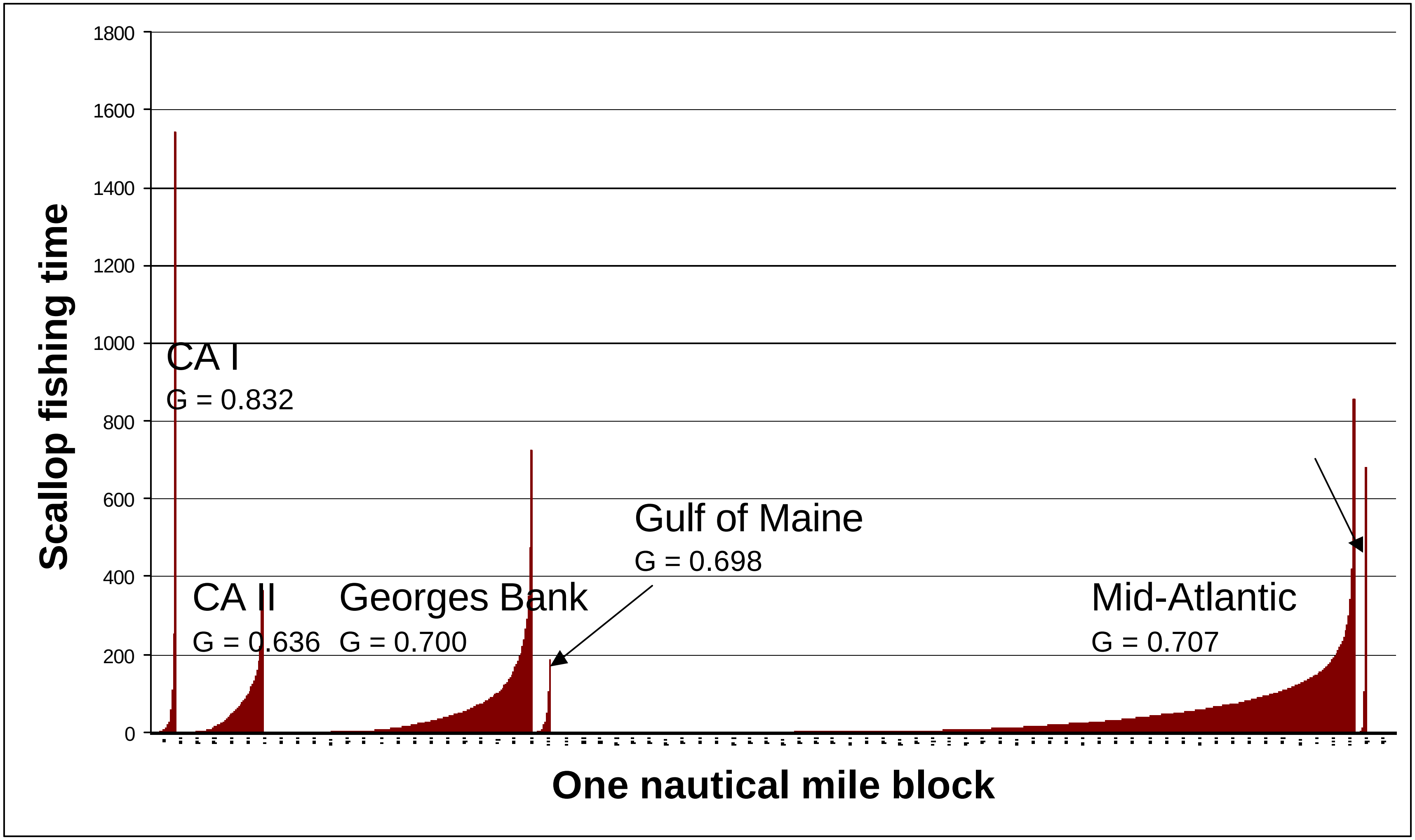


Figure 131. **Cumulative total VMS fishing time (hours) by region. G is the Gini index that ranges from 0 (uniform distribution) to 1 (highly concentrated).**

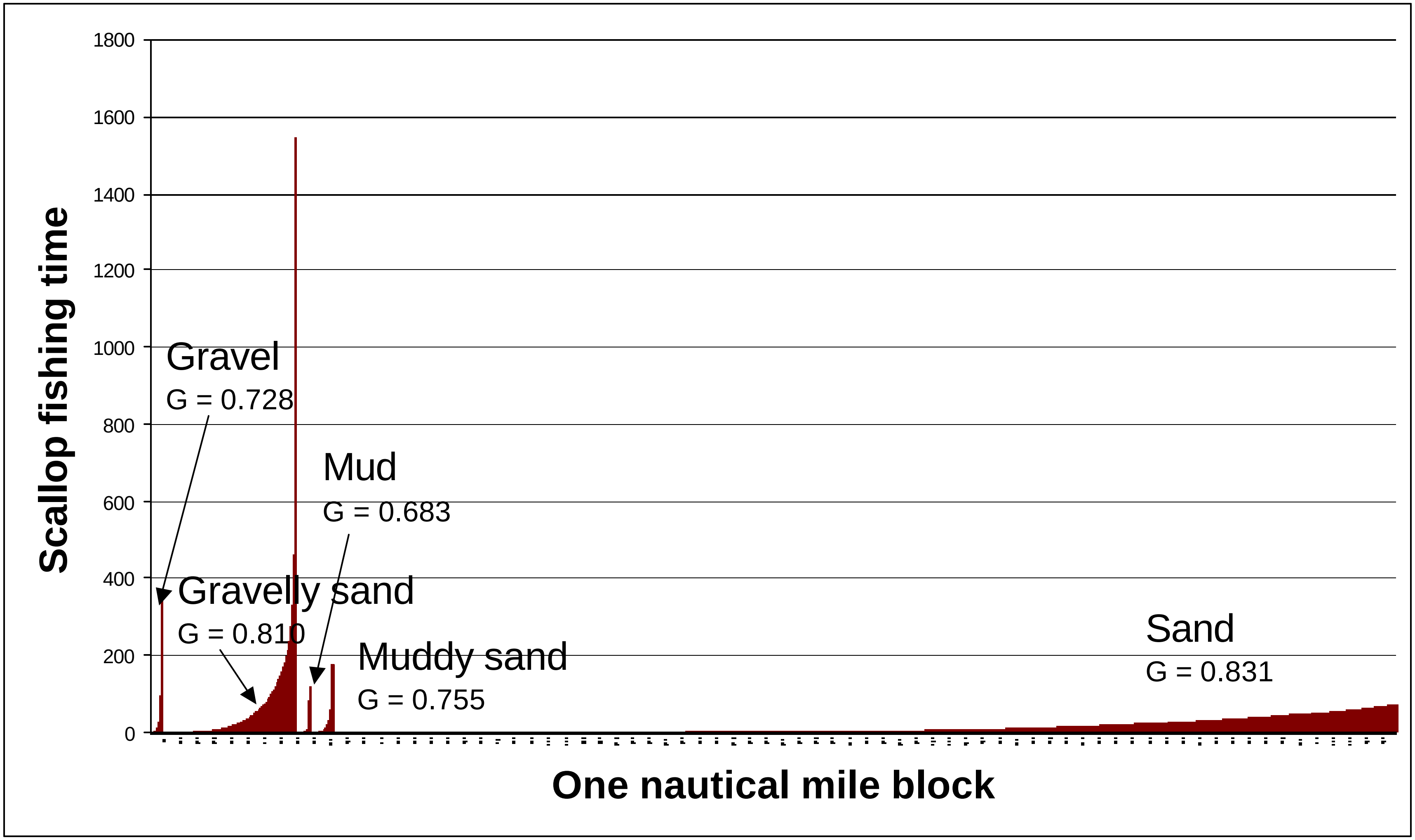


Figure 132. **Cumulative total VMS fishing time (hours) by region. G is the Gini index that ranges from 0 (uniform distribution) to 1 (highly concentrated). Effort distribution for sand substrates are truncated on the right due to software limitations.**

8.5.4.14.2.2 Vessel Trip Reports

Although benefit and practicality analysis both must analyze the impacts on the regulated fishery and on all other fisheries and activities, this analysis focuses on the scallop fishery impacts, i.e. vessels using scallop dredges and trawls. Although it would be preferable that the data were together in one data set, the kept and discarded portions have been summarized in two different data sets requiring parallel analysis. There has been insufficient time to work on the discards, so far, and any further discussion is only about the kept portion of the catches.

Kept catches and associated effort and trip/vessel characteristics were analyzed from VTR records with valid position data (latitude and longitude). Reports with no or impossible location data (land, Canada, etc.) were excluded. These data were filtered by each area closure option and the kept scallops were expanded to total scallop landings reported by dealer data. The VTR data were prorated by 4-digit port group, year, month, and trip type (limited access, general category, and open access).

Total scallop landings from 1995 to 2001 reported in the VTR system totaled 114,804,508 lbs. of meats, while the total scallop landings from dealer reports were 153,545,642 lbs. of meats. The prorated landings from the VTR data totaled 169,194,088 lbs., the difference being some months/ports in which the VTR kept scallops exceeded the dealer landings, in which the VTR kept was assumed to be correct. This may result in a minor amount of double reporting in the analysis, but did not exclude landings in the VTR that might not have been reported by dealers.

With respect to the proposed closed areas, each VTR record was treated as point data, since the geographic range of tows on the reports is not given. This may result in some loss of resolution, but there appears to be no source of directional bias.

Using these methods, a considerable number of historical summaries with respect to the closed areas are possible, including potential impacts by year, month, quarter, port, trip type, gear, vessel size, crew, etc., for all reported kept or discarded species. Several examples are included in the tables that follow this report, all of which compare the kept portion of catches inside (labeled Closed) versus outside (labeled blank) the proposed closures.

In the tables that follow, the potential impact of the proposed habitat closures can be examined by year (1995-2001), quarter (Table 231), permit type (Table 230), gear (Table 232), port (Table 364 to Table 366) and state (Table 233). The results of course vary, but some effects may stand out with careful examination. Overall, the results vary over time (Table 234 to Table 237) but habitat alternative 3a, 3b, and 5b would have the most impacts on landings and the scallop fishery, ranging from 7.1 to 17.6 percent of total landings.

It is also notable that landings per day (LPUE) tends to be about 50 percent higher for proposed closure areas for these three alternatives than for the areas that would remain open (Table 234 to Table 237). This difference also occurs for alternatives 8a and 8b, but the effects are much less. Thus, these five alternatives would cause the scallop fishery to operate in areas that are less productive. Since there is a demonstrated relationship between catch per day and bottom contact time, they have a potential to mitigate the effectiveness of the closure areas by increases in bottom contact elsewhere. For other alternatives, the landings per day in the open areas would be equal to or higher than the LPUE in proposed closed areas. Thus bottom contact time would be either unaffected or be lowered by fishing in more productive areas.

Table 230. Summary of the retrospective impact on total scallop landings by permit type in 1995-2001, assuming that habitat alternative 3a would have been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.

Habitat Alternaitve 3a

Closure effects **Open areas**

		Habitat Alternaitve 3aData					
		Closed			(blank)		
Year_	Trip type	Prorated scallop landings (lbs.)	Percent	LPUE	Prorated scallop landings (lbs.)	Percent	LPUE
1995							
	General Category	3,846	1.9%	129	202,562	98.1%	173
	Limited Access	1,351,430	6.8%	914	18,511,926	93.2%	721
	Open Access	6	0.1%	0	4,978	99.9%	31
1995 Total		**1,355,282**	**6.8%**	**890**	**18,719,466**	**93.2%**	**694**
1996							
	General Category	2,700	1.1%	223	251,809	98.9%	208
	Limited Access	1,894,082	10.3%	753	16,492,747	89.7%	620
	Open Access		0.0%		11,980	100.0%	73
1996 Total		**1,896,782**	**10.2%**	**751**	**16,756,536**	**89.8%**	**599**
1997							
	General Category	4,475	1.3%	206	347,675	98.7%	203
	Limited Access	1,992,233	14.9%	671	11,420,936	85.1%	482
	Open Access	65	0.7%	30	9,576	99.3%	65
1997 Total		**1,996,773**	**14.5%**	**667**	**11,778,187**	**85.5%**	**460**
1998							
	General Category	3,367	1.0%	142	321,365	99.0%	196
	Limited Access	2,075,522	18.0%	588	9,432,948	82.0%	452
	Open Access	156	1.4%	61	10,943	98.6%	78
1998 Total		**2,079,045**	**17.6%**	**585**	**9,765,256**	**82.4%**	**431**
1999							
	General Category		0.0%		378,110	100.0%	269
	Limited Access	2,447,161	11.2%	1,237	19,403,537	88.8%	1,059
	Open Access	30	0.4%	70	7,470	99.6%	64
1999 Total		**2,447,191**	**11.0%**	**1,237**	**19,789,117**	**89.0%**	**997**
2000							
	General Category	1,870	0.6%	312	286,327	99.4%	493
	Limited Access	5,012,841	16.3%	3,172	25,689,296	83.7%	2,785
	Open Access	600	9.1%	63	5,988	90.9%	68
2000 Total		**5,015,311**	**16.2%**	**3,143**	**25,981,611**	**83.8%**	**2,626**
2001							
	General Category	27,755	2.4%	1,050	1,114,842	97.6%	582
	Limited Access	3,417,289	7.4%	3,749	42,598,754	92.6%	2,611
	Open Access	126	1.3%	24	9,748	98.7%	66
2001 Total		**3,445,170**	**7.3%**	**3,653**	**43,723,344**	**92.7%**	**2,379**
Grand Total		**18,235,554**	**11.1%**	**1,206**	**146,513,517**	**88.9%**	**968**

Table 231. Summary of the retrospective impact on total scallop landings by calendar quarter in 1995-2001, assuming that habitat alternative 3a would have been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.

Habitat Alternaitve 3a

Closure effects **Open areas**

		Habitat Alternaitve 3a Data Closed			(blank)		
Year_	Quarter	Prorated scallop	Percent	LPUE	Prorated scallop	Percent	LPUE
1995							
	1	124,562	3.7%	446	3,222,509	96.3%	673
	2	51,051	0.6%	942	8,830,579	99.4%	926
	3	486,885	8.9%	621	4,993,046	91.1%	594
	4	692,784	29.3%	1,704	1,673,332	70.7%	369
1995 Total		**1,355,282**	**6.8%**	**890**	**18,719,466**	**93.2%**	**687**
1996							
	1	144,136	6.3%	531	2,155,369	93.7%	483
	2	284,707	3.8%	798	7,260,122	96.2%	754
	3	880,705	15.5%	843	4,800,051	84.5%	591
	4	587,234	18.8%	688	2,540,994	81.2%	425
1996 Total		**1,896,782**	**10.2%**	**751**	**16,756,536**	**89.8%**	**594**
1997							
	1	423,672	14.5%	913	2,490,756	85.5%	515
	2	745,571	14.3%	817	4,451,449	85.7%	530
	3	461,466	12.0%	548	3,400,130	88.0%	419
	4	366,064	20.3%	463	1,435,852	79.7%	323
1997 Total		**1,996,773**	**14.5%**	**664**	**11,778,187**	**85.5%**	**457**
1998							
	1	426,874	19.7%	538	1,742,790	80.3%	427
	2	640,633	14.6%	599	3,753,436	85.4%	478
	3	588,962	18.0%	568	2,679,967	82.0%	398
	4	422,576	21.0%	637	1,589,063	79.0%	376
1998 Total		**2,079,045**	**17.6%**	**584**	**9,765,256**	**82.4%**	**427**
1999							
	1	366,267	13.2%	983	2,399,826	86.8%	605
	2	935,941	11.4%	1,196	7,269,749	88.6%	1,065
	3	360,075	5.4%	1,206	6,273,047	94.6%	1,206
	4	784,908	16.9%	1,481	3,846,495	83.1%	923
1999 Total		**2,447,191**	**11.0%**	**1,234**	**19,789,117**	**89.0%**	**981**
2000							
	1	602,900	18.4%	2,819	2,670,874	81.6%	2,785
	2	635,398	5.6%	5,961	10,812,369	94.4%	4,881
	3	1,384,897	13.7%	3,133	8,754,131	86.3%	1,951
	4	2,392,116	39.0%	2,852	3,744,237	61.0%	1,564
2000 Total		**5,015,311**	**16.2%**	**3,132**	**25,981,611**	**83.8%**	**2,584**
2001							
	1	740,777	11.8%	3,477	5,549,608	88.2%	1,964
	2	896,917	5.2%	6,645	16,193,769	94.8%	2,649
	3	1,108,263	7.7%	2,876	13,275,882	92.3%	2,322
	4	699,213	7.4%	3,316	8,704,085	92.6%	2,260
2001 Total		**3,445,170**	**7.3%**	**3,649**	**43,723,344**	**92.7%**	**2,362**
Grand Total		**18,235,554**	**11.1%**	**1,204**	**146,513,517**	**88.9%**	**958**

Table 232. Summary of the retrospective impact on total scallop landings by state of landing in 1995-2001, assuming that habitat alternative 3a would have been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.

Habitat Alternaitve 3a Closure effects | **Open areas**

Year	Port State	Habitat Alternaitve 3a Data Closed Prorated scallop	Percent	LPUE	(blank) Prorated scallop	Percent	LPUE
1995							
	CT		0.0%		392,419	100.0%	617
	MA	1,355,282	14.7%	890	7,851,991	85.3%	678
	ME		0.0%		265,498	100.0%	343
	NC		0.0%		135,448	100.0%	386
	NH		0.0%		17,085	100.0%	853
	NJ		0.0%		2,795,839	100.0%	602
	NY		0.0%		21,964	100.0%	533
	RI		0.0%		97,975	100.0%	522
	VA		0.0%		7,141,247	100.0%	790
1995 Total		**1,355,282**	**6.8%**	**890**	**18,719,466**	**93.2%**	**687**
1996							
	CT	3,519	0.9%	365	377,694	99.1%	495
	MA	1,888,935	20.7%	754	7,245,528	79.3%	613
	MD		0.0%		2,065	100.0%	78
	ME	4,328	1.2%	391	362,646	98.8%	359
	NC		0.0%		122,619	100.0%	346
	NH		0.0%		4,000	100.0%	252
	NJ		0.0%		2,440,322	100.0%	514
	NY		0.0%		3,233	100.0%	452
	RI		0.0%		16,183	100.0%	267
	VA		0.0%		6,179,305	100.0%	659
	(blank)		0.0%		2,941	100.0%	229
1996 Total		**1,896,782**	**10.2%**	**751**	**16,756,536**	**89.8%**	**594**
1997							
	CT	21,669	6.1%	514	331,951	93.9%	446
	MA	1,952,045	25.9%	670	5,586,648	74.1%	505
	MD		0.0%		800	100.0%	200
	ME	14,458	5.8%	519	235,326	94.2%	307
	NC		0.0%		51,729	100.0%	273
	NH		0.0%		1,147	100.0%	86
	NJ		0.0%		2,004,676	100.0%	415
	NY		0.0%		1,551	100.0%	257
	RI		0.0%		118,853	100.0%	435
	VA	8,601	0.2%	341	3,444,966	99.8%	437
	(blank)		0.0%		540	100.0%	64
1997 Total		**1,996,773**	**14.5%**	**664**	**11,778,187**	**85.5%**	**457**
1998							
	CT	12,400	3.2%	440	372,842	96.8%	378
	MA	2,034,675	34.3%	584	3,894,711	65.7%	431
	MD		0.0%		2,680	100.0%	259
	ME	2,366	1.6%	184	149,599	98.4%	242
	NC		0.0%		37,064	100.0%	269
	NH		0.0%		3,970	100.0%	100
	NJ		0.0%		1,649,828	100.0%	388
	NY		0.0%		375	100.0%	200
	RI		0.0%		106,229	100.0%	321
	SC						0
	VA	29,604	0.8%	839	3,547,396	99.2%	475
	(blank)		0.0%		562	100.0%	107
1998 Total		**2,079,045**	**17.6%**	**584**	**9,765,256**	**82.4%**	**427**
1999							
	CT		0.0%		654,118	100.0%	814
	FL		0.0%		8,440	100.0%	2,873
	MA	2,436,973	19.4%	1,232	10,146,259	80.6%	1,161
	ME		0.0%		226,862	100.0%	465
	NC		0.0%		5,462	100.0%	25
	NH		0.0%		45,944	100.0%	741
	NJ	10,218	0.3%	1,790	2,914,872	99.7%	832
	NY		0.0%		11,725	100.0%	306
	RI		0.0%		200,648	100.0%	753
	SC						0

Table 233. Summary of the retrospective impact on total scallop landings by gear type in 1995-2001, assuming that habitat alternative 3a would have been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.

Habitat Alternaitve 3a

		Closure effects			**Open areas**		
		Habitat Alternaitve 3a Data Closed			**(blank)**		
Year_	**Gear**	**Prorated scallop**	**Percent**	**LPUE**	**Prorated scallop**	**Percent**	**LPUE**
1995							
	sctrawl		0.0%		1,868,411	100.0%	831
	sdredge	1,355,282	7.4%	890	16,851,055	92.6%	674
1995 Total		**1,355,282**	**6.8%**	**890**	**18,719,466**	**93.2%**	**687**
1996							
	sctrawl		0.0%		1,454,582	100.0%	748
	sdredge	1,896,782	11.0%	751	15,301,954	89.0%	583
1996 Total		**1,896,782**	**10.2%**	**751**	**16,756,536**	**89.8%**	**594**
1997							
	sctrawl		0.0%		758,598	100.0%	406
	sdredge	1,996,773	15.3%	664	11,019,589	84.7%	461
1997 Total		**1,996,773**	**14.5%**	**664**	**11,778,187**	**85.5%**	**457**
1998							
	sctrawl		0.0%		983,936	100.0%	555
	sdredge	2,079,045	19.1%	584	8,781,320	80.9%	416
1998 Total		**2,079,045**	**17.6%**	**584**	**9,765,256**	**82.4%**	**427**
1999							
	sctrawl		0.0%		1,855,699	100.0%	912
	sdredge	2,447,191	12.0%	1,234	17,933,418	88.0%	989
1999 Total		**2,447,191**	**11.0%**	**1,234**	**19,789,117**	**89.0%**	**981**
2000							
	sctrawl		0.0%		2,542,037	100.0%	2,026
	sdredge	5,015,311	17.6%	3,132	23,439,574	82.4%	2,663
2000 Total		**5,015,311**	**16.2%**	**3,132**	**25,981,611**	**83.8%**	**2,584**
2001							
	sctrawl		0.0%		3,965,302	100.0%	2,154
	sdredge	3,445,170	8.0%	3,649	39,758,042	92.0%	2,385
2001 Total		**3,445,170**	**7.3%**	**3,649**	**43,723,344**	**92.7%**	**2,362**
Grand Total		**18,235,554**	**11.1%**	**1,204**	**146,513,517**	**88.9%**	**958**

Table 234. Summary of the retrospective impact on total scallop landings by alternative in 1995-1996, assuming they had been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.

		1995			1996	
		Prorated scallop landings (lbs.)	Percent	LPUE	Prorated scallop landings (lbs.)	Percent
Habitat Alternative 1 (SQ;NA)	Closed	57,041	0.3%	455	105,431	0.6%
	Open	20,017,707	99.7%	698	18,547,887	99.4%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternaitve 3a	Closed	1,355,282	6.8%	890	1,896,782	10.2%
	Open	18,719,466	93.2%	687	16,756,536	89.8%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternaitve 3b	Closed	1,356,046	6.8%	896	1,896,782	10.2%
	Open	18,718,702	93.2%	686	16,756,536	89.8%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternaitve 4	Closed	946,956	4.7%	1,064	1,306,818	7.0%
	Open	19,127,792	95.3%	686	17,346,500	93.0%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternaitve 5a	Closed	192,183	1.0%	388	373,268	2.0%
	Open	19,882,565	99.0%	703	18,280,050	98.0%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternaitve 5b	Closed	2,737,511	13.6%	825	2,865,105	15.4%
	Open	17,337,237	86.4%	681	15,788,213	84.6%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternaitve 5c	Closed	197,175	1.0%	420	350,653	1.9%
	Open	19,877,573	99.0%	702	18,302,665	98.1%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternaitve 5d	Closed	203,301	1.0%	387	344,509	1.8%
	Open	19,871,447	99.0%	703	18,308,809	98.2%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternative 6	Closed	46,320	0.2%	474	95,248	0.5%
	Open	20,028,428	99.8%	698	18,558,070	99.5%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternative 7	Closed	5,239,776	26.1%	751	5,079,221	27.2%
	Open	14,834,972	73.9%	680	13,574,097	72.8%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternaitve 8a	Closed	20,074,748	100.0%	697	18,653,318	100.0%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternaitve 8b	Closed	703,197	3.5%	1,704	580,280	3.1%
	Open	19,371,551	96.5%	683	18,073,038	96.9%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**
Habitat Alternaitve 9	Closed	57,930	0.3%	439	108,125	0.6%
	Open	20,016,818	99.7%	698	18,545,193	99.4%
	Grand Total	**20,074,748**	**100.0%**	**697**	**18,653,318**	**100.0%**

Table 235. **Summary of the retrospective impact on total scallop landings by alternative in 1997-1998, assuming they had been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.**

		1997			1998	
		Prorated scallop landings (lbs.)	Percent	LPUE	Prorated scallop landings (lbs.)	Percent
Habitat Alternative 1 (SQ;NA)	Closed	174,618	1.3%	490	95,093	0.8%
	Open	13,600,342	98.7%	478	11,749,208	99.2%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternaitve 3a	Closed	1,996,773	14.5%	664	2,079,045	17.6%
	Open	11,778,187	85.5%	457	9,765,256	82.4%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternaitve 3b	Closed	2,002,819	14.5%	663	2,089,665	17.6%
	Open	11,772,141	85.5%	457	9,754,636	82.4%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternaitve 4	Closed	1,397,593	10.1%	690	1,286,594	10.9%
	Open	12,377,367	89.9%	462	10,557,707	89.1%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternaitve 5a	Closed	354,740	2.6%	560	203,202	1.7%
	Open	13,420,220	97.4%	476	11,641,099	98.3%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternaitve 5b	Closed	2,446,902	17.8%	567	1,053,255	8.9%
	Open	11,328,058	82.2%	463	10,791,046	91.1%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternaitve 5c	Closed	312,729	2.3%	530	172,087	1.5%
	Open	13,462,231	97.7%	477	11,672,214	98.5%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternaitve 5d	Closed	355,006	2.6%	513	210,330	1.8%
	Open	13,419,954	97.4%	477	11,633,971	98.2%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternative 6	Closed	142,278	1.0%	479	70,957	0.6%
	Open	13,632,682	99.0%	478	11,773,344	99.4%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternative 7	Closed	4,103,407	29.8%	492	2,281,380	19.3%
	Open	9,671,553	70.2%	473	9,562,921	80.7%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternaitve 8a	Closed	13,774,960	100.0%	478	11,844,301	100.0%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternaitve 8b	Closed	624,991	4.5%	666	618,164	5.2%
	Open	13,149,969	95.5%	472	11,226,137	94.8%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**
Habitat Alternaitve 9	Closed	178,342	1.3%	490	96,377	0.8%
	Open	13,596,618	98.7%	478	11,747,924	99.2%
	Grand Total	**13,774,960**	**100.0%**	**478**	**11,844,301**	**100.0%**

Table 236. **Summary of the retrospective impact on total scallop landings by alternative in 1998-1999, assuming they had been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.**

		1999			2000	
		Prorated scallop landings (lbs.)	Percent	LPUE	Prorated scallop landings (lbs.)	Percent
Habitat Alternative 1 (SQ;NA)	Closed	6,121,662	27.5%	1,481	5,356,358	17.3%
	Open	16,114,646	72.5%	895	25,640,564	82.7%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternaitve 3a	Closed	2,447,191	11.0%	1,234	5,015,311	16.2%
	Open	19,789,117	89.0%	981	25,981,611	83.8%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternaitve 3b	Closed	2,444,734	11.0%	1,235	5,015,011	16.2%
	Open	19,791,574	89.0%	981	25,981,911	83.8%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternaitve 4	Closed	1,342,811	6.0%	1,279	4,016,483	13.0%
	Open	20,893,497	94.0%	990	26,980,439	87.0%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternaitve 5a	Closed	172,769	0.8%	711	42,682	0.1%
	Open	22,063,539	99.2%	1,007	30,954,240	99.9%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternaitve 5b	Closed	1,586,433	7.1%	888	2,493,874	8.0%
	Open	20,649,875	92.9%	1,014	28,503,048	92.0%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternaitve 5c	Closed	181,872	0.8%	692	74,865	0.2%
	Open	22,054,436	99.2%	1,008	30,922,057	99.8%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternaitve 5d	Closed	88,388	0.4%	594	29,973	0.1%
	Open	22,147,920	99.6%	1,007	30,966,949	99.9%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternative 6	Closed	154,087	0.7%	1,307	139,537	0.5%
	Open	22,082,221	99.3%	1,002	30,857,385	99.5%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternative 7	Closed	3,911,060	17.6%	882	4,890,097	15.8%
	Open	18,325,248	82.4%	1,035	26,106,825	84.2%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternaitve 8a	Closed	Confidential	Confidential	1,592	Confidential	Confidential
	Open	22,204,776	Confidential	1,004	30,996,172	Confidential
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternaitve 8b	Closed	620,093	2.8%	1,134	419,377	1.4%
	Open	21,616,215	97.2%	1,001	30,577,545	98.6%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**
Habitat Alternaitve 9	Closed	6,123,662	27.5%	1,481	5,356,358	17.3%
	Open	16,112,646	72.5%	895	25,640,564	82.7%
	Grand Total	**22,236,308**	**100.0%**	**1,004**	**30,996,922**	**100.0%**

Table 237. **Summary of the retrospective impact on total scallop landings by alternative in 2001, assuming they had been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.**

		2001		
		Prorated scallop landings (lbs.)	Percent	LPUE
Habitat Alternative 1 (SQ;NA)	Closed	1,237,187	2.6%	3,339
	Open	45,931,327	97.4%	2,407
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternaitve 3a	Closed	3,445,170	7.3%	3,649
	Open	43,723,344	92.7%	2,362
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternaitve 3b	Closed	3,445,170	7.3%	3,649
	Open	43,723,344	92.7%	2,362
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternaitve 4	Closed	1,753,688	3.7%	3,217
	Open	45,414,826	96.3%	2,402
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternaitve 5a	Closed	591,981	1.3%	2,150
	Open	46,576,533	98.7%	2,429
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternaitve 5b	Closed	5,218,337	11.1%	2,233
	Open	41,950,177	88.9%	2,451
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternaitve 5c	Closed	607,053	1.3%	2,049
	Open	46,561,461	98.7%	2,431
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternaitve 5d	Closed	429,232	0.9%	1,971
	Open	46,739,282	99.1%	2,430
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternative 6	Closed	193,078	0.4%	2,986
	Open	46,975,436	99.6%	2,423
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternative 7	Closed	8,314,937	17.6%	2,135
	Open	38,853,577	82.4%	2,497
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternaitve 8a	Closed	Confidential	Confidential	3,880
	Open	47,076,921	Confidential	2,423
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternaitve 8b	Closed	465,334	1.0%	2,985
	Open	46,703,180	99.0%	2,420
	Grand Total	**47,168,514**	**100.0%**	**2,425**
Habitat Alternaitve 9	Closed	1,237,187	2.6%	3,339
	Open	45,931,327	97.4%	2,407
	Grand Total	**47,168,514**	**100.0%**	**2,425**

Table 238. Summary of the retrospective impact on total scallop landings (lbs.) by alternative in 1995-2001, assuming that they alternatives had been implemented at that time. Data are from vessel trip reports with valid latitude and longitude positions, raised to total revenue by port group, gear, and month of landing.

		1995		1996		1997		1998		1999		2000		2001		Total
		Total scallop landings	Percent	Total scallop landings	Percent	Total scallop landings	Percent	Total scallop landings	Percent	Total scallop landings	Percent	Total scallop landings	Percent	Total scallop landings	Percent	Percent
Habitat Alternative 1 (SQ;NA)	Closed	57,041	0.3%	105,431	0.6%	174,618	1.3%	95,093	0.8%	6,121,662	27.5%	5,356,358	17.3%	1,237,187	2.6%	8.0%
	Open	20,017,707	99.7%	18,547,887	99.4%	13,600,342	98.7%	11,749,208	99.2%	16,114,646	72.5%	25,640,564	82.7%	45,931,327	97.4%	92.0%
Habitat Alternative 3a	Closed	1,355,282	6.8%	1,896,782	10.2%	1,996,773	14.5%	2,079,045	17.6%	2,447,191	11.0%	5,015,311	16.2%	3,445,170	7.3%	11.1%
	Open	18,719,466	93.2%	16,756,536	89.8%	11,778,187	85.5%	9,765,256	82.4%	19,789,117	89.0%	25,981,611	83.8%	43,723,344	92.7%	88.9%
Habitat Alternative 3b	Closed	1,356,046	6.8%	1,896,782	10.2%	2,002,819	14.5%	2,089,665	17.6%	2,444,734	11.0%	5,015,011	16.2%	3,445,170	7.3%	11.1%
	Open	18,718,702	93.2%	16,756,536	89.8%	11,772,141	85.5%	9,754,636	82.4%	19,791,574	89.0%	25,981,911	83.8%	43,723,344	92.7%	88.9%
Habitat Alternative 4	Closed	946,956	4.7%	1,306,818	7.0%	1,397,593	10.1%	1,286,594	10.9%	1,342,811	6.0%	4,016,483	13.0%	1,753,688	3.7%	7.3%
	Open	19,127,792	95.3%	17,346,500	93.0%	12,377,367	89.9%	10,557,707	89.1%	20,893,497	94.0%	26,980,439	87.0%	45,414,826	96.3%	92.7%
Habitat Alternative 5a	Closed	192,183	1.0%	373,268	2.0%	354,740	2.6%	203,202	1.7%	172,769	0.8%	42,682	0.1%	591,981	1.3%	1.2%
	Open	19,882,565	99.0%	18,280,050	98.0%	13,420,220	97.4%	11,641,099	98.3%	22,063,539	99.2%	30,954,240	99.9%	46,576,533	98.7%	98.8%
Habitat Alternative 5b	Closed	2,737,511	13.6%	2,865,105	15.4%	2,446,902	17.8%	1,053,255	8.9%	1,586,433	7.1%	2,493,874	8.0%	5,218,337	11.1%	11.2%
	Open	17,337,237	86.4%	15,788,213	84.6%	11,328,058	82.2%	10,791,046	91.1%	20,649,875	92.9%	28,503,048	92.0%	41,950,177	88.9%	88.8%
Habitat Alternative 5c	Closed	197,175	1.0%	350,653	1.9%	312,729	2.3%	172,087	1.5%	181,872	0.8%	74,865	0.2%	607,053	1.3%	1.2%
	Open	19,877,573	99.0%	18,302,665	98.1%	13,462,231	97.7%	11,672,214	98.5%	22,054,436	99.2%	30,922,057	99.8%	46,561,461	98.7%	98.8%
Habitat Alternative 5d	Closed	203,301	1.0%	344,509	1.8%	355,006	2.6%	210,330	1.8%	88,388	0.4%	29,973	0.1%	429,232	0.9%	1.0%
	Open	19,871,447	99.0%	18,308,809	98.2%	13,419,954	97.4%	11,633,971	98.2%	22,147,920	99.6%	30,966,949	99.9%	46,739,282	99.1%	99.0%
Habitat Alternative 6	Closed	46,320	0.2%	95,248	0.5%	142,278	1.0%	70,957	0.6%	154,087	0.7%	139,537	0.5%	193,078	0.4%	0.5%
	Open	20,028,428	99.8%	18,558,070	99.5%	13,632,682	99.0%	11,773,344	99.4%	22,082,221	99.3%	30,857,385	99.5%	46,975,436	99.6%	99.5%
Habitat Alternative	Closed	5,239,776	26.1%	5,079,221	27.2%	4,103,407	29.8%	2,281,380	19.3%	3,911,060	17.6%	4,890,097	15.8%	8,314,937	17.6%	20.5%

		1995		1996		1997		1998		1999		2000		2001		Total
		Total scallop landings	Percent	Total scallop landings	Percent	Total scallop landings	Percent	Total scallop landings	Percent	Total scallop landings	Percent	Total scallop landings	Percent	Total scallop landings	Percent	Percent
7	Open	14,834,972	73.9%	13,574,097	72.8%	9,671,553	70.2%	9,562,921	80.7%	18,325,248	82.4%	26,106,825	84.2%	38,853,577	82.4%	79.5%
Habitat Alternative 8a	Closed		0.0%		0.0%		0.0%		0.0%	Confidential		Confidential		Confidential		0
	Open	20,074,748	100.0 %	18,653,318	100.0%	13,774,960	100.0%	11,844,301	100.0%	Confidential		Confidential		Confidential		1
Habitat Alternative 8b	Closed	4,289,300	4.2%	3,418,259	3.3%	4,162,249	4.7%	3,868,560	5.4%	3,570,717	2.9%	2,264,058	1.5%	1,939,963	0.9%	
	Open	98,077,264	95.8%	101,225,124	96.7%	84,981,397	95.3%	68,409,804	94.6%	118,288,150	97.1%	153,546,647	98.5%	213,753,068	99.1%	
Habitat Alternative 9	Closed	57,930	0.3%	108,125	0.6%	178,342	1.3%	96,377	0.8%	6,123,662	27.5%	5,356,358	17.3%	1,237,187	2.6%	8.0%
	Open	20,016,818	99.7%	18,545,193	99.4%	13,596,618	98.7%	11,747,924	99.2%	16,112,646	72.5%	25,640,564	82.7%	45,931,327	97.4%	92.0%
GF Mortality Alternative 1	Closed	1,719,876	8.6%	2,506,457	13.4%	2,941,175	21.4%	1,999,792	16.9%	5,515,435	24.8%	6,242,051	20.1%	3,559,686	7.5%	14.9%
	Open	18,354,872	91.4%	16,146,861	86.6%	10,833,785	78.6%	9,844,509	83.1%	16,720,873	75.2%	24,754,871	79.9%	43,608,828	92.5%	85.1%
Grand Total		**102,366,565**	**20,074,748**		**18,653,318**		**13,774,960**		**11,844,301**		**22,236,308**		**30,996,922**		**47,168,514**	

Table 239. Summary of the retrospective impact on total scallop revenue by alternative in 1995-2001, assuming that they alternatives had been implemented at that time. Data are from vessel trip reports with valid latitude and longitude positions, raised to total revenue by port group, gear, and month of landing.

		1995		1996		1997		1998		1999		2000		2001		Total
		Total scallop revenue	Percent	Total scallop revenue	Percent	Total scallop revenue	Percent	Total scallop revenue	Percent	Total scallop revenue	Percent	Total scallop revenue	Percent	Total scallop revenue	Percent	Percent
Habitat Alternative 1 (SQ;NA)	Closed	353,810	0.3%	630,541	0.6%	1,128,143	1.3%	602,259	0.8%	35,787,509	29.4%	30,210,593	19.4%	5,766,218	2.7%	8.6%
	Open	102,012,754	99.7%	104,012,843	99.4%	88,015,503	98.7%	71,676,106	99.2%	86,071,359	70.6%	125,600,112	80.6%	209,926,813	97.3%	91.4%
Habitat Alternative 3a	Closed	7,927,064	7.7%	11,369,557	10.9%	13,297,725	14.9%	12,950,115	17.9%	14,078,935	11.6%	27,974,935	18.0%	15,875,060	7.4%	12.0%
	Open	94,439,501	92.3%	93,273,827	89.1%	75,845,921	85.1%	59,328,250	82.1%	107,779,932	88.4%	127,835,770	82.0%	199,817,971	92.6%	88.0%
Habitat Alternative 3b	Closed	7,938,339	7.8%	11,369,557	10.9%	13,341,141	15.0%	13,018,005	18.0%	14,065,916	11.5%	27,972,933	18.0%	15,875,060	7.4%	12.0%
	Open	94,428,226	92.2%	93,273,827	89.1%	75,802,505	85.0%	59,260,359	82.0%	107,792,951	88.5%	127,837,772	82.0%	199,817,971	92.6%	88.0%
Habitat Alternative 4	Closed	5,667,685	5.5%	7,794,920	7.4%	9,342,814	10.5%	8,035,642	11.1%	7,883,405	6.5%	22,908,380	14.7%	8,078,863	3.7%	8.1%
	Open	96,698,879	94.5%	96,848,464	92.6%	79,800,832	89.5%	64,242,722	88.9%	113,975,462	93.5%	132,902,324	85.3%	207,614,168	96.3%	91.9%
Habitat Alternative 5a	Closed	1,149,972	1.1%	2,314,239	2.2%	2,356,367	2.6%	1,274,970	1.8%	969,945	0.8%	257,310	0.2%	2,622,305	1.2%	1.3%
	Open	101,216,593	98.9%	102,329,145	97.8%	86,787,279	97.4%	71,003,394	98.2%	120,888,923	99.2%	155,553,395	99.8%	213,070,726	98.8%	98.7%
Habitat Alternative 5b	Closed	13,853,722	13.5%	16,658,772	15.9%	16,084,383	18.0%	6,507,730	9.0%	8,822,471	7.2%	12,945,753	8.3%	22,663,977	10.5%	11.3%
	Open	88,512,842	86.5%	87,984,612	84.1%	73,059,263	82.0%	65,770,634	91.0%	113,036,396	92.8%	142,864,951	91.7%	193,029,054	89.5%	88.7%
Habitat Alternative 5c	Closed	1,128,614	1.1%	2,191,507	2.1%	2,093,246	2.3%	1,079,758	1.5%	1,026,093	0.8%	541,429	0.3%	2,709,792	1.3%	1.2%
	Open	101,237,951	98.9%	102,451,877	97.9%	87,050,400	97.7%	71,198,606	98.5%	120,832,775	99.2%	155,269,276	99.7%	212,983,239	98.7%	98.8%
Habitat Alternative 5d	Closed	1,157,390	1.1%	2,155,998	2.1%	2,360,923	2.6%	1,313,335	1.8%	505,247	0.4%	193,467	0.1%	1,968,068	0.9%	1.1%
	Open	101,209,175	98.9%	102,487,386	97.9%	86,782,723	97.4%	70,965,030	98.2%	121,353,621	99.6%	155,617,238	99.9%	213,724,963	99.1%	98.9%
Habitat Alternative 6	Closed	287,142	0.3%	564,760	0.5%	910,665	1.0%	452,910	0.6%	952,759	0.8%	783,841	0.5%	839,596	0.4%	0.6%
	Open	102,079,423	99.7%	104,078,623	99.5%	88,232,981	99.0%	71,825,455	99.4%	120,906,109	99.2%	155,026,864	99.5%	214,853,435	99.6%	99.4%
Habitat Alternative	Closed	27,445,939	26.8%	29,763,381	28.4%	26,940,805	30.2%	14,213,984	19.7%	22,076,488	18.1%	25,865,188	16.6%	37,451,914	17.4%	21.3%

		1995		1996		1997		1998		1999		2000		2001		Total
		Total scallop revenue	Percent	Total scallop revenue	Percent	Total scallop revenue	Percent	Total scallop revenue	Percent	Total scallop revenue	Percent	Total scallop revenue	Percent	Total scallop revenue	Percent	Percent
7	Open	74,920,626	73.2%	74,880,002	71.6%	62,202,841	69.8%	58,064,380	80.3%	99,782,379	81.9%	129,945,517	83.4%	178,241,117	82.6%	78.7%
Habitat Alternative 8a	Closed		0.0%		0.0%		0.0%		0.0%	Confidential		Confidential		Confidential		0.1%
	Open	102,366,565	100.0%	104,643,384	100.0%	89,143,646	100.0%	72,278,364	100.0%	Confidential		Confidential		Confidential		99.9%
Habitat Alternative 8b	Closed	4,289,300	4.2%	3,418,259	3.3%	4,162,249	4.7%	3,868,560	5.4%	3,570,717	2.9%	2,264,058	1.5%	1,939,963	0.9%	2.7%
	Open	98,077,264	95.8%	101,225,124	96.7%	84,981,397	95.3%	68,409,804	94.6%	118,288,150	97.1%	153,546,647	98.5%	213,753,068	99.1%	97.3%
Habitat Alternative 9	Closed	359,091	0.4%	646,811	0.6%	1,153,541	1.3%	610,233	0.8%	35,800,370	29.4%	30,210,593	19.4%	5,766,218	2.7%	8.7%
	Open	102,007,474	99.6%	103,996,572	99.4%	87,990,104	98.7%	71,668,131	99.2%	86,058,497	70.6%	125,600,112	80.6%	209,926,813	97.3%	91.3%
GF Mortality Alternative 1	Closed	10,038,394	9.8%	14,962,785	14.3%	19,331,656	21.7%	12,534,948	17.3%	32,391,973	26.6%	34,922,680	22.4%	16,480,626	7.6%	16.3%
	Open	92,328,171	90.2%	89,680,598	85.7%	69,811,990	78.3%	59,743,417	82.7%	89,466,894	73.4%	120,888,025	77.6%	199,212,406	92.4%	83.7%
Grand Total		**102,366,565**		**104,643,384**		**89,143,646**		**72,278,364**		**121,858,867**		**155,810,705**		**215,693,031**		

8.5.4.14.2.3 Effects on incidental landings and bycatch

Habitat closures will always help to minimize bycatch, but also reduce incidental (or non-target) landings of finfish if fishing mortality targets in the remaining open areas is held constant (i.e. no effort displacement). The effects vary by species depending on the location of the proposed habitat closure relative to the distribution of the species.

The tables below summarize the percent of landings of all species from scallop dredge and trawl trips, reported as "Kept" on vessel trip reports, relative to the proposed habitat closure areas. To generalize, the habitat closures are more effective for reducing the non-target landings of finfish (and possibly discards) when the percent of total landings for a species exceeds the percent of total scallop landings affected by the proposed closure. In other words, the closure would have a greater reduction in landings of some finfish species than the comparable reduction of scallop landings.

For yellowtail flounder, a species highly vulnerable to scallop dredges, only alternatives that retain the existing groundfish closed areas (Alternatives 1 and 9) and groundfish mortality alternative 1 would be more effective at reducing yellowtail flounder landings on scallop dredge vessels than it would for reducing sea scallop landings.

Table 240. **Summary of the retrospective impact on total scallop and incidental finfish landings in 1995-2001, assuming the various habitat alternatives would have been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.**

	Gear	Area status	Prorated scallop landings (lbs.)	Percent	Cod	Haddock	Winter Flounder	American Plaice	Witch Flounder	Windowpane flounder	Yellowtail Flounder	Pollock	Redfish	White Hake
Habitat Alternative 1 (SQ;NA)	sctrawl	Closed	9,815	0.0%	0.0%	0.0%	0.0%	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Open	13,418,750	8.1%	1.9%	1.9%	4.9%	26.6%	4.4%	49.0%	7.8%	6.1%	100.0%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	13,137,575	8.0%	2.8%	0.0%	11.3%	16.2%	12.1%	12.9%	25.9%	0.0%	0.0%	0.0%
		Open	138,182,931	83.9%	95.4%	98.1%	83.8%	55.6%	83.5%	38.1%	66.3%	93.9%	0.0%	99.6%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
GF Mortality Alternative 1	sctrawl	Closed	0	0.0%	0.6%	0.0%	0.3%	2.7%	1.1%	0.0%	0.1%	0.0%	83.3%	0.0%
		Open	13,428,565	8.2%	1.3%	1.9%	4.7%	25.5%	3.3%	49.0%	7.7%	6.1%	16.7%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	24,484,472	14.9%	37.0%	75.2%	48.1%	29.8%	22.5%	21.3%	30.4%	0.0%	0.0%	0.1%
		Open	126,836,034	77.0%	61.1%	22.8%	47.0%	42.0%	73.1%	29.7%	61.8%	93.9%	0.0%	99.5%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
Habitat Alternative 3a	sctrawl	Open	13,428,565	8.2%	1.9%	1.9%	5.0%	28.2%	4.4%	49.0%	7.8%	6.1%	100.0%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	18,235,554	11.1%	35.8%	75.2%	43.0%	21.3%	9.4%	9.8%	8.4%	0.0%	0.0%	0.0%
		Open	133,084,952	80.8%	62.3%	22.8%	52.0%	50.5%	86.2%	41.2%	83.9%	93.9%	0.0%	99.6%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
Habitat Alternative 3b	sctrawl	Open	13,428,565	8.2%	1.9%	1.9%	5.0%	28.2%	4.4%	49.0%	7.8%	6.1%	100.0%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	18,250,227	11.1%	35.8%	75.2%	42.9%	21.4%	9.3%	9.8%	8.4%	0.0%	0.0%	0.0%
		Open	133,070,279	80.8%	62.3%	22.8%	52.1%	50.4%	86.3%	41.2%	83.9%	93.9%	0.0%	99.6%

	Gear	Area status	Prorated scallop landings (lbs.)	Percent	Cod	Haddock	Winter Flounder	American Plaice	Witch Flounder	Windowpane flounder	Yellowtail Flounder	Pollock	Redfish	White Hake
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
Habitat Alternative 4	sctrawl	Open	13,428,565	8.2%	1.9%	1.9%	5.0%	28.2%	4.4%	49.0%	7.8%	6.1%	100.0%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	12,050,943	7.3%	28.1%	74.9%	34.7%	19.2%	6.7%	9.8%	5.3%	0.0%	0.0%	0.0%
		Open	139,269,563	84.5%	70.0%	23.2%	60.3%	52.6%	88.9%	41.2%	86.9%	93.9%	0.0%	99.6%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
Habitat Alternative 5a	sctrawl	Closed	5,745	0.0%	0.5%	0.0%	0.4%	1.3%	0.8%	0.0%	0.0%	0.0%	83.3%	0.0%
		Open	13,422,820	8.1%	1.4%	1.9%	4.5%	26.9%	3.6%	49.0%	7.8%	6.1%	16.7%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	1,925,080	1.2%	2.6%	0.0%	2.8%	1.7%	7.8%	0.0%	1.9%	0.0%	0.0%	0.0%
		Open	149,395,426	90.7%	95.5%	98.1%	92.2%	70.1%	87.8%	51.0%	90.4%	93.9%	0.0%	99.6%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
Habitat Alternative 5b	sctrawl	Closed	130,649	0.1%	0.5%	0.0%	0.0%	1.3%	0.8%	0.0%	0.0%	0.0%	83.3%	0.0%
		Open	13,297,916	8.1%	1.4%	1.9%	5.0%	26.9%	3.6%	49.0%	7.8%	6.1%	16.7%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	18,270,768	11.1%	13.0%	0.1%	13.6%	7.0%	18.5%	1.9%	8.7%	0.0%	0.0%	0.0%
		Open	133,049,738	80.8%	85.1%	98.0%	81.5%	64.8%	77.1%	49.1%	83.5%	93.9%	0.0%	99.6%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
Habitat Alternative 5c	sctrawl	Closed	2,561	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Open	13,426,004	8.1%	1.9%	1.9%	4.5%	28.2%	4.4%	49.0%	7.8%	6.1%	100.0%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	1,893,873	1.1%	2.6%	0.0%	2.6%	0.8%	4.4%	0.6%	1.8%	0.0%	0.0%	0.0%
		Open	149,426,633	90.7%	95.5%	98.1%	92.5%	71.0%	91.2%	50.4%	90.4%	93.9%	0.0%	99.6%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**

	Gear	Area status	Prorated scallop landings (lbs.)	Percent	Cod	Haddock	Winter Flounder	American Plaice	Witch Flounder	Windowpane flounder	Yellowtail Flounder	Pollock	Redfish	White Hake
Habitat Alternative 5d	sctrawl	Closed	54	0.0%	0.5%	0.0%	0.0%	19.4%	0.8%	32.9%	6.2%	0.0%	83.3%	0.0%
		Open	13,428,511	8.2%	1.4%	1.9%	5.0%	8.8%	3.6%	16.1%	1.6%	6.1%	16.7%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	1,660,685	1.0%	2.7%	0.0%	2.9%	1.3%	6.3%	0.0%	2.3%	0.0%	0.0%	0.0%
		Open	149,659,821	90.8%	95.4%	98.1%	92.1%	70.5%	89.3%	51.0%	89.9%	93.9%	0.0%	99.6%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
Habitat Alternative 6	sctrawl	Open	13,428,565	8.2%	1.9%	1.9%	5.0%	28.2%	4.4%	49.0%	7.8%	6.1%	100.0%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	841,505	0.5%	1.8%	0.0%	1.4%	1.4%	2.1%	2.9%	0.5%	0.0%	0.0%	0.0%
		Open	150,479,001	91.3%	96.3%	98.1%	93.6%	70.4%	93.5%	48.1%	91.7%	93.9%	0.0%	99.6%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
Habitat Alternative 7	sctrawl	Closed	1,543,471	0.9%	1.8%	1.9%	3.9%	24.7%	3.5%	45.3%	6.4%	6.1%	100.0%	0.4%
		Open	11,885,094	7.2%	0.1%	0.0%	1.0%	3.5%	0.9%	3.7%	1.4%	0.0%	0.0%	0.0%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	32,276,407	19.6%	15.7%	70.3%	24.5%	33.7%	34.6%	6.5%	17.6%	0.0%	0.0%	3.2%
		Open	119,044,099	72.3%	82.5%	27.8%	70.5%	38.1%	61.0%	44.5%	74.6%	93.9%	0.0%	96.4%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
Habitat Alternative 8a	sctrawl	Open	13,428,565	8.2%	1.9%	1.9%	5.0%	28.2%	4.4%	49.0%	7.8%	6.1%	100.0%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	123,875	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	2.5%	0.0%	0.0%	0.0%	0.0%
		Open	151,196,631	91.8%	98.1%	98.1%	94.9%	71.8%	95.6%	48.5%	92.2%	93.9%	0.0%	99.6%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
Habitat Alternative 8b	sctrawl	Open	13,428,565	8.2%	1.9%	1.9%	5.0%	28.2%	4.4%	49.0%	7.8%	6.1%	100.0%	0.4%

	Gear	Area status	Prorated scallop landings (lbs.)	Percent	Cod	Haddock	Winter Flounder	American Plaice	Witch Flounder	Windowpane flounder	Yellowtail Flounder	Pollock	Redfish	White Hake
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	4,031,436	2.4%	19.0%	0.0%	9.4%	3.9%	2.1%	4.7%	1.1%	0.0%	0.0%	0.0%
		Open	147,289,070	89.4%	79.1%	98.1%	85.7%	67.9%	93.5%	46.3%	91.1%	93.9%	0.0%	99.6%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**
Habitat Alternative 9	sctrawl	Closed	9,815	0.0%	0.0%	0.0%	0.0%	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Open	13,418,750	8.1%	1.9%	1.9%	4.9%	26.6%	4.4%	49.0%	7.8%	6.1%	100.0%	0.4%
	sctrawl Total		**13,428,565**	**8.2%**	**1.9%**	**1.9%**	**5.0%**	**28.2%**	**4.4%**	**49.0%**	**7.8%**	**6.1%**	**100.0%**	**0.4%**
	sdredge	Closed	13,148,166	8.0%	2.8%	0.3%	11.3%	16.3%	12.1%	12.9%	25.9%	0.0%	0.0%	0.0%
		Open	138,172,340	83.9%	95.3%	97.8%	83.8%	55.6%	83.5%	38.1%	66.3%	93.9%	0.0%	99.6%
	sdredge Total		**151,320,506**	**91.8%**	**98.1%**	**98.1%**	**95.0%**	**71.8%**	**95.6%**	**51.0%**	**92.2%**	**93.9%**	**0.0%**	**99.6%**

Table 241. **Summary of the retrospective impact on total scallop and incidental finfish landings in 1995-2001, assuming the various habitat alternatives would have been implemented. Data are from vessel trip reports with valid latitude and longitude positions, raised to total landings by port group, gear, and month of landing.**

	Gear	Area status	White Hake	Small Mesh species	Skates	Squid	Herring & Mackerel	Scup	Black Sea Bass	Fluke	Surf clam & Ocean quahog	Shrimp	Monkfish	Dogfish	Lobster	Tuna
Habitat Alternative 1 (SQ;NA)	sctrawl	Closed	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Open	0.4%	35.2%	3.6%	19.3%	10.4%	5.6%	65.7%	49.8%	0.0%	43.2%	1.6%	42.6%	9.7%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	0.0%	2.3%	10.8%	1.5%	14.0%	2.0%	0.1%	0.0%	0.0%	5.1%	0.0%	5.4%	20.1%
		Open	99.6%	64.8%	94.0%	69.9%	88.1%	80.3%	32.3%	50.1%	100.0%	56.8%	93.2%	57.4%	84.9%	69.3%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
GF Mortality Alternative 1	sctrawl	Closed	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.5%	0.1%	0.0%
		Open	0.4%	35.0%	3.7%	19.3%	10.4%	5.6%	65.7%	49.8%	0.0%	43.2%	1.7%	38.1%	9.6%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.1%	33.5%	6.7%	22.2%	4.6%	14.0%	2.6%	0.2%	0.0%	2.6%	13.6%	0.0%	21.7%	10.3%
		Open	99.5%	31.3%	89.6%	58.5%	85.0%	80.3%	31.7%	50.0%	100.0%	54.2%	84.8%	57.4%	68.6%	79.1%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
Habitat Alternative 3a	sctrawl	Open	0.4%	35.2%	3.7%	19.3%	10.4%	5.6%	65.7%	49.8%	0.0%	43.2%	1.7%	42.6%	9.7%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	0.0%	4.8%	0.0%	0.0%	7.3%	0.5%	0.2%	0.0%	0.0%	13.4%	0.0%	16.5%	7.6%
		Open	99.6%	64.8%	91.5%	80.7%	89.6%	87.1%	33.8%	50.0%	100.0%	56.8%	85.0%	57.4%	73.9%	81.8%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
Habitat Alternative 3b	sctrawl	Open	0.4%	35.2%	3.7%	19.3%	10.4%	5.6%	65.7%	49.8%	0.0%	43.2%	1.7%	42.6%	9.7%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	0.0%	4.9%	0.0%	0.0%	7.3%	0.5%	0.2%	0.0%	0.0%	13.4%	0.0%	16.5%	7.6%
		Open	99.6%	64.8%	91.4%	80.7%	89.6%	87.1%	33.8%	50.0%	100.0%	56.8%	84.9%	57.4%	73.9%	81.8%

	Gear	Area status	White Hake	Small Mesh species	Skates	Squid	Herring & Mackerel	Scup	Black Sea Bass	Fluke	Surf clam & Ocean quahog	Shrimp	Monkfish	Dogfish	Lobster	Tuna
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
Habitat Alternative 4	sctrawl	Open	0.4%	35.2%	3.7%	19.3%	10.4%	5.6%	65.7%	49.8%	0.0%	43.2%	1.7%	42.6%	9.7%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	0.0%	3.5%	0.0%	0.0%	7.3%	0.5%	0.1%	0.0%	0.0%	6.5%	0.0%	7.4%	0.0%
		Open	99.6%	64.8%	92.8%	80.7%	89.6%	87.1%	33.8%	50.1%	100.0%	56.8%	91.8%	57.4%	82.9%	89.4%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
Habitat Alternative 5a	sctrawl	Closed	0.0%	29.6%	0.1%	0.3%	10.2%	0.9%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
		Open	0.4%	5.6%	3.7%	19.0%	0.2%	4.8%	65.0%	49.8%	0.0%	43.2%	1.7%	42.6%	9.6%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	0.0%	5.2%	1.0%	0.0%	0.0%	0.8%	0.7%	0.9%	0.4%	1.9%	0.0%	3.7%	22.3%
		Open	99.6%	64.8%	91.1%	79.7%	89.6%	94.4%	33.6%	49.5%	99.1%	56.4%	96.4%	57.4%	86.6%	67.1%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
Habitat Alternative 5b	sctrawl	Closed	0.0%	0.3%	0.0%	0.0%	0.0%	0.1%	0.3%	0.0%	0.0%	0.0%	0.1%	0.0%	1.1%	0.0%
		Open	0.4%	35.0%	3.7%	19.3%	10.4%	5.6%	65.3%	49.8%	0.0%	43.2%	1.5%	42.6%	8.6%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	23.3%	6.2%	6.9%	4.2%	50.1%	1.6%	2.9%	0.0%	28.4%	13.2%	21.3%	15.5%	21.5%
		Open	99.6%	41.5%	90.1%	73.8%	85.3%	44.3%	32.7%	47.2%	100.0%	28.4%	85.1%	36.1%	74.8%	67.9%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
Habitat Alternative 5c	sctrawl	Closed	0.0%	29.3%	0.1%	0.3%	10.2%	0.9%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
		Open	0.4%	5.9%	3.7%	19.0%	0.2%	4.8%	65.0%	49.8%	0.0%	43.2%	1.7%	42.6%	9.6%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	7.6%	5.2%	1.0%	0.0%	0.0%	0.8%	0.7%	0.0%	0.8%	1.8%	0.0%	3.6%	32.6%
		Open	99.6%	57.1%	91.0%	79.7%	89.6%	94.4%	33.6%	49.5%	100.0%	56.0%	96.5%	57.4%	86.7%	56.8%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
Habitat Alternative 5d	sctrawl	Closed	0.0%	0.3%	0.0%	0.1%	0.0%	0.0%	0.0%	4.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

	Gear	Area status	White Hake	Small Mesh species	Skates	Squid	Herring & Mackerel	Scup	Black Sea Bass	Fluke	Surf clam & Ocean quahog	Shrimp	Monkfish	Dogfish	Lobster	Tuna
		Open	0.4%	35.0%	3.7%	19.2%	10.4%	5.6%	65.7%	45.1%	0.0%	43.2%	1.7%	42.6%	9.7%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	0.0%	0.6%	0.8%	0.0%	2.0%	0.0%	0.1%	0.0%	0.4%	2.6%	0.0%	2.6%	32.6%
		Open	99.6%	64.8%	95.7%	79.9%	89.6%	92.4%	34.3%	50.1%	100.0%	56.4%	95.8%	57.4%	87.7%	56.8%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
Habitat Alternative 6	sctrawl	Open	0.4%	35.2%	3.7%	19.3%	10.4%	5.6%	65.7%	49.8%	0.0%	43.2%	1.7%	42.6%	9.7%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.0%	0.3%	0.0%
		Open	99.6%	64.8%	96.2%	80.7%	89.6%	94.4%	34.3%	50.2%	100.0%	56.8%	97.8%	57.4%	90.0%	89.4%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
Habitat Alternative 7	sctrawl	Closed	0.4%	30.5%	3.4%	10.5%	10.4%	1.2%	11.3%	29.6%	0.0%	34.7%	0.3%	12.2%	2.7%	0.0%
		Open	0.0%	4.7%	0.3%	8.8%	0.0%	4.5%	54.3%	20.2%	0.0%	8.5%	1.3%	30.4%	7.0%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	3.2%	33.6%	14.5%	30.6%	10.4%	58.8%	4.4%	7.6%	99.8%	39.1%	24.2%	21.3%	22.9%	21.5%
		Open	96.4%	31.2%	81.8%	50.0%	79.1%	35.5%	29.9%	42.6%	0.2%	17.8%	74.2%	36.1%	67.4%	67.9%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
Habitat Alternative 8a	sctrawl	Open	0.4%	35.2%	3.7%	19.3%	10.4%	5.6%	65.7%	49.8%	0.0%	43.2%	1.7%	42.6%	9.7%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Open	99.6%	64.8%	96.3%	80.7%	89.6%	94.4%	34.3%	50.2%	100.0%	56.8%	98.3%	57.4%	90.3%	89.4%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**
Habitat Alternative 8b	sctrawl	Open	0.4%	35.2%	3.7%	19.3%	10.4%	5.6%	65.7%	49.8%	0.0%	43.2%	1.7%	42.6%	9.7%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	0.0%	1.3%	0.0%	0.0%	0.0%	0.5%	0.1%	0.0%	0.0%	2.8%	0.0%	5.1%	0.0%
		Open	99.6%	64.8%	95.0%	80.7%	89.6%	94.4%	33.8%	50.1%	100.0%	56.8%	95.6%	57.4%	85.2%	89.4%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**

	Gear	Area status	White Hake	Small Mesh species	Skates	Squid	Herring & Mackerel	Scup	Black Sea Bass	Fluke	Surf clam & Ocean quahog	Shrimp	Monkfish	Dogfish	Lobster	Tuna
Habitat Alternative 9	sctrawl	Closed	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Open	0.4%	35.2%	3.6%	19.3%	10.4%	5.6%	65.7%	49.8%	0.0%	43.2%	1.6%	42.6%	9.7%	10.6%
	sctrawl Total		**0.4%**	**35.2%**	**3.7%**	**19.3%**	**10.4%**	**5.6%**	**65.7%**	**49.8%**	**0.0%**	**43.2%**	**1.7%**	**42.6%**	**9.7%**	**10.6%**
	sdredge	Closed	0.0%	0.0%	2.3%	10.8%	1.5%	14.0%	2.0%	0.1%	0.0%	0.0%	5.2%	0.0%	5.5%	20.1%
		Open	99.6%	64.8%	94.0%	69.9%	88.1%	80.3%	32.3%	50.1%	100.0%	56.8%	93.1%	57.4%	84.8%	69.3%
	sdredge Total		**99.6%**	**64.8%**	**96.3%**	**80.7%**	**89.6%**	**94.4%**	**34.3%**	**50.2%**	**100.0%**	**56.8%**	**98.3%**	**57.4%**	**90.3%**	**89.4%**

8.5.5 Evaluation of Habitat Impacts of Scallop Management Measures under Consideration

The following metrics are used qualitatively and quantitatively in the habitat impacts analysis of the proposed management measures in Amendment 10.

8.5.5.1 Changes in fishing effort: Days-at-sea

There are a number of factors that will affect the speed and degree of habitat recovery in areas where bottom tending mobile gear use is reduced. These include: 1) the degree, duration, and extent of fishing in the area; 2) any other anthropogenic sources of habitat disturbance (e.g., contamination of bottom sediments in coastal waters); 3) the natural disturbance regime (e.g., frequency and intensity of storms, bottom currents, etc.); 4) the type of substrate or sediment; 5) depth; 6) the type of benthic organisms that inhabit the area; and 7) the length of time that the area remains undisturbed by fishing. Improvements in habitat quality would most likely occur in areas where trawling and dredging activity was minimal to begin with and is totally eliminated, or substantially reduced; in deeper, low-energy locations not exposed to storm events or strong bottom currents; in hard-bottom areas (in shallow or deep water) that support prolific growth of large, attached epifauna, or in other bottom habitat types that provide food and cover for demersal fish; and in areas populated by benthic organisms that grow faster and reproduce quickly. For some benthic environments that have been altered by fishing activity, complete recovery could take years. For others, recovery might only take a few months. If reductions in bottom trawling activity in marginal areas are temporary and increase after a year or two as stock abundance increases, habitat recovery in certain areas may never be complete.

A useful conceptual model for understanding the relationship between changes in fishing effort and the degree of habitat modification is described in the National Research Council report on trawling and dredging effects (NRC 2002). Starting from zero fishing effort with no habitat impact, a change in fishing effort will change the degree of habitat modification, but as effort continues to increase habitat alteration reaches its maximum point and levels off even as effort continues to increase. For heavily modified habitats exposed to high levels of fishing activity, effort must be reduced substantially before any improvement in habitat quality is realized. Although there is much uncertainty regarding the relationship between fishing effort and habitat alteration at low effort levels, it is probably not linear as depicted in NRC 2002. A more realistic relationship, at least for certain habitats exposed to mobile bottom-tending gear, is curvilinear since the first few tows in an undisturbed habitat would be expected to produce the greatest relative change in habitat conditions (e.g. three-dimensional structure), with reduced effects as fishing effort increases to the point of maximum habitat modification. In this scenario, reductions in effort would have to be even more severe (approaching zero effort) in order to achieve, say, a 50% habitat recovery.

Most of the available studies of gear effects for mobile gear types used in the Northeast region examine the effects of single or multiple tows in previously fished or un-fished locations within some defined time period, with control plots in nearby undisturbed locations. There are a few studies that compare benthic communities or physical habitat features in areas exposed historically to different levels of fishing effort. One of them (Frid et al. 1999) compared periods of low, medium, and high otter trawling activity at two sites in the North Sea over a 27-year period. At the heavily-fished, mud-bottom, site, benthic organisms that were predicted to increase as fishing effort did increase in abundance, but organisms that were expected to decrease in abundance did not. At the lightly-fished, sand-bottom site, there was a correlation with primary production, but no correlation with fishing effort. In a similar study, Kaiser et al. (2000b) compared benthic communities exposed to high, medium, and low fishing intensity by otter trawls, beam trawls, toothed scallop dredges, and lobster pots in the English Channel (sand substrate) and found no significant effects of increased effort on the numbers of benthic organisms or species, but did find reductions in the abundance of larger, less mobile, emergent epifauna and increased abundance of more mobile invertebrate species, fewer larger organisms, and more smaller organisms in high effort areas. Two factors that complicate this kind of research are the effects of different habitat conditions (e.g., depth, sediment type) that may exist at low and high-effort sites, and temporal changes in environmental conditions (e.g., changes in sediment composition or water temperatures) that occur over the time period being investigated.

More direct evidence of the effects of changes in bottom fishing effort is provided by studies that relate progressive increases in disturbance to changes in benthic community structure and seafloor topography and sediment composition. Jennings et al. (2001) documented effects of increasing beam trawling activity on sand and muddy sand-bottom communities in the North Sea. Thrush et al. (1998) did the same for 18 stations (mud and sand bottom) in Hauraki Gulf, New Zealand, that were fished at varying levels of effort by otter trawls, Danish seines, and toothed scallop dredges. Unfortunately, these studies examine the combined effects of a number of gear types, including toothed scallop dredges and beam trawls, that are not used in the Northeast region of the U.S. Nevertheless, a number of significant impacts to benthic communities are identified which can probably, to some extent, be generalized to dredging and otter trawling on similar habitat types in the Northeast region. These included decreased infaunal and epifaunal biomass (North Sea), decreased densities of large epifauna, echinoderms, and long-lived surface dwellers, and increased densities of small, opportunistic species (New Zealand).

There are three experimental studies of the habitat effects of increasing otter trawling effort in commercially un-exploited areas. Two of these were performed in mud-bottom habitats, one in Sweden (Hansson et al. 2000) and the other in Scotland (Tuck et al. 1998). Another (Moran and Stephenson 2000) was conducted in Australia on sandy substrate. In the Swedish study, two tows were made per week for a year in an area closed to fishing for six years. During the last six months of the experiment, 61% of the infaunal species were negatively affected (i.e., they decreased more or increased less in the trawled sites compared to the control sites), and there were significant reductions in brittle stars (compared to a control area), but not in polychaetes, amphipods, or mollusks. In the Scottish study, multiple tows were made during a single day for 16 consecutive months in an area closed to fishing for more than 25 years. Increased bottom trawling produced door tracks, increased bottom roughness, but had no effect on sediment composition. There were significant increases in the number of infaunal species after 16 months of disturbance, but no changes in biomass or total number of individuals; community structure, however, was altered after five months and community diversity declined six months after trawling ceased. Effects on species groups varied: polychaetes increased in abundance while bivalves decreased in abundance five months after trawling began. In the Australian study, four tows made at 2-day intervals on the same area of bottom. Underwater video surveys showed that the first tow reduced the density of large (>20 cm) benthic organisms by 15% and four tows by 50%. Sainsbury et al. (1997), working in the same general area, reported that a single pass of a trawl footrope removed 89% of sponges larger than 15 cm.

Although there is some information (summarized above) that documents habitat modifications that result from increasing fishing effort by mobile bottom-tending gear, there is no corresponding evidence of the effects of progressive reductions in fishing effort on benthic marine habitats. There are, however, a number of studies that document the recovery of benthic habitats following the cessation of bottom fishing. These have been performed in areas that have been closed to various types of fishing activity, mostly by mobile bottom-tending gear. Tuck et al. (1998) monitored the recovery of a mud-bottom benthic habitat for 18 months in a closed area in Scotland after 16 months of bottom trawling and found that door tracks were still visible after 18 months, and that the infaunal community had recovered completely within the same period. This is the only directed study of recovery from simulated commercial trawling activity that has been conducted. Other observations have been made by a number of authors who have monitored the recovery of benthic habitats from single trawl or dredge tows, or following multiple tows in a single day (see section 9.3.2). Kenchington et al. (2001) did note that infaunal organisms that were reduced in abundance during one of three years of experimental fishing in a closed area on the Grand Banks had recovered by the time experimental fishing resumed a year later and Schwinghamer et al. (1998), working on the same project, noted that door tracks lasted up to a year and seafloor topography recovered within a year's time. Sainsbury et al. (1997) compared historical survey data – collected before and after commercial fishing started – to data collected in an area in Australia that remained open to trawling and another area that was closed for five years and reported increased catch rates of fish associated with large epifauna and small benthic epifaunal organisms (but not large ones) within the five-year period.

8.5.5.2 Changes in fishing effort: Area swept

The amount of sea bottom disturbed by scallop fishing depends on two factors: the amount of fishing effort and the geographic concentration of that effort. Although the lasting effects of scallop fishing on sea bottom communities and its relationship to the ecosystem require more research, the amount and distribution of that effort can be examined in much more detail than previously possible.

There are two sources of data with which to conduct an area swept analysis: day-at-sea use and VMS reports. The first source can provide a crude estimate of total area swept, as if it were laid out like a blanket (i.e. individual tows lying end-to-end and side-by-side). Applying a few simple assumptions yields a maximum estimate of the total sea floor bottom that might be disturbed by fishing. The second data source comes from the VMS units, required on nearly all limited access scallop vessels, which allow a finer estimate of actual fishing time and the potential for modeling overlapping fishing areas. These two data sources are used to hind cast approximations of swept area, based on the following assumptions.

Total dredge width is assumed to be 31 feet. Vessels are required to use dredges no more than two 15-foot dredges. The extra foot accounts for the edges of the dredge that could come into contact with the sea floor. In actuality, the average is less than this because some vessels use two 13-foot dredges and others use a single 10.5 foot dredge. Another consideration is that some of the day-at-sea use is by scallop trawl vessels that have much wider sweeps, but believed to have less impact per square foot swept by the gear.

Another assumption is that vessels fish at 4.5 knots. In actuality some vessels fish slower than this, depending on the vessel's horsepower, the size of the dredges, currents, and bottom conditions. A third factor is the amount of time fishermen has the gear on deck to haul back and dump the catch. In this exercise, the assumption is that the vessels had gear on the bottom for 22 hours per day, or approximately five minutes for haul-back, dumping the catch, and resetting the gear for an hour long tow. This assumption is probably too high for historical data, and is almost certainly too high under current conditions, but it is a conservative assumption and will overestimate the total area swept.

Processing time will increase as catches rise, because the crew cannot shuck enough scallops to keep up with the catches in the dredges. Under this condition, vessels temporarily stop fishing to maximize their shucking production. This factor is estimated in the forecast projections.

A fourth factor to take into account is the days-at-sea used to steam to the fishing grounds from port and back. This time is estimated to be roughly 3 days for an average 15-day trip, or roughly 20% of the fishing time (NEFMC 2001, Rago et al. 2000). To factor this in, 20% of a 24-hour day (4.8 hours) is subtracted from the estimated gear bottom time of 22 hours, leaving an average of 17.2 hours fishing per day. VMS-based estimates do not employ this correction, as fishing time is computed using VMS positional data.

Area swept calculations are not intended to provide meaningful data with regard to the actual impacts of fishing upon EFH. For example, it does not account for the impacts of the “first pass” of a scallop dredge vs. subsequent scallop dredge passes on a given area of the bottom. Similar to the DAS discussion above (Section 8.5.5.1), the habitat types affected and their sensitivity and recovery times are critical to understanding actual impacts on habitat, as are the effects of individual dredge or trawl tows on entire fishing grounds. At this time there is not enough information available on habitat sensitivity and recovery times to quantify impacts based upon the swept area calculation. What it can show, however, is a relative amount of area potentially impacted by scallop fishing in aggregate.

Table 242. Backcast swept area calculations based on DAS utilized from 1990-1999.

Year	Days At Sea	Hours Fished (total- 17.2 hr fishing day)	Area Swept (sqft X 10^9- 31 ft dredge width)	Area Swept (nm^2)
90	41191	708485.2	600.5	16,266.0
91	42122	724498.4	614.1	16,633.7
92	42670	733924	622.1	16,850.1
93	34469	592866.8	502.5	13,611.5
94	28223	485435.6	411.5	11,145.0
95	28446	489271.2	414.7	11,233.1
96	29730	511356	433.4	11,740.1
97	29532	507950.4	430.5	11,662.0
98	25441	437585.2	370.1	10,046.5
99	24720	425184	360.4	9,761.7

This analysis estimates total area swept, as if no scallop fishing tows overlap and is simply an estimate of total bottom contact time, a product of days fished and fishing time per day (which is affected by the crew shucking capacity). It does not take into account the distribution of that effort or where it occurs, because the necessary data for that type of analysis is only available from VMS monitoring since 1998. A more detailed analysis of this is given in Section 8.5.7.2.1.1 and the total area swept by the fishery is estimated in one nautical mile square blocks, which are characterized by their association with underlying sediment maps and with EFH designations. The area swept or footprint of the fishery is about ¼ to ½ of the total area swept calculations using the method in this section.

8.5.5.3 Changes in fishing effort: Vessel trip report data

VTR data is used throughout the habitat analysis to establish baseline levels of otter trawl and clam dredge intensity. In areas where Amendment 10 management measures will influence the frequency and intensity of scallop vessel effort, but not prohibit fishing effort by other gear types, it is important to understand the potential magnitude of the impacts of otter trawls on traditional scalloping bottom and scallop EFH.

The dataset includes all trips not reported to occur on land or in waters outside of the Northwest Atlantic. Spatial data errors such as reporting the latitude and longitude of a vessel’s homeport (instead of fishing area), reporting inaccurate positions, and data entry errors are assumed to be random and, due to the large sample size, are not likely to bias the magnitude and direction of these data. However, at the individual trip level high levels of inaccuracy have been noted. Additionally, the VTR data format requires vessel captains to chose one latitude/longitude or, more commonly, set of loran TD lines (time delay lines) to summarize an entire multi-day fishing trip. Therefore, the area reported may or may not be a close approximation of the area in which the majority of a fishing trip has occurred. No formal studies have been conducted to determine the extent of any inaccuracies within this data set.

8.5.6 Practicability Analysis

The legal EFH provisions state that each FMP shall identify and "minimize to the extent practicable adverse effects on such habitat caused by fishing…" In this context "practicable" was interpreted to man "reasonable and capable of being done in light of available technology and economic considerations."

The EFH regulations at 50 CFR 600.815(a)(2)(iii) provide guidance on evaluating the practicability of management measures:

> *"In evaluating the practicability of the identified habitat management measures, Council should consider the nature and extent of the adverse effect on EFH and the long and short-term costs and benefits of potential management measures to EFH, associated fisheries and the nation consistent with national standard 7. In determining whether management measures are practicable, Councils are not required to perform a formal cost/benefit analysis."*

A practicability analysis of EFH measures in a fisheries management plan is supposed to weigh the economic and social costs (and benefits) against the benefits to habitat of EFH protections. However, the ecological costs and benefits (of taking or not taking action) are substantially harder to evaluate. In essence, the benefits of specific actions to protect or restore habitat are not all readily quantifiable in the same units as the costs (dollars). It is therefore very difficult to make direct quantitative comparisons and hence give specific quantified answers to questions of practicability. This is in part due to uncertainty in the direct effects of fishing gears on habitat function and the lack of information on the relationships between habitat function and the productivity of managed and non-managed species. This uncertainty and lack of information is both a consequence of and exacerbated by the complexities of the ecological relationships and processes involved.

8.5.6.1 Assessing Practicability

There is no preferred methodology for conducting the practicability analysis. Therefore, the Habitat Technical Team and members of the Scallop PDT have worked together to combine habitat, economic, and social analysis of the habitat alternatives to determine their overall practicability. The habitat closed area alternatives have been analyzed in a more quantitative fashion by incorporating habitat, economic, and social information described in earlier sections of the document. The non-closed area habitat alternatives are analyzed in a more qualitative manner. This analysis synthesizes some of the conclusions from the habitat analysis, the socio-economic impact analysis, the biological and ecological impacts, as well as issues such as compliance with National Standards or MSA in general that are described in other parts of the document.

Specific practicability factors relevant to the EFH Final rule requirements were used to determine if each action is reasonable and capable of being done in light of available technology and economic considerations, and will not impose unreasonable burdens on the fishing industry. Four primary components have been extracted from the full analysis to assess the practicability of the habitat management alternatives.

Table 243. **Description of four primary analytical components used to determine practicability.**

Practicability Factor	Relevance to 50 CFR 600.815(a)(2(iii)	Description
Net economic change to fishery	The long and short-term costs and benefits of potential management measures to **associated fisheries and the nation**	Industry-level impacts to scallop, groundfish, monkfish and other fisheries
Equity of potential costs among communities	The long and short-term costs and benefits of potential management measures to **fishing communities**	Short-term impacts on coastal subregions
Differences in EFH Value	The nature and extent of the adverse impact on EFH and the long and short-term costs and benefits of potential management measures to **EFH (direct impacts)**	Directionality of change in amount and type of area, vulnerable or adversely impacted EFH and complex sediment types
Population effects and ecosystem changes	The long and short-term costs and benefits of potential management measures to **EFH (indirect impacts)**	Directionality of change in amount and type of important species guilds and species assemblages as indicated by analysis

8.5.6.2 Assessing Practicability with Limited Information

According to information included and evaluated in this document (see Gear Effects Evaluation, Vulnerability of EFH to Bottom-Tending Fishing Gears, and Adverse Impact Determination Sections), there is some understanding in the Northeast U.S. that a relationship exists between the type and intensity of fishing and effects on habitat. For some species, there is also some understanding of the links between exploited populations and habitat in terms of ecological functions. However, there is little or no understanding of how habitat degradation (past, present and future) affects the productivity of managed species populations. According to a provisional framework outlined in Auster (2001), it would seem that the types of management measures needed for preventing, mitigating, or minimizing adverse effects of fishing on EFH are a mixture of preventative and corrective measures and the precautionary approach. The types of actions the author suggests be taken under each of these approaches are as follows:

Preventative approach: restrict effort or gear or use no-take marine protected areas (MPAs) to minimize effects of particular gear types on particular habitats.

Corrective approach: Adjust boundaries or change management measures on the basis of data on habitat recovery and links to population dynamics.

Precautionary approach: Designate no-take MPAs to protect long-lived and sensitive species in areas that do or potentially contain such taxa.

The Council will be considering similar issues and approaches in the upcoming Omnibus Habitat Amendment #2. Additionally, the Council's MPA Committee will be developing a policy and approach to MPAs for the Council's consideration in the near future.

8.5.6.3 Results

8.5.6.3.1 Area Closure-Based Alternatives

This analysis synthesizes some of the conclusions from the habitat analysis, the socio-economic impact analysis, the biological and ecological impacts, as well as issues such as compliance with National Standards or MSA in general that are described in other parts of the document. Six primary components have been pulled out of the full analysis. This information will feed into the analysis of the Practicability Factors.

8.5.6.3.1.1 Net Economic Change to Fishery

The retrospective impact on yield was analyzed in Section 8.5.4.14.2 by including the percent of effort, landings, and revenues that would have been affected by habitat closed area alternatives as compared to historic scallop distribution and area management policies. A projected impact on yield was included to analyze the overall landings that are projected to be harvested if the habitat closed areas are implemented with the Preferred Area Access Alternative 1 (Section 8.2.6). A projected impact on producer surplus was performed (Section 8.7.4.5) to estimate the gross profit (un-adjusted for fixed costs) for the entire scallop fleet if the habitat closed areas are implemented combined with all four access alternatives. Net benefits were estimated to assess the overall impact to the nation (a summation of total producer surplus and consumer surplus).

Retrospective Yield Evaluation

Analyzing the retrospective yield that would have been generated from the habitat closed area alternatives is one way to evaluate the potential effort, landings, and revenues that have been generated from these areas in the recent past. Section 8.5.4.14.2 provides a detailed description of the retrospective yield analysis.

Percent of <u>Effort</u> Potentially Impacted

Table 244 and Figure 133 summarize the retrospective impact on yield based on effort. Simply averaging the percentages over time is misleading because management measures have been implemented over the years that have prevented access into portions of areas or entire alternatives. The effort data has to be based on 1998-2000 because those are the years after VMS was required. Keep in mind that this could be misleading because during these years scallop vessels were restricted from fishing in some of the areas. Therefore, the shifts in effort are heavily dependent on changes to management measures. Overall, Alternatives 1, 3a, 3b, and 9 contained more effort on average in recent years than most of the other habitat closed area alternatives.

Table 244. Percent of Retrospective Effort potentially impacted by each of the habitat closed area alternatives, assuming that the alternatives had been implemented at that time

	1998	1999	2000	Average 98-00
No Action	1.40	17.67	13.91	**10.99**
3a	16.84	9.71	12.80	**13.12**
3b	16.84	9.71	12.80	**13.12**
4	10.03	5.46	9.55	**8.35**
5a	2.11	0.88	0.62	**1.20**

	1998	1999	2000	Average 98-00
5b	10.37	9.11	0.75	**6.74**
5c	2.32	0.95	0.36	**1.21**
5d	2.18	0.63	0.52	**1.11**
6	0.90	0.56	14.24	**5.23**
7	12.17	12.95	0.09	**8.40**
8a	0.28	0.11	1.74	**0.71**
8b	4.86	2.60	13.92	**7.13**
9	1.48	17.69	15.79	**11.65**

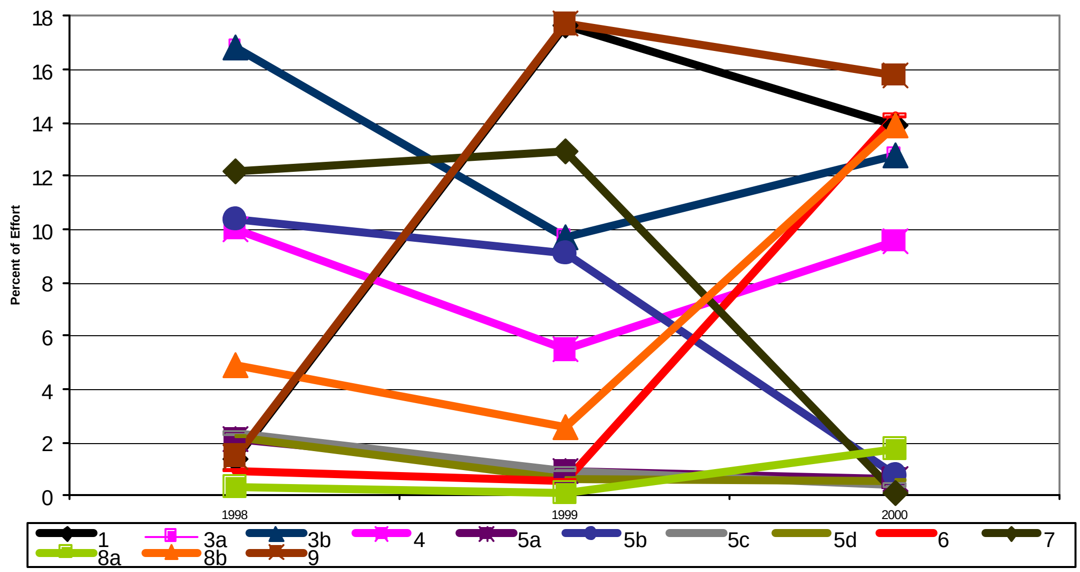


Figure 133. **Retrospective impact on total scallop effort by alternative in 1995-2001, assuming that the alternative had been implemented at that time.**

Percent of Landings Potentially Impacted

Table 245 and Figure 134 summarize the retrospective impact on yield based on landings. Simply averaging the percentages over time is misleading so the table and figure below highlight the changes each year. Overall, Alternatives 3a, 3b, 5b, and 7 contained the most landings on average from 1995 to 2001. Once again, trends in landings are heavily dependent on other management measures. The same data could be presented for years before the implementation of the groundfish closures, but the status of the stock was much different prior to 1995 in most areas.

Table 245. Percent of Retrospective Landings potentially impacted by each of the habitat closed area alternatives, assuming that the alternatives had been implemented at that time.

	1995	1996	1997	1998	1999	2000	2001	Average 95-01
No Action	0.3	0.6	1.3	0.8	27.5	17.3	2.6	**7.2**
3a	6.8	10.2	14.5	17.6	11.0	16.2	7.3	**11.9**
3b	6.8	10.2	14.5	17.6	11.0	16.2	7.3	**11.9**
4	4.7	7.0	10.1	10.9	6.0	13.0	3.7	**7.9**
5a	1.0	2.0	2.6	1.7	0.8	0.1	1.3	**1.4**

	1995	1996	1997	1998	1999	2000	2001	Average 95-01
5b	13.6	15.4	17.8	8.9	7.1	8.0	11.1	**11.7**
5c	1.0	1.9	2.3	1.5	0.8	0.2	1.3	**1.3**
5d	1.0	1.8	2.6	1.8	0.4	0.1	0.9	**1.2**
6	0.2	0.5	1.0	0.6	0.7	0.5	0.4	**0.6**
7	26.1	27.2	29.8	19.3	17.6	15.8	17.6	**21.9**
8a	0.0	0.0	0.0	0.0	Conf	Conf	Conf	**0.0**
8b	3.5	3.1	4.5	5.2	2.8	1.4	1.0	**3.1**
9	0.3	0.6	1.3	0.8	27.5	17.3	2.6	**7.2**

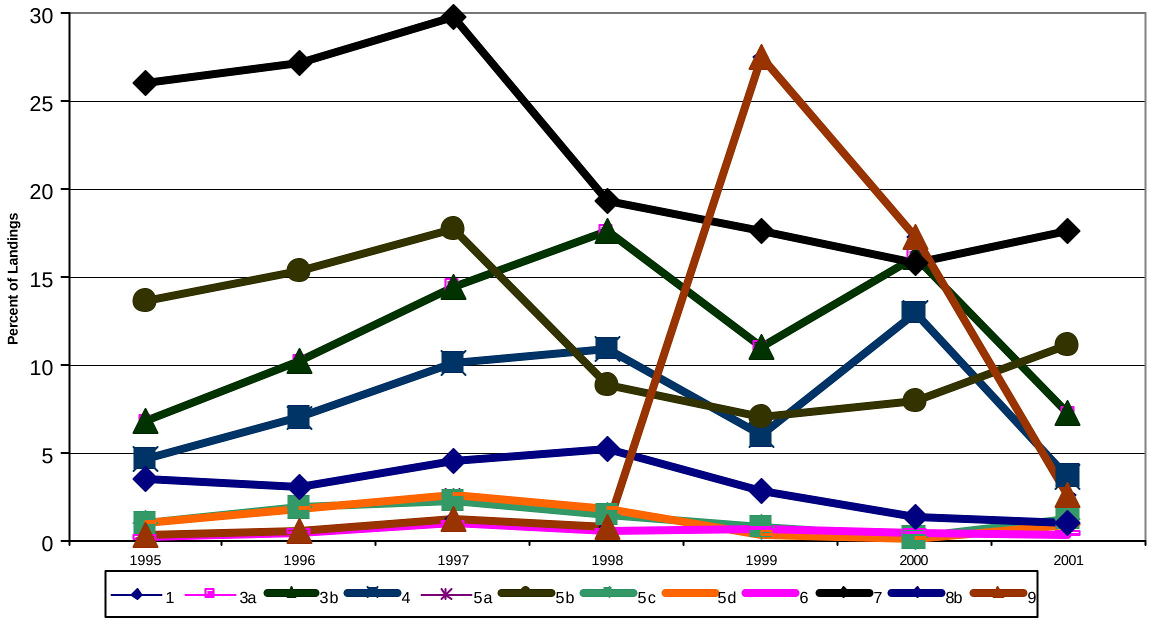


Figure 134. **Retrospective impact on total scallop landings by alternative in 1995-2001 (assuming that the alternative had been implemented at that time).**

Percent of <u>Revenues</u> Potentially Impacted

Table 246 and Figure 135 summarize the retrospective impact on yield based on revenues. Simply averaging the percentages over time is misleading so the table and figure below highlight the changes each year. For example, the percentages of revenues that have been generated from areas within Alternatives 1, 4, and 9 increased dramatically starting in 1998 because of the Georges Bank controlled access program implemented through Framework 11. Overall, Alternatives 3a, 3b, 5b, and 7 have contained the greatest amount of revenues on average compared to the other alternatives.

Table 246. Percent of Retrospective Revenues potentially impacted by each of the habitat closed area alternatives, assuming that the alternatives had been implemented at that time

	1995	1996	1997	1998	1999	2000	2001	Average 95-01
No Action	0.3	0.6	1.3	0.8	29.4	19.4	2.7	**7.8**
3a	7.7	10.9	14.9	17.9	11.6	18.0	7.4	**12.6**
3b	7.8	10.9	15.0	18.0	11.5	18.0	7.4	**12.7**

	1995	1996	1997	1998	1999	2000	2001	Average 95-01
4	5.5	7.4	10.5	11.1	6.5	14.7	3.7	**8.5**
5a	1.1	2.2	2.6	1.8	0.8	0.2	1.2	**1.4**
5b	13.5	15.9	18.0	9.0	7.2	8.3	10.5	**11.8**
5c	1.1	2.1	2.3	1.5	0.8	0.3	1.3	**1.3**
5d	1.1	2.1	2.6	1.8	0.4	0.1	0.9	**1.3**
6	0.3	0.5	1.0	0.6	0.8	0.5	0.4	**0.6**
7	26.8	28.4	30.2	19.7	18.1	16.6	17.4	**22.5**
8a	0.0	0.0	0.0	0.0	Conf.	Conf.	Conf.	**Conf.**
8b	4.2	3.3	4.7	5.4	2.9	1.5	0.9	**3.3**
9	0.4	0.6	1.3	0.8	29.4	19.4	2.7	**7.8**

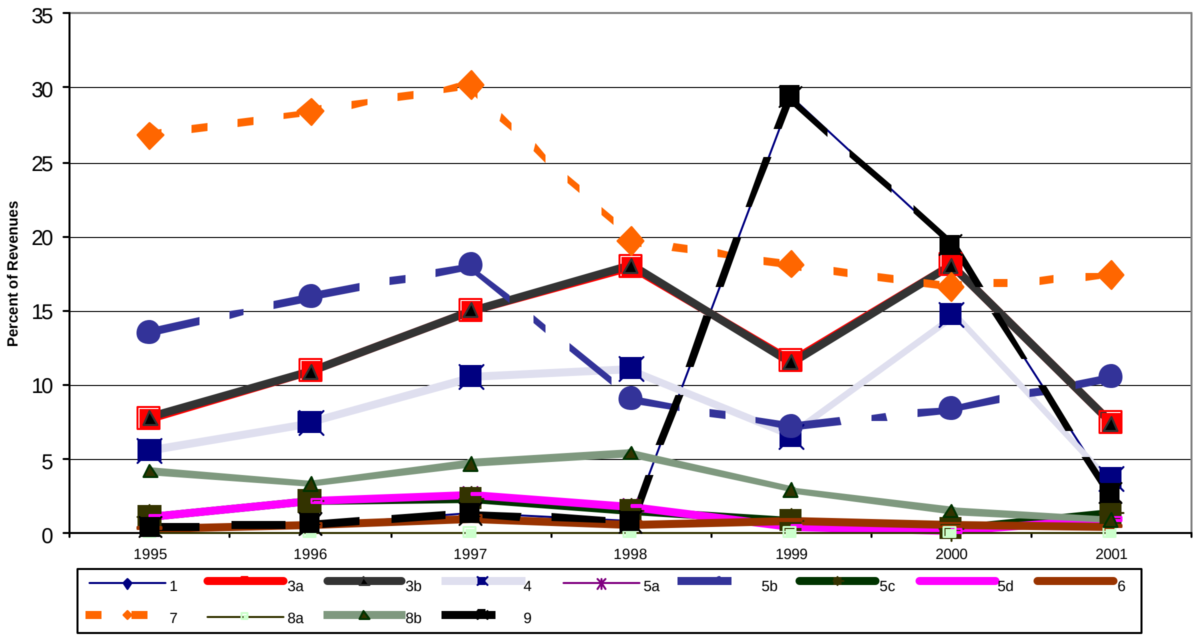


Figure 135. **Retrospective impact on total scallop revenue by alternative in 1995-2001, assuming that the alternative had been implemented at that time.**

Projected Yield Evaluation (Landings for 2004-2007)

In contrast to the retrospective analysis just described, Table 247 reports the net influence of the various habitat alternatives on the Council's preferred scallop management alternative as projected for the years 2004-2007. The last row in the table shows outcomes for the preferred alternative before taking into account the impacts of habitat measures. These values are subtracted from the options which combine the preferred alternative with each habitat alternative to show the impact of the alternative. For example, average annual landings under the preferred alternative for scallop fishery management is 43 million pounds. In contrast, when combined with Habitat Closure Alternative 3a, landings are projected to average 41 million pounds a year during 2004-2007, a net loss of 2 million pounds.

Habitat Closure Alternatives 7 (-9 million pounds) and, especially, 9 (-14 million pounds) and 1 (-17 million pounds) should have the greatest impact on landings in the short-term if these areas provide no access to the scallop fleet. Not surprisingly, these alternatives also encompass the greatest amounts of both juvenile scallop EFH and EFH for species with vulnerable EFH. The remaining alternatives reduce landings by less than 10% compared to the preferred alternative with no habitat alternative combined. Of particular interest are Habitat Closure Alternatives 3a, 3b, and 4, which encompass nearly 10% of the juvenile scallop EFH and 4-5% of the managed species EFH at a cost of only two million pounds of scallop landings.

Projected Producer Surplus (2004-2007)

The results for producer surplus are similar to landings. (Although not technically precise, producer surplus can be thought of as gross profit, i.e. revenues minus operating costs (fixed costs are not subtracted.)) Habitat Closure Alternatives 1 (assuming no access) and 9 are projected to cost industry nearly $100 million (nearly 20%) over the four years compared to the Council's preferred alternative for scallop fishery management with no habitat alternatives (not an annual average). The producer surplus for Alternative 7 would be reduced more than a $40 million over the next four years, and all other alternatives are predicted to reduce producer surplus by $12 million or less.

Projected Net Benefits to the Nation (2004-2007)

Total net economic benefits combine producer surplus with the effect of prices on consumers, i.e., consumer surplus. Once again, Habitat Closure Alternatives 1 and 9 have the greatest impact with losses approaching $250 million over 2004-2007, but in this case losses amount to about a third of the net benefits of the preferred alternative due to the large impact on consumers. Remember that this analysis assumes that Alternative 1 would not provide access into the existing groundfish closed areas. Losses from other habitat alternatives range from $5 million (alternatives 5a, 5c, 5d) to $49 million (alternative 5b) and $131 million (alternative 7) over the next four years.

Table 247. Summary of economic benefits and costs associated with closure alternatives.

Alt.	Retrospective Yield			Projected Yield (2004-2007)		Projected Producer Surplus (2004-2007)		Projected Net Benefits	
	Average % of Total Effort (98-00)	Average % of Total Landings (95-01)	Average % of Total Revenues (95-01)	Average Landings for Alternative 2 (million lbs.)	Projected yield as compared to Alternative 2	Cumulative Discounted Producer Surplus Alternative 2 (million $)	Projected PS as compared to Alternative 2	Cumulative Discounted Net Benefits for Alternative 2 PS+CS (million $)	Projected Net Benefits as compared to Alternative 2
No Action	10.99	7.2	7.8	26	-17	407	-98	522	-246
3a	13.12	11.9	12.6	41	-2	494	-11	735	-33
3b	13.12	11.9	12.7	41	-2	494	-11	735	-33
4	8.35	7.9	8.5	41	-2	494	-11	735	-33
5a	1.2	1.4	1.4	42	-1	504	-1	763	-5
5b	6.74	11.7	11.8	39	-4	493	-12	719	-49
5c	1.21	1.3	1.3	42	-1	504	-1	763	-5
5d	1.11	1.2	1.3	42	-1	504	-1	763	-5
6	5.23	0.6	0.6	40	-3	497	-8	736	-32
7	8.4	21.9	22.5	34	-9	463	-42	637	-131

Alt.	Retrospective Yield			Projected Yield (2004-2007)		Projected Producer Surplus (2004-2007)		Projected Net Benefits	
	Average % of Total Effort (98-00)	Average % of Total Landings (95-01)	Average % of Total Revenues (95-01)	Average Landings for Alternative 2 (million lbs.)	Projected yield as compared to Alternative 2	Cumulative Discounted Producer Surplus Alternative 2 (million $)	Projected PS as compared to Alternative 2	Cumulative Discounted Net Benefits for Alternative 2 PS+CS (million $)	Projected Net Benefits as compared to Alternative 2
8a	0.71	0	Conf.	42	-1	504	-1	736	-32
8b	7.13	3.1	3.3	42	-1	503	-2	758	-10
9	11.65	7.2	7.8	29	-14	407	-98	522	-246
No Action with No Access	N/A	N/A	N/A	22		365		446	
SQ with No Access	N/A	N/A	N/A	30		432		577	
Area Access Alt.1	N/A	N/A	N/A	43		505		768	

8.5.6.3.1.2 Equity of Potential Costs Among Communities

An indicator for social impacts by port will be summarized to analyze the variation of impacts across all affected ports. The synthesis of all these components, coupled with additional detail from other sections of the analysis and input from public comment will help determine the overall practicability of implementing each of the habitat closed area alternatives.

There are numerous ways to describe the potential social impacts of closed areas on ports, fishing communities etc. The overall practicability analysis has incorporated a coefficient of variance to indicate whether the potential impacts of closed areas on a community are evenly distributed throughout the entire region. For a detailed description of how this coefficient of variance indicator is determined and a summary of the overall social impacts of the alternatives refer to Section 8.8.4.1. In general, the higher the value, the more “unequal” the social impacts are distributed. Therefore, Alternative 8a has the greatest “risk” of unequal social impacts based on this analysis (Table 248). The majority of the habitat alternatives seem to have a similar value for distribution of impacts, except Alternative 7,which had a low risk of unequal social impacts because this alternative proposes to close areas throughout the range.

The overall practicability analysis focused on the relative distribution of gross sales impacts by sub-region to give an indication of how the impacts would be distributed in different regions. The gross sales impacts measures the total losses associated with a reduction in harvest landings on all industries impacted by fishing in the region (processing, transportation, etc.). The general trends of revenue impacts from each proposed alternative are described for each region (Table 247). It is very clear from this analysis that the New Bedford Area is expected to bear the majority of revenue losses for all of the alternatives, although some alternatives have a less disproportionate impact on New Bedford and other Massachusetts ports than others (See Section 8.8.4.1).

Table 248. Summary of social benefits and costs associated with each closure alternative.

Alt.	**Community Impacts** Coefficient of Variance as a measure of distribution of impacts
No Action	3.18
3a	3.43
3b	3.44
4	3.53
5a	3.89
5b	2.79
5c	3.55
5d	4.2
6	4.61
7	1.03
8a	10.55
8b	5.25
9	3.17

8.5.6.3.1.3 Differences in EFH Value

Three primary components have been incorporated in the overall habitat evaluation portion of the practicability analysis: 1) size of closed areas, 2) EFH value, and 3) amount of rocky substrate. The size/overlap component includes the area of each alternative in square nautical miles, and the percent of each alternative that occurs inside the existing groundfish closed areas. The EFH component includes per-unit-area EFH values for all species with M/H vulnerable and with only H vulnerable EFH. The substrate component of the practicability analysis includes the amount of bedrock and "gravel" (in square nautical miles) contained in each area. These two substrate types best represent "hard-bottom" habitats, which are structurally more complex and support the growth of emergent epifauna. The "gravel" substrate classification includes pebbles, cobbles, and boulders.

The area closure options range from about 150 to 65,000 square nautical miles in size (Table 249). Alternative 7 is the largest proposed closed area. The habitat closed area alternatives contain from 0.4% to 71.7% of the percent-of-total EFH values for all species with M/H vulnerable EFH. Alternative 6 contains the highest amount of total EFH for both categories. Alternatives 6, 7, and 9 contain the highest percent of EFH for all species with moderately and highly vulnerable EFH, as well as the highest percent of EFH for all species with highly vulnerable EFH. The substrate component, however, demonstrates a large disparity among the alternatives, with 3(a), 3(b), 4, 6 and 7 containing rockier substrate than the others.

Table 249. Percent of total EFH area inside each alternative for species with EFH moderately and highly vulnerable to bottom tending gear, and species with EFH highly vulnerable to bottom tending gear.

Alternative	Size of Closures	Vulnerable EFH for All Species	Highly Vulnerable EFH	Rocky Substrate
	Area closed in square nautical miles	Percent of total EFH contained in each area for all species with "highly and moderately vulnerable" EFH	Percent of EFH Area for Species with Highly Vulnerable EFH Only	Total amount of Bedrock and "Gravel" enclosed by each alternative (measured in nm^2)
No Action	5853	11.2%	10.6%	106
3(a)	2913	6.1%	6.5%	196
3(b)	2821	5.9%	6.2%	196
4	2241	5.0%	5.2%	154
5(a)	3032	6.4%	6.8%	21
5(b)	3073	6.6%	6.5%	15
5(c)	3022	6.7%	6.9%	32
5(d)	3098	5.4%	5.7%	38
6	4041	7.9%	7.6%	92
7	65,503	71.7%	69.7%	542
8a	186	0.4%	0.5%	0
8b	732	1.5%	1.7%	35
9	6254	12.1%	11.5%	129

Table 250 summarizes the effectiveness of the various closure options based upon the amount (summed area) of designated EFH they contain relative to their size. It makes sense that the larger alternatives contain more EFH because of their size; therefore the amount of EFH (in square nautical miles) was also divided by the area of each alternative (in square nautical miles) to give a measure of the relative effectiveness of each closure, in terms of EFH contained in each alternative. According to the relative effectiveness values, Alternatives 4, 5c and 8a are the most effective in protecting all adversely impacted species and life stages, while Alternative 8a is the most effective in protecting the highly vulnerable species and life stages. When looking specifically at protecting juvenile or scallop EFH, alternatives 3a, 3b 7 and 9 are the most effective. These data are provided for informational purposes. Because scallop EFH is not adversely affected by bottom-tending gear, therefore, alternatives to minimize adverse effects are not necessary. See Section 8.5.2 for a detailed description of the EFH benefits of each alternative.

Table 250. Relative Effectiveness of Habitat Closed Area Alternatives in Protecting EFH for Two Categories of Species and Life Stages

Alternatives	Species with EFH Medium/Highly Vulnerable	Species with EFH Highly Vulnerable Only	Juvenile or Adult Scallop EFH ***
	Sum*	Sum*	
NoAction	15.8	4.4	0.30
3a	17.3	5.3	0.21
3b	17.2	5.3	0.21
4	18.4	5.6	0.18
5a	17.4	5.2	0.01
5b	17.6	4.9	0.16
5c	18.3	5.2	0.01
5d	14.3	4.1	0.03
6**	16.0	4.4	0.11
7	9.0	2.6	0.25
8a	18.6	6.4	0.03
8b	17.4	5.7	0.08
9	15.9	4.4	0.30

**Values are EFH area (in square nautical miles) per 100 square nautical miles in each closed area summed for all moderately and highly vulnerable species and life stages, for only the highly vulnerable species and life stages, and for juvenile and adult scallop EFH..*

*** Proposed measures*

**** The relative effectiveness of each alternative in protecting juvenile or adult Scallop EFH has been included for information only since this is a Scallop action; the EFH of this species has not been deemed vulnerable to bottom tending gear for any life stages.*

8.5.6.3.1.4 Population Effects and Ecosystem Changes

Distribution of biomass by type of trophic guild and species assemblage

The EFH Final Rule stipulates that fishery management measures be evaluated in terms of their direct and indirect effects on essential fish habitat, or the direct and indirect benefits of proposed habitat protection measures in meeting the provision of the Magnuson-Stevens Act to minimize the effects of fishing on EFH. The previous section of this Practicability Analysis considered the more direct benefits of the ten proposed habitat closure alternatives on EFH. This section evaluates the indirect benefits or ecosystem effects of these closures on EFH by examining the fish communities that occupy them (Section 8.5.2).

Bottom-feeding fish accounted for most of the total biomass in all the proposed closed areas and would therefore benefit the most from management measures that minimize the adverse impacts of fishing on EFH (see Table 251). This result confirms the importance of habitat closures that protect benthic invertebrate prey populations, which are the food source for benthic-feeding fishes. Fish that feed exclusively on other bottom feeders and on plankton were more abundant in the four Alternative 5a, 5d and 7 options. Species and sizes of fish that feed on shrimp and smaller fish are highest in Alternative 6 but are also important components of the fish fauna in Alternatives 3a, 3b, 4 and 7.

Principal groundfish species (cod, haddock, redfish, pollock, two species of hake, and five species of flounder) accounted for a greater proportion of the finfish biomass in alternatives 3a, 3b and 4 but were also important components of the fauna in proposed closures 6, 8a, 8b and 9. These species made up a relatively small percentage of the fish biomass in the Alternatives 5a-d. A large group (many species) of demersal (bottom-dwelling) finfish species accounted for about 50% of the fish biomass in all the alternatives.

These results indicate that habitat closed areas would be practicable as management measures to protect assemblages of bottom-feeding and bottom-dwelling finfish, especially alternatives 3a, 3b, 4 and 6. Fish populations in the four Alternative 5 closures were ecologically more diverse and included pelagic as well as demersal species.

Table 251. Percent composition of total biomass (summed mean wt/tow by ten minute squares of latitude and longitude) within each proposed habitat closed area for three trophic guilds and two species assemblages during 1995-2001.

Alt.	Trophic Guilds[89]			Species Assemblages[90]	
	Bottom Feeders	Amphipod Feeders	Shrimp & Fish Eaters	Principle Groundfish	Demersal Finfish
No Action	38%	17%	19%	16%	49%
3(a)	42%	11%	24%	22%	49%
3(b)	42%	11%	23%	21%	49%
4	43%	11%	23%	22%	49%
5(a)	26%	14%	17%	11%	47%
5(b)	33%	14%	6%	9%	47%
5(c)	32%	15%	9%	11%	47%
5(d)	28%	8%	12%	11%	45%
6[91]	36%	14%	26%	15%	49%
7	24%	6%	23%	10%	49%
8a	46%	16%	2%	15%	49%
8b	43%	19%	2%	17%	50%
9	36%	16%	24%	17%	49%

8.5.6.3.2 Non-Area Closure-Based Alternatives

The practicability analysis of the non-closure habitat alternatives is qualitative in nature. Overall the practicability of these alternatives is described in Table 252. After public comment the practicability analysis of these alternatives will be completed.

Table 252. Assessment of non-closed area habitat alternatives based on habitat benefits and social and economic costs of the measures.

Alternative	Assessment of non closed area habitat alternatives based on habitat benefits and social and economic costs of the measures
2	Neutral
10	Neutral to slightly negative
11	Slightly positive

[89] *Two guilds and three assemblages not shown.*
[90] *Two guilds and three assemblages not shown.*
[91] Proposed measure

Alternative	Assessment of non closed area habitat alternatives based on habitat benefits and social and economic costs of the measures
12	Negative
13	N/A

8.5.6.4 Overall Discussion of Practicability

The impacts of other habitat alternatives compared to the Status Quo and No Action would be sizeable, but not as large as the comparison to Alternatives 2, 11 and 12.

8.5.6.4.1 Alternative 1 (Section 5.3.4.1)

Net economic change to fishery / Equity of potential costs among communities

Although the status quo alternative does seem to contain some EFH in the region, it may not be the most effective way to protect habitat. However, this alternative does not require additional regulatory burden on the fishing community since the same measures would be in place as in fishing year 2001. It is not expected that the industry or fishing dependent communities would be impacted in any additional way from the status quo habitat alternative. In fact, this alternative may be more practical than some of the other habitat alternatives because less ocean bottom would be closed, causing potentially less social and economic consequences. This alternative may be practical in the short term in terms of implementation, but may be less practical in the long term in regards to effectiveness of habitat protection.

Based on the results of the overall practicability analysis, Alternative 1 contains a significant amount of EFH and retrospective yield of sea scallops. When this alternative is combined with the Preferred Alternative (Area Access Alternative 1), the projected loss of landings, producer surplus, and Net benefits are significantly more than the other alternatives. This is important because the analysis assumes no access in any of the areas, which has not been the case for the last several years. According to the community impacts analysis, the distribution of impacts on fishing communities are relatively the same as the other habitat alternatives.

Differences in EFH Value / Population effects and ecosystem changes

Based on analysis from the habitat metric approach, habitat benefits are derived from the status quo measures primarily in the form of large year round area closures. It is important to keep in mind that the analysis assumed that no access would be granted to the scallop fleet into the groundfish closed areas. If some gears were permitted into the closures under the Status Quo/ No Action alternative, then the habitat benefits would be reduced. The status quo alternative does seem to contain some EFH, but not as effectively as many of the other habitat closed area options. Although the biomass and EFH of many species are most likely contained within these areas, when the overall sum is scaled for area, the habitat "strength" of this alternative is reduced.

This alternative does not minimize the adverse impacts of the scallop fishery on EFH. Therefore, the Council has determined that this alternative is not practicable.

8.5.6.4.2 Alternative 2 (Section 5.3.4.2; also proposed action in Section 5.1.6.1)

Net economic change to fishery / Equity of potential costs among communities

This alternative appends no further costs to industry or management beyond those required of the management measure in question.

Differences in EFH Value / Population effects and ecosystem changes

Alternative 2 includes the habitat protection components inherent in the non-habitat protection alternative and the Council has determined that the non-habitat alternatives chosen for implementation in Amendment 10 will help to minimize adverse effects on EFH to the extent practicable.

Summary

The Council selected to implement Habitat Alternative 2 (a preferred alternative in the DSEIS). The Council discussed the practicability of the alternatives to minimize adverse effects of fishing on EFH and concluded that Habitat Alternative 2, which relies on the habitat benefits derived from the other Amendment 10 measures to meets the SFA mandate, was practicable.

Alternative 2 is clearly practicable. The Council discussed the idea that the area swept reductions seen under the analysis bolster the argument for Alternative 2. Although not as high a reduction as under the proposed overfishing definition, the analysis shows some reduction in area swept under status quo overfishing definition.

8.5.6.4.3 Alternative 3 (Section 5.3.4.3)

Net economic change to fishery / Equity of potential costs among communities

Closing more area for fishing will most likely negatively impact the industry. Based on the results of the overall practicability analysis, these two alternatives contain a significant amount of retrospective yield. The distributions of impacts on fishing communities are relatively the same as the other habitat alternatives. Both the groundfish and other fishery revenue losses are significant for these alternatives, assuming no displacement. These alternatives may be less beneficial in the short term because they require additional closures, which could be a regulatory burden and additional cost to the industry.

Differences in EFH Value / Population effects and ecosystem changes

Alternative 3 contains modifications of the boundaries of existing groundfish closed areas. According to the overall habitat metric analysis, alternative 3a and 3b rank relatively high. Compared to the other habitat closed area alternatives, these closures seem to contain a variety of habitat types, EFH, and biomass of defined guilds and aggregations.

Habitat Alternative 3a and 3b are areas intended to protect more complex and sensitive bottom, therefore these closures may be more practicable from an ecological and biological standpoint for habitat protection. Furthermore, the majority of these areas are enclosed in existing year-round closures, so the additional closures may not be as burdensome on the industry as closing entirely new areas. However, this alternative does close more ocean bottom to fishing, so there may be economic losses for vessels that have less fishing opportunities, especially id these additional areas are critical ones. Overall, both alternatives 3a and 3b are beneficial from a habitat standpoint because they add significantly more sensitive habitat protection from relatively small additional closures. More bedrock, gravel, and gravelly sand are contained under these alternatives. Furthermore, over 75% of Alternative 3(a) and 3(b) contain juvenile cod and haddock EFH, which are important species to protect because of their high vulnerability and reliance on complex bottom.

Summary

Alternative 3 includes the closure of the Great South Channel, which is impracticable due to the dramatic social and economic impacts. Further, the equity of impacts is uneven and is focused mainly in the New Bedford, MA port. Due to the significant revenue losses to the scallop fishery, the groundfish fishery and other fisheries, the Council has determined that this alternative is not practicable.

8.5.6.4.4 Alternative 4 (Section 5.3.4.4)

Net economic change to fishery / Equity of potential costs among communities

Closing more ocean bottom to fishing does impact the industry and this needs to be considered when determining the practicality of implementing this alternative. This alternative contains a significant amount of retrospective yield, but less than Alternatives 3a and 3b. The distribution of impacts on fishing communities is relatively the same as the other habitat alternatives. The potential revenue losses are also slightly less that Alternatives 3a and 3b. This alternative may be less beneficial in the short term because it requires additional areas to be closed, which could be a regulatory burden and additional cost to the industry.

Differences in EFH Value / Population effects and ecosystem changes

Alternative 4 contains a significant amount of sensitive habitat and EFH. Alternative 4 may also have long-term habitat benefits for reasons explained under Alternative 3; both alternatives add closed bottom in close proximity to existing closed areas. Habitat Alternative 4 ranked relatively high in all the habitat metric components except for Aggregation. This scenario consistently seems to contain more sediment types, EFH, and biomass of defined species according to the habitat metric analysis. About 18% of gravelly sand in the Northwest Atlantic analysis area is contained under this alternative as well as over 25% of gravel. Furthermore, several key species have high percentages of EFH contained within this closure. For example, 76% of the area has juvenile cod EFH within the boundaries, 43% has juvenile halibut EFH, 59% has juvenile Pollock EFH, and 85% of the area contains EFH for red fish.

Summary

Alternative 4 was deemed impracticable because it is inconsistent with the rotational management areas as they overlap the boundaries of Alternative 4. The Council expressed concern of implementing an area-based rotational management scheme with these areas closed as habitat closures. Due to the significant revenue losses to the scallop fishery, the groundfish fishery and other fisheries, the Council has determined that this alternative is not practicable.

8.5.6.4.5 Alternative 5 (Section 5.3.4.5)

Net economic change to fishery / Equity of potential costs among communities

From a regulatory standpoint, this alternative may present some issues because there are several alternatives that close areas in the Mid-Atlantic bight, which may not be necessary to protect New England species. Furthermore, these areas are high-energy sand environments that recover rapidly from impacts. Additionally, the Mid-Atlantic Council has determined that it is not necessary to implement year-round closures in the Mid-Atlantic bight to protect species managed by the Mid-Atlantic. Qualitatively speaking, the costs associated to the industry for closing these additional areas outweighs the habitat benefits associated with closing these areas. Compared to Alternatives 5a, 5c, and 5d, Alternative 5b generates greater losses in projected yield, producer surplus, and Net benefits when combined with the Preferred Alternative. Furthermore, Alternative 5b generates greater potential losses in groundfish, scallop, and "other fishery" revenues if those areas were closed. On the other hand, Alternatives 5a and 5b contain areas that would cause more revenue losses for the Monkfish fishery, assuming no displacement.

Differences in EFH Value / Population effects and ecosystem changes

When the alternatives are scaled for area, the habitat benefits generated from the four scenarios under alternative 5 are reduced because these alternatives close more ocean bottom than most of the other habitat alternatives. There was significant variety between the results of these alternatives in the overall habitat metric analysis. For example, Alternative 5c ranked first in the EFH component, and almost last in the Guild component.

As stand-alone alternatives, these four alternatives contain less complex bottom (bedrock and gravel). Since impacts to this type of habitat has been shown to be of the highest concern (NEEFHSC 2002, NRC 2002) and the stocks of many species that depend on these habitats are overfished, this is considered one habitat type that is very important to protect. Alternatives 5a-5d contained less EFH than some of the other alternatives, however Alternative 5b does contain a significant amount of juvenile scallop EFH.

Summary

Alternative 5 was thought to be impracticable due to the inequity of social and economic impacts in the ports of Provincetown, MA, Chatham, MA, and Gloucester,MA. Due to the significant revenue losses to the scallop fishery, the groundfish fishery and other fisheries, the Council has determined that this alternative is not practicable.

8.5.6.4.6 Alternative 6 (Section 5.3.4.6; also proposed action in Section 5.1.6.2)

Net economic change to fishery / Equity of potential costs among communities

This alternative is completely contained within existing closed areas, thus would not require closing any new areas. Based on the overall practicability analysis, this alternative negative effects the projected yield, producer surplus, and net benefits. When combined with the Preferred alternative, this habitat alternative generates slightly more losses in projected yield, producer surplus, and net benefits than most of the other habitat alternatives. This is the only alternative that does not have significant revenue losses for the groundfish, monkfish, scallop, or "other fishery" categories. This is intuitive since most of this area was not accessible to these fisheries in 2001. This alternative may be beneficial in the short term in terms of implementation, but may be less practical in the long term in regards to effectiveness of habitat protection. It is impracticable to eliminate all future access to these areas by scallop dredge gear and not to other gears that adversely effect EFH.

Differences in EFH Value / Population effects and ecosystem changes

Habitat Alternative 6 includes the access areas from the Controlled Area Access Program in Framework 13 for scallops. This alternative closes more ocean than most of the other stand-alone habitat closed area alternatives. However, under Alternative 6 habitat closures are entirely contained within the existing year round groundfish closed areas. According to the sediment metric analysis, this alternative contains a significant amount of gravel and gravelly sand, but still not as much as Alternative 4 or 3. Based on the overall practicability analysis, this alternative does not score as well in the EFH components. According to the overall habitat metric analysis, this alternative ranks very high for the guild and aggregate component.

This alternative will help to minimize the adverse impacts of the scallop fishery on EFH. Additionally, because it closes areas that are already within existing groundfish closed areas only and allows for the potential access of Framework 13 scallop areas, Alternative 6 will not incur as high a burden on the fishery. Therefore, the Council has determined that this alternative is practicable.

Summary

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

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

The Council determined that Habitat Alternative 6 is practicable and selected to implement this alternative in Amendment 10 for the following reasons:

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

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

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

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

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

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

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

8.5.6.4.7 Alternative 7 (Section 5.3.4.7)

Net economic change to fishery / Equity of potential costs among communities

Based on the overall practicability analysis, this alternative seems to generate significant losses to the industry and the nation. The distributions of impacts are distributed relatively evenly, but the benefits to habitat probably do not outweigh the costs since other gear types will be permitted in these areas.

Differences in EFH Value / Population effects and ecosystem changes

Habitat Alternative 7 proposes to close the majority of the Northwest Atlantic to scallop dredge gear only. Although this alternative provides significant protection for most species that are vulnerable to dredge gear, other bottom tending gears will still be permitted in these areas, thus compromising the overall habitat benefits. Therefore, the potential habitat benefits from this large area will not provide effective EFH protection for species with vulnerable EFH in the region.

Summary

Alternative 7 is impracticable because it includes a tremendous amount of the EEZ, which is largely comprised of sandy sediment. These areas do not experience scallop dredging and don't warrant protection. Due to the significant revenue losses and the failure of this alternative to minimize adverse impacts to EFH, the Council has determined that this alternative is not practicable.

8.5.6.4.8 Alternative 8 (Section 5.3.4.8)

Net economic change to fishery / Equity of potential costs among communities

Based on the overall practicability analysis, these alternatives do not score very high in terms of projected net benefits to the nation when compared to other habitat alternatives that potentially protect EFH.

Differences in EFH Value / Population effects and ecosystem changes

These areas are too small to provide sufficient protection for essential fish habitat. Both Alternative 8a and 8b may be too small to provide sufficient habitat protection. The potential habitat benefits from these small areas will not provide enough EFH protection for species with vulnerable EFH in the region. Furthermore, alternative 8a permits other gear types to fish within the area, which will compromise the potential habitat benefits from closing the area to scallop dredging.

Summary

Alternative 8 is impracticable due to the concern with implementing either of these closure alternatives only to scallop gear was noted. The Council acknowledges that closing these areas to scallop dredging will lead to some habitat benefit. However, since otter trawling will still be able to occur in this area, the habitat benefit will be greatly reduced. This alternative does not minimize the adverse impacts of the scallop fishery on EFH. Therefore, the Council has determined that this alternative is not practicable.

8.5.6.4.9 Alternative 9 (Section 5.3.4.9)

Net economic change to fishery / Equity of potential costs among communities

Based on the overall practicability analysis, this alternative does contain a significant amount of total EFH for species with EFH vulnerable to bottom tending gear, but the economic costs to society and the industry are higher than most of the other alternatives.

Differences in EFH Value / Population effects and ecosystem changes

Alternative 9 implements the groundfish mortality closed areas that were in place during the fishing year 2001 as habitat closures, with the addition of the Cashes Ledge closure as a year-round closures. Closing Cashes Ledge year-round may increase the habitat benefits of this alternative versus the no action alternative, but this area does not seem to provide more habitat benefit than the No action alternative (assuming no access). According to the overall habitat metric analysis, this alternative did rank slightly higher than the no action alternative in all components (excluding the aggregate component). This alternative may be practical in the short term in terms of implementation, but may be less beneficial in the long term in regards to effectiveness of habitat protections.

Summary

Alternative 9 was not practicable because it included the Framework 13 Access Areas as habitat closures. The Council believes that not allowing access to these areas is be impracticable due to the high costs that are associated with lack of access to scallops, compared to the benefits that might accrue from closing the parts of the groundfish closed areas that had been previously open for scallop fishing. Due to the significant revenue losses and the failure of this alternative to minimize adverse impacts to EFH, the Council has determined that this alternative is not practicable.

8.5.6.4.10 Alternative 10 (Section 5.3.4.10)

Net economic change to fishery / Equity of potential costs among communities

Alternative 10 may place an economic burden on industry that is disproportionate with anticipated positive impacts on habitat.

Differences in EFH Value / Population effects and ecosystem changes

Analysis concludes that this alternative may not yield the benefits intended; specifically, this alternative may not decrease fishable bottom for the scallop fishery. Furthermore, there may be serious safety concerns by the elimination or modification of rock chains, which further decrease the practicability of this alternative.

Summary

Scallop vessels using dredges often use rock chains in some areas to deflect large rocks, boulders, and other debris. It prevents damage to fishing gear, handling problems at the surface and on deck, improves safety at sea, and reduces bycatch mortality due to crushing. On the other hand, the use of rock chains allows vessels to fish in more rugged areas, having complex habitats. Controlling the use of rock chains has the potential to reduce fishing in these areas having more sensitive and vulnerable habitats. Therefore, this alternative does not minimize the adverse impacts of the scallop fishery on EFH and it places an economic cost to the industry that is not commensurate with its habitat benefits. The Council has determined that this alternative is not practicable.

8.5.6.4.11 Alternative 11 (Section 5.3.4.11; also proposed action in Section 5.1.6.3)

Net economic change to fishery / Equity of potential costs among communities

This alternative proposes to increase the dredge ring size to 4 inches throughout the range of the fishery. New requirements would be phased in to allow time for manufacturers to produce the larger dredge rings and fisherman to fit them to their gear. Short-term costs associated with the first option include potentially reduced yields. Both options have long-term benefits to industry through increased productivity and revenues.

Differences in EFH Value / Population effects and ecosystem changes

The impacts of increasing dredge ring size to 4 inches are positive to EFH. It has been observed that the bycatch of benthic organisms such as finfish, sponges, crabs, and starfish is reduced in dredges with larger rings. Reduced damage and mortality of bottom dwelling species enhances biodiversity and reduces the impact of dredging on benthic community structure. As the average size of scallops throughout the range of the fishery increases, the area swept will decrease.

Summary

Scallop research indicates that gear efficiency for a dredge outfitted with 4" rings increases by 10-15 percent for scallops over 110 mm. Particularly in areas having predominately large scallops, like a re-opened controlled access scallop rotation area, this measure will decrease bottom contact time to take the same number of scallops and achieve the fishing mortality targets. This result can help reduce habitat benefits, particularly when it reduces the 'footprint' of the fishing activity by reducing effort in areas that are fished infrequently. Four-inch dredge rings appear to be more efficient harvesters of larger (110+ mm) scallops, and long-term projections indicate that the effect will be to also improve scallop yield by about 4 to 5%. As a result of the combined effect of improving scallop yield (i.e. the fleet catching larger sea scallops) and dredge efficiency for large scallops, long-term projection indicate an reduction in area swept by 14%. Because of the long-term benefits to the industry through increased productivity and revenues and the ability to minimize adverse effects of scallop fishing on EFH from the 4-inch ring size, this alternative has been determined to be practicable.

8.5.6.4.12 Alternative 12 (Section 5.3.4.12; also proposed action in Section 5.1.6.4)

Net economic change to fishery / Equity of potential costs among communities

So far as the TAC set-aside is an approved feature of management, use of these funds for habitat research imposes no additional regulatory costs.

Differences in EFH Value / Population effects and ecosystem changes

This alternative proposes funding from the TAC set-aside for habitat research, which may benefit EFH protection in the future.

Summary

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

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

8.5.6.4.13 Alternative 13

This alternative would integrate habitat management with area rotation. The concept is outlined and described in Section 5.3.2.7, one of the scallop area rotation alternatives. Under the alternatives, the frequency, duration, and intensity of scallop fishing in rotation management areas would be modified to minimize adverse habitat impacts. Although the concept and structure of this alternative is described in Section 5.3.2.7, specific criteria for controlling the frequency, duration, and intensity of scallop fishing have not been defined. Therefore, it is impossible to assess the social, economic and habitat costs and benefits.

Summary

Habitat impacts could vary with the frequency, duration, and intensity of scallop fishing. For example, rotation management area closures could reduce overall habitat impacts by allowing time for a more complete habitat recovery after a period of fishing. Some benthic species take longer to recolonize the bottom and restore ecological structure than it takes for scallops to grow from juveniles to an optimum size for harvest as adults. On the other hand, scallop yield loss from waiting too long to fish is small for a slightly longer closure (an additional 3-5 years, for example), but could have measureable benefits to the ecosystem. Over a longer period, the annual scallop yield loss (because scallops don't migrate) would approach the natural mortality rate, or about 20 percent per year. Very long rotation management area closures would also increase the risk of episodic, widespread scallop mortality from thermal stress or predation. Thus, habitat impacts from scallop fishing might be addressed through adjustments in area rotation strategies rather than long-term, indefinite closures described in other habitat alternatives in this section. However, because the area based management with area-specific fishing mortality targets without formal rotation (Section 5.3.2.7) was not selected for implementation in Amendment 10, it is not practicable to implement Alternative 13 at this time.

8.5.7 Environmental Consequences of Proposed Scallop Management Alternatives

8.5.7.1 No Action and Status Quo Alternatives

8.5.7.1.1 No Action Alternative

The No Action Alternative continues the provisions set forth in Amendment 7 to the Atlantic sea scallop FMP. These include DAS reductions of up to 70% by fishing year 2005 and the re-opening of the Hudson Canyon and VA/NC Areas to regular scallop fishing. The year-round groundfish closed areas continue to be closed to scallop vessels under the No Action Alternative.

DAS Reductions

Reductions in DAS may have a significant impact on benthic habitats, scallop EFH and other species' EFH. The impacts of DAS reductions on habitat, in general terms, are discussed below.

The reductions DAS and bottom contact time that would result from the no-action alternative would be substantial (Table 253). It is expected, in certain circumstances, that a 70% reduction in bottom contact time will have beneficial effects on benthic marine habitats in the Northeast region by reducing the adverse effects of fishing that are identified in this document.

The primary gear to consider in evaluating the habitat benefits of reduced days-at-sea in this fishery is the scallop dredge. Scallop dredges account for the majority of the landings in the fishery and, along with bottom trawls, have a greater impact on EFH for Northeast region species than hydraulic clam dredges (Section 7.2.6.2.4.6.3). Management alternatives included in this document would not affect fishing activities managed by other federal or state management plans

An overall reduction in scallop fishing activity throughout the range of the fishery will not uniformly reduce bottom contact time in all areas where fishing is currently taking place. Highly productive fishing grounds that remain accessible to the fleet will, in all probability, continue to be fished at high intensity while fishing effort in less productive areas declines to a much greater degree. This seems a likely scenario given the fact that fishermen concentrate their fishing activity in areas where they can maximize catch rates. Reductions in bottom contact time in marginal fishing grounds could be substantial. If these are areas that are also not exposed to much, or any, trawling activity, improvements in habitat function and value are likely.

It is not currently possible to quantify the habitat benefits of even large DAS reductions for the scallop fishery. Given that otter trawls are typically used in similar areas as scallop dredges, the effect of reduced intensity of scallop dredging effort becomes even more difficult to determine. However, evidence supports the general assumption that large reductions in DAS, as seen under the No Action Alternative, would generally improve habitat conditions for scallops and other affected resources through the reduction in the frequency and intensity of scallop dredging. In addition to a projected 78% reduction in swept area by the year 2005 (Table 253) in all areas that would remain open to scallop fishing, this alternative would result in further increases in scallop biomass and density which would improve juvenile scallop EFH by increasing the amount of hard surface area available for spat settlement. An increased density of scallops could also improve habitat for bottom fish and other organisms that find shelter from predators among scallop shells and provide substrate for epifauna that attach to scallop shells.

	No Action Alternative			
	Swept Area	DAS	Land(MT)	Biomass(MT)
2003	**5,871.8**	30,532.5	23,439.3	179,340.1
2004	**6,684.7**	30,686.0	24,566.9	183,427.3
2005	**1,281.4**	9,259.1	9,668.5	207,333.9
2006	**1,318.2**	9,285.5	9,650.2	231,301.7
2007	**1,467.2**	10,291.3	10,759.6	253,803.1
2008	**1,436.1**	10,308.5	10,867.9	275,757.8
Total:	**18,059.4**	100,363.0	88,952.4	1,330,963.8

Table 253. Projected Swept Area, DAS and Landings under the No Action Alternative.

Gear Modifications

No gear modifications are proposed under the No Action Alternative.

Groundfish Closed Areas

Under the No Action Alternative, there are no scallop access programs and scallop vessels would not be permitted to harvest scallops inside the groundfish year-round closed areas.

Scallop Closed Areas in the Mid-Atlantic

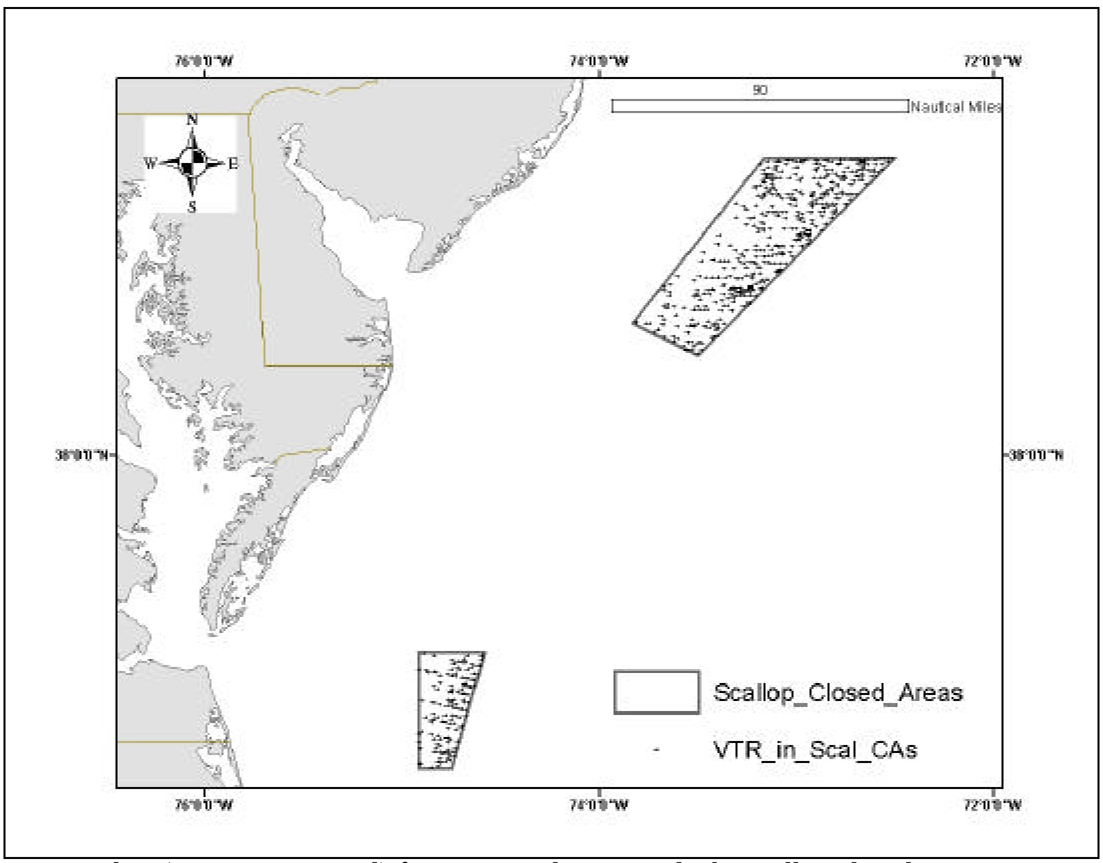
The re-opening of the Hudson Canyon and VA/NC Closed Areas will increase fishing pressure on those areas, which are known to be highly productive scallop grounds and will likely see large increases in scallop fishing effort should they re-open.

VTR Data for Otter Trawl Activity Levels in the Scallop Closed Areas

The Hudson Canyon and Virginia/North Carolina scallop closure areas have been open to fisheries other than scalloping throughout their duration. VTR data from 1995 – 2001 indicates that 1,279 fishing trips employing otter trawls took place inside these two areas, corresponding to approximately 4,915 days absent from port. Due to the nature of the days absent data field in the VTR data (which accounts for both fishing and transiting time) these numbers over-estimate actual fishing time inside these areas.

	# Trips/yr	# Days Absent/yr	Area (nm^2)	Days Absent/nm^2
All Northwest Atlantic Trips	32,289.9	51,669.1	69,486	0.744
Trips Occurring Inside Scallop Closed Areas	182.7	702.1	1,901	0.369

Table 254. VTR data (1995 – 2001) for otter trawl gear inside the scallop closed areas.



Map 57. VTR data (1995 – 2001 total) for otter trawl gear inside the scallop closed areas.

Map 57 is a visual display of the otter trawl effort reported to have occurred inside the two scallop closed areas. Table 254 summarizes the reported days absent from these trips. The Days Absent per square nautical mile metric is an indication of the relative intensity of otter trawling activity inside these areas. It is important to note that this metric cannot quantify the intensity of fishing effort's impacts on habitat; i.e. the relationship between decreasing Days Absent per square nautical mile and decreasing adverse impacts of fishing on EFH is not a linear one. Days Absent per square nautical mile does, however, provide a baseline from which to build an understanding of relative levels of otter trawl effort.

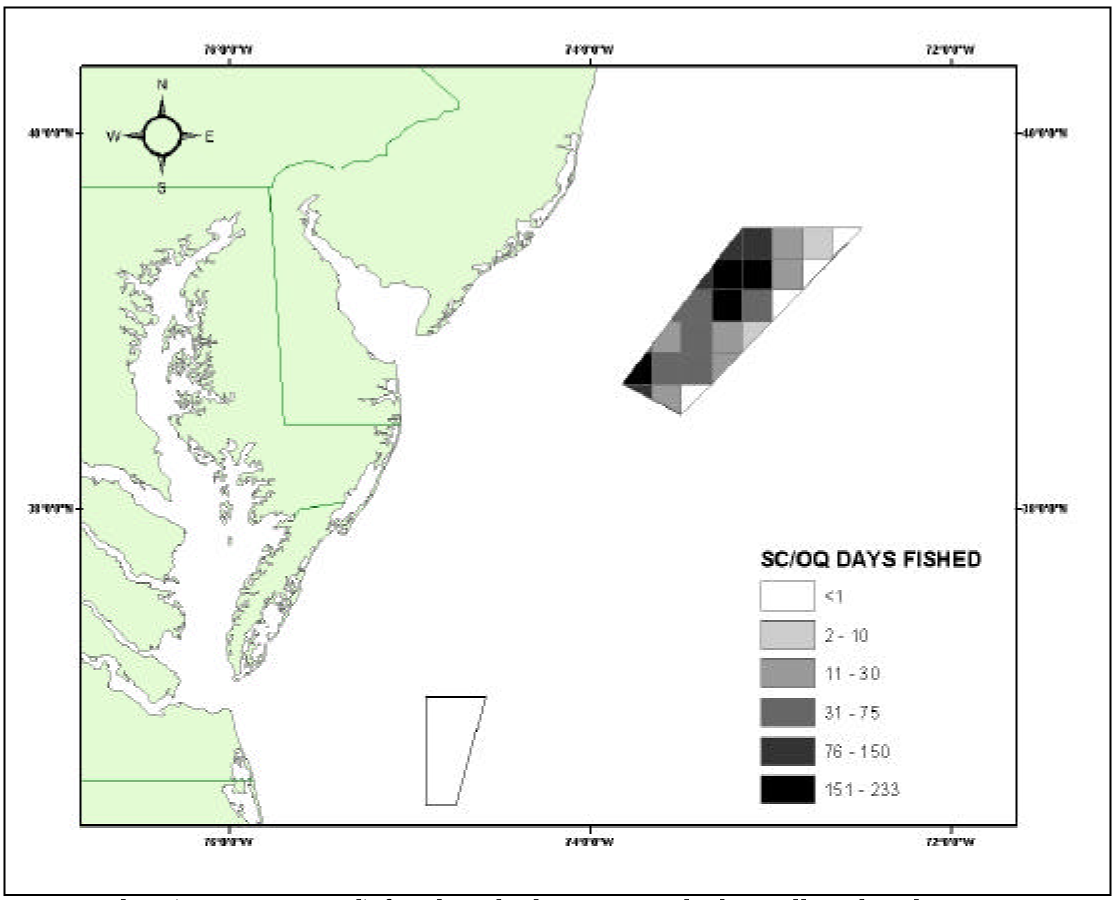
In this case, the otter trawling intensity is substantially lower than that in the entire Northwest Atlantic analysis area. Therefore, the addition of scallop dredge activity will likely have an adverse impact on benthic communities of these areas as well as the species' EFH contained within them.

VTR Data for Clam Dredge Activity Levels in the Scallop Closed Areas

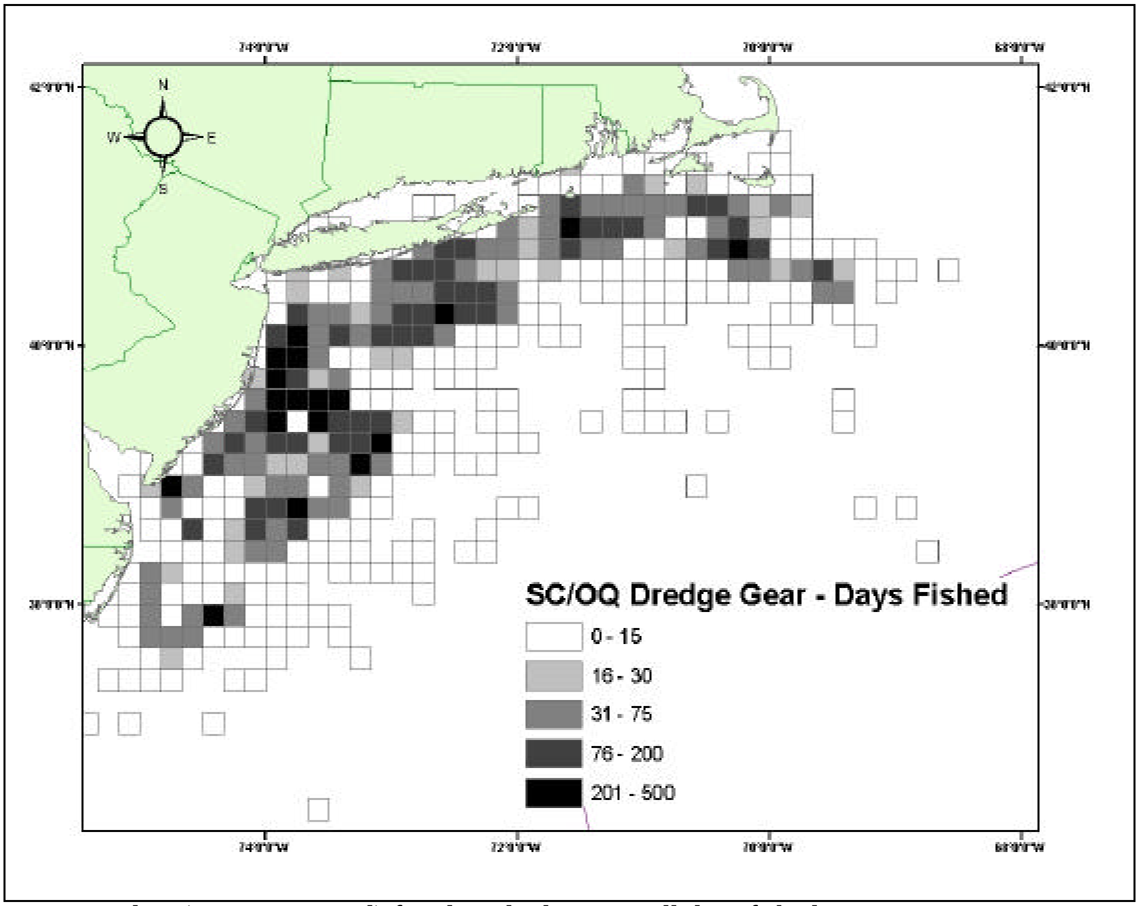
VTR data from 1995 – 2001 indicates that surf clam/ocean quahog vessels employed clam dredge gear inside these two areas for approximately 1,282 fishing days. This data field takes in to account transit time and is therefore likely to be a more accurate indicator of actual time fishing than the similar metric utilized for calculating otter trawl activity levels.

	# Days Fished/yr	Area (nm^2)	Days Fished/nm^2
All Northwest Atlantic Trips	2,306.0	69,486	0.033
Trips Occurring Inside Scallop Closed Areas	183.14	1,901	0.096

Table 255. VTR data (1995 – 2001) for clam dredge gear inside the scallop closed areas.



Map 58. VTR data (1995-2001 total) for clam dredge gear inside the scallop closed areas.



Map 59. VTR data (1995-2001 total) for clam dredge gear, all days fished.

VTR data shows that no trips were made inside the VA/NC scallop closed area. Map 58 shows a slightly higher intensity within the scallop closed areas (which, in fact, would be even higher given that there was no clam dredge activity inside the VA/NC closure) than within the NWA analysis area as a whole. This is a slightly deceiving result, as the surf clam/ocean quahog fishery is highly concentrated (Map 59).

Summary of otter trawl and clam dredge impacts on scallop closed areas

Clam dredge gears have no impact on bottom sediments in the VA/NC closure and otter trawl intensity in this area is low. Opening this area to scallop dredging would likely expose these habitats to levels of fishing pressure not seen since the area was closed in 1998. The Hudson Canyon closure, however, has a significantly higher level of fishing pressure from gears other than scallop dredges. The opening of this area to scalloping would have a somewhat less severe impact. The predominantly sandy bottom sedimentation and shallow average depth (20-65 fathoms) of these two areas, however, indicates that these two areas recover relatively quickly from fishing impacts.

Other Considerations

Further discussion on the physical characteristics of the Hudson Canyon and Virginia Beach scallop closed areas are found in Section 7.3.2.4. Additional analysis of the affected habitats and impacts of scalloping in these areas are contained in Framework Adjustment 14 to the Atlantic Sea Scallop FMP (NEFSC 2001).

8.5.7.1.2 Status Quo Alternative

The Status Quo Alternative involves an indefinite constant fishing mortality rate of F=0.2. This rate is roughly equivalent to 120 DAS. The Hudson Canyon and Virginia/North Carolina scallop closed areas remain closed. The Status Quo Alternative does not provide for access to the year-round groundfish closed areas.

	Status Quo			
	SweptAr	DAS	Land(MT)	Biomass(MT)
2003	**5,871.8**	30,532.5	23,439.3	179,340.1
2004	**6,684.7**	30,686.0	24,566.9	183,427.3
2005	**7,632.5**	30,972.1	23,758.9	184,004.3
2006	**8,168.3**	30,304.7	20,653.0	185,822.2
2007	**9,151.3**	30,100.6	16,991.1	190,235.2
2008	**9,781.2**	30,780.9	17,285.9	197,032.2

Table 256. Projected Swept Area, DAS and Landings under the Status Quo.

The Status Quo Alternative impacts species' EFH most notably through the continuation of current DAS allocations. The result is a dramatic increase in nominal fishing effort (DAS) relative to the NAA. Swept area also increases dramatically over six years (67%) due to the additional effort required to maintain landings Table 256 points out very clearly an important relationship between effort levels, landings and swept area. If effort levels remain above those corresponding to optimal LPUE, LPUE will tend to decline. Under the status quo, the decline in LPUE is projected to be on the order of 27%, with a corresponding 40% increase in swept area. The implication of these projections in the scallop industry is that as resource abundance declines, the fishery shifts from shucking-limited production to resource-limited production. Projected bottom contact time (swept area) increases substantially as this shift occurs.

8.5.7.2 Alternatives to Improve Scallop Yield (Section 5.3.2)

Ten alternatives are presented for the purpose of improving scallop yield. Of these, six employ various permutations of a rotational area management regime.

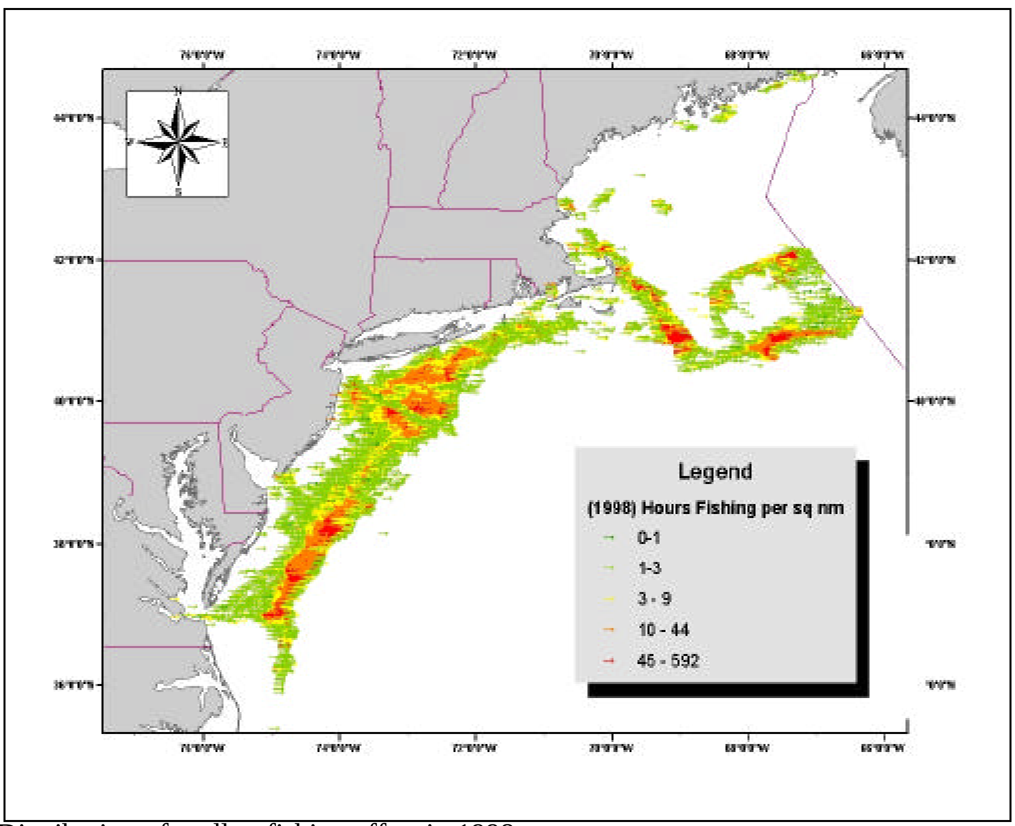
8.5.7.2.1 Rotational Area Management

Under rotational area management, three types of areas are defined: Closed Rotation, Recently Re-opened, and Open Areas. Varying levels of fishing effort are permitted in each of the three area types; none of these prohibit fishing with gears other than scallop dredges or scallop trawls. Closed Rotation areas are closed to all limited access and general category scallop permit holders fishing for scallops with dredge or trawl gear. It is very important to note that vessels may fish in such an area with gear other than scallop dredges or trawls. Closed Rotation areas, additionally, are closed for a limited duration (estimated to be between 3 and 5 years) intended to precede a Recently Re-opened designation. Recently Re-opened areas will be fished with significantly higher levels of intensity than either Closed Rotation or Open Areas. Open Areas will be no different than the areas not designated as a part of the rotational management program and may be fished by all limited entry and general category scallop permits, as well as all other gear types, as constrained by applicable Fishery Management Plans. These areas will likely see a more consistent, albeit lower, level of fishing effort.

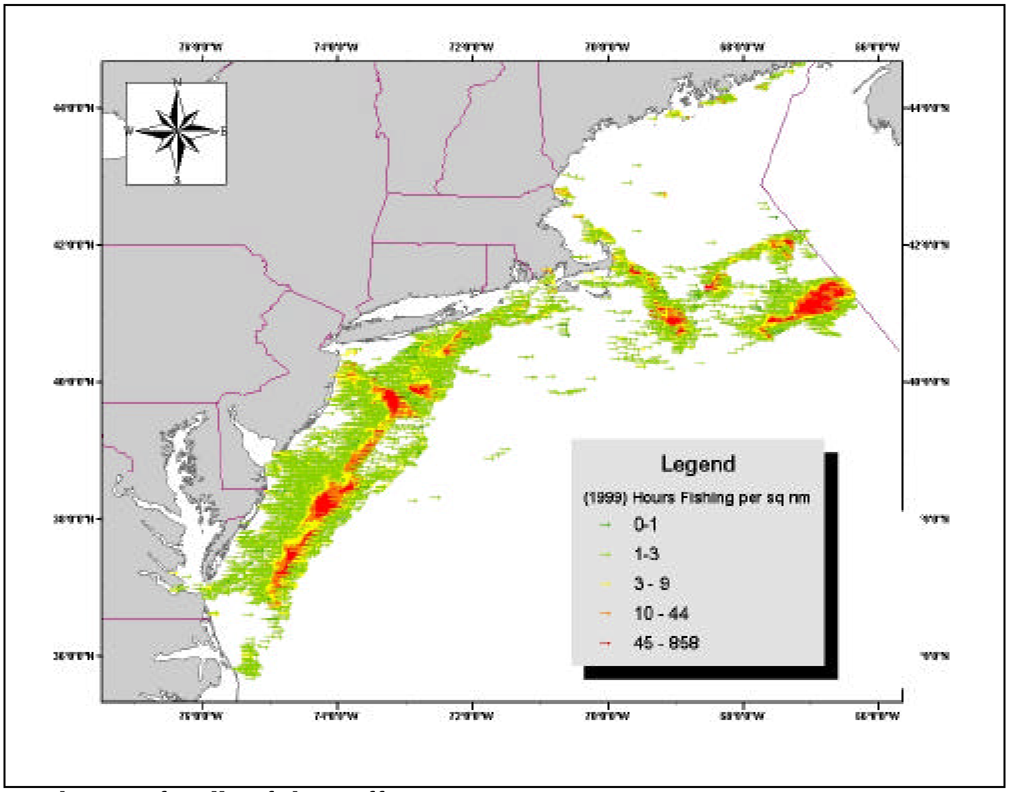
The areas designated as Closed Rotation are open to fishing with other gear types, and will eventually be reopened to higher than normal levels of scallop fishing intensity. The specific impacts of these temporal intensity shifts will depend on the environments they take place within. For example, closed rotation and recently re-opened areas along the southern portion of Georges Bank, which is comprised primarily of sand and gravely sand bottom sedimentation, are considered "high energy" environments that recover from the effects of fishing relatively quickly. [Areas deeper than 65 m on eastern GB are considered "low energy" – this includes most of the southern portion of CAII]. The same is true for the rotational management areas occurring in similar sandy, "high energy" environments along the continental shelf from waters south of Long Island and extending southward to the shelf areas east of the DELMARVA peninsula.

Rotational areas occurring in deeper water along the northern areas of Georges Bank and off of Cape Cod, where bottom sediments contains more gravelly sand and gravel and support more prolific epifaunal communities. These environments are generally thought of as "lower energy" and may not recover as fast, if at all, from the elevated levels of fishing intensity expected while in a Recently Re-opened stage. Such elevated, short-term fishing intensities in these areas (specifically GB15, GB7, GB6, GB2 and GB1) may in fact have more detrimental effects on EFH than the consistent lower fishing effort levels associated with either an Open Area designation or those areas that lie outside the rotational management's proposed scope. There is no literature available on potential impacts of "pulse" fishing; i.e. elevated fishing intensity over limited spatial and temporal scales, followed by a period of lower fishing intensities.

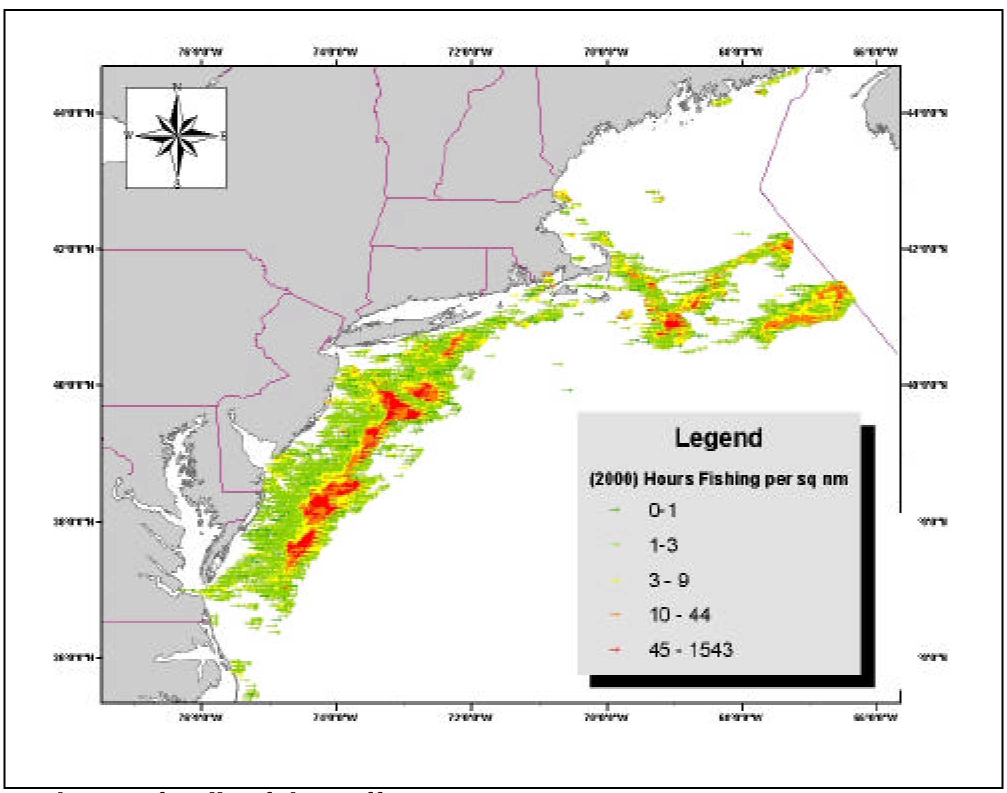
Vessel Monitoring System data from 1998-2000, however, indicates that the scallop fishery currently operates on a somewhat limited spatial scale. Vessels tend to fish only productive areas, and these at high levels of intensity.



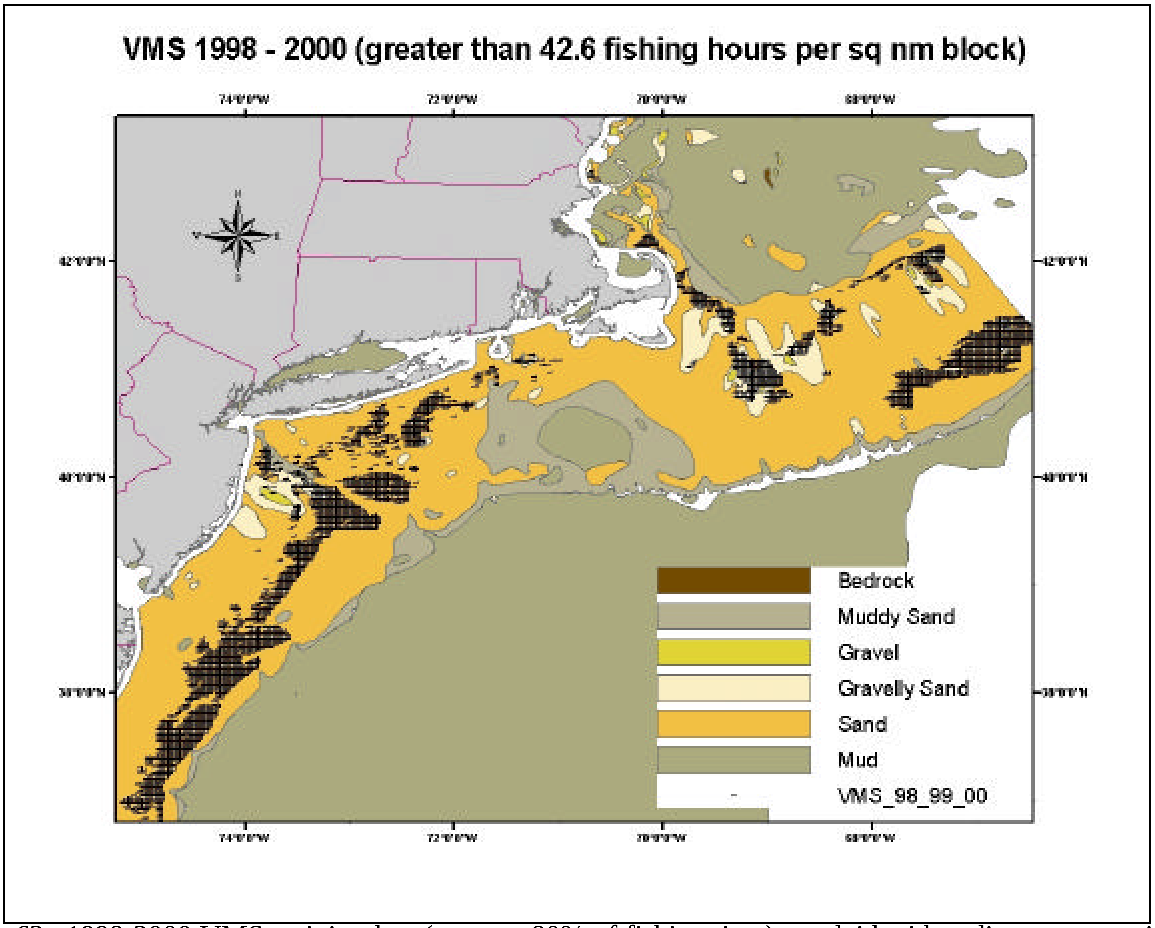
Map 60. Distribution of scallop fishing effort in 1998.



Map 61. Distribution of scallop fishing effort in 1999.



Map 62. Distribution of scallop fishing effort in 2000.



Map 63. 1998-2000 VMS activity data (greatest 80% of fishing time) overlaid with sediment categories (summarized from Poppe et al. 1989).

Map 60 through Map 62 show the limited spatial extent of the bulk of the fishery. Map 63 shows the spatial range of the highest 80% of scallop fishing activity. This cutoff corresponds to greater than 42.6 hours fished within a 1 nm block; this truncation eliminates positions where little scalloping occurred, as well as transiting positions.

The fishery is primarily one of intense fishing pressure over a relatively small area. The areas of greatest fishing pressure change over time (as seen even over the limited three-year time series). Furthermore, as resource conditions improve the fishery may have become even more spatially constrained. There is likely an inverse relationship between abundance and total bottom contacted. This concept is strengthened by the relationship between swept area and total effort analyzed in Section 8.5.4.14.2.1. In an analysis of VMS data and scallop fleet behavior, scientists also observed contracting fishing areas between 1998 and 1999 (Rago et al. 2000).

8.5.7.2.1.1 Habitat evaluation of rotational area management

8.5.7.2.1.1.1 Methods

To examine the effect that rotation area management is likely to have on essential fish habitat, the past and probable future distribution of limited access scallop fishing effort (contributing about 95-98 percent of total landings) were compared to the distributions of two metrics that were used to evaluate habitat closures: a summary of six sediment classifications (bedrock, mud, muddy sand, gravel, gravelly sand, and sand) and EFH designations for the juvenile and adult life stages of 23 species that have been classified as having EFH that is moderately or highly vulnerable to scallop dredges or otter trawls (see Section 7.2.6.2.5). Species with EFH that were judged to be moderately or highly vulnerable to the effects of trawls and dredges may be adversely impacted by fishing. These species and life stages are listed in Table 138. Note that the EFH of juvenile scallops has been determined to have low vulnerability to bottom tending gear and is therefore not included in this analysis (See Section 7.2.6.2.5). The six sediment categories are based on nine classifications used in U.S. Geological Survey sediment maps (Poppe et al. 1986, 1989). (See Appendix IV for more details). This analysis used the same EFH designation and sediment data that the Council's Habitat Technical Team used to evaluate the effectiveness of habitat closure alternatives.

EFH distribution data for species with EFH moderately or highly vulnerable to bottom tending gear are already classified into ten-minute squares of latitude and longitude. For juvenile and adult life stages individually, the number of species that had an EFH designation for a ten-minute square were summed, the total ranging from zero to 16. There were no ten-minute squares with more than 16 different species with vulnerable EFH. Within this group of sixteen species, there are some that might be thought to be more highly vulnerable to habitat alteration by scallop dredges, for example, which could be highlighted and evaluated more thoroughly.

To be consistent with the data, the six-classification sediment distribution data were summed for area within each ten-minute square. A square that had more than one sediment type classified in it, for example, had a sum of area for each sediment classification, the total adding up to the area of the total ten-minute square. The sum of sediment areas in each ten-minute square were preserved when comparing the projected effort in each ten-minute square and then summed across sediment types to estimate the proportion of effort that occurred over each sediment type. For a historic analysis, more direct comparison might be possible with better sediment distribution data, because the VMS scallop effort data are collected continuously by polling the vessel every 30 minutes and classifying the effort since the previous polling to the nearest nautical mile. For analysis of projections, however, a ten-minute square is probably the best resolution that can be expected to be meaningful.

The 1998 – 2000 VMS effort distribution data (See Section 8.5.4.14.2.1) were compared with both the sediment and EFH data described above, and used to derive the expected future distribution of fishing effort within the rotation management area used for analysis and projections. Projections of scallop biomass, catch, and effort were averaged within each rotation management area and then the effort data and area swept calculations were applied as if the effort distribution within each ten-minute square was the same as it had been in 1998 – 2000. This is appropriate because the effort distribution in rotational management areas is associated with the relatively constant distribution of scallop biomass within those areas. Used in this way, the projected effort distribution within rotation management areas is expected to remain stable, but the effort distribution among rotation management areas is allowed to vary according to the biomass dynamics projection model in Section 8.2.1. Projections were averaged for 2004, an annual average for 2005-2007, and a long-term annual average for 2022-2031.

VMS data require considerable processing to be suitable for further analysis. At the present time, the 2001 and 2002 VMS data have not been processed in this way to audit the information, distinguish fishing time from steaming time, combine the data with catch and revenue information from dealer data, and classify/sum the data by one nautical mile blocks in appropriate time increments.

Although there could be some small changes in resource distribution and corresponding fishing effort within a rotation management area during this time, it is not believed to be a critical factor in this analysis, except possibly to compare historic impacts across the entire fishery with another time period in history. For example, the 1998 – 2000 period included the time when the Hudson Canyon and VA/NC Areas were closed to fishing and area access to the Georges Bank closed areas occurred in 1999 and 2000. To the extent that more EFH designations or hard bottom substrates occur within the Framework 13 access areas, the historic data for 1998 – 2000 overstate the impacts on these habitats relative to scallop fishing conditions that will prevail without access.

Historic effort distributions were compared with EFH designation density and sediment distributions by summing the scallop fishing time[92] over ten-minute squares. The total fishing time in a ten-minute square was then allocated according to the proportion of the six sediment types in each ten-minute square, then summed over the six sediment classifications. The total fishing time in a ten-minute square was also classified according to the number of EFH designations in the ten-minute square and then summed with other ten-minute squares having the same number of EFH designations, although the mix of species within various ten-minute squares with equal EFH ranks vary.

A substantial portion of total fishing time occurs in a relatively few one nautical mile blocks (see Figure 130). Even though the most substantial habitat impact is thought to occur with the first pass of a dredge, the most complete coverage by fishing activity occurs in areas (in this case one nautical mile blocks) where fishing effort is highest. One cutoff or criteria that may be used to distinguish high effort blocks from low effort blocks is the amount of effort that would completely sweep a one nautical mile block, if the tows were distributed side by side and end to end, with no overlap. Based on a 30-foot dredge towed at 4 knots, this takes slightly more than 50 hours of bottom contact time. Assuming no reduction in bottom contact time due to tending the gear, shucking scallops, or other effects, this criteria were used to distinguish one nautical mile blocks as being "intensely fished" vs. "lightly fished".

Averaged over the three years, 21 percent (range 20 to 23 percent) of the one nautical mile blocks had more than 50 hours of fishing time per year. The effort in each ten-minute square that was "intensely fished" was then summed to compare the habitat effects, measured by the sediment type and EFH designation metrics, where effort was highest.

[92] Scallop fishing time was determined by classifying the VMS pollings that implied a velocity of less than 5 nm/hr. During these times, vessels could be actively fishing, drifting or anchored while shucking scallops caught in prior tows, searching for fishing locations, or drifting or anchoring to wait out weather, eat, or repair equipment, etc. These totals are very different from the estimated bottom contact time and area swept in the projection data which reduces the amount of the implied fishing time with gear on the bottom by the ratio of the estimated catch rates and the crew's shucking capacity.

Table 257. Percent of one nautical mile blocks classified by whether it had more than 50 hours of fishing time derived from VMS pollings and whether it fell within the boundaries of rotation management areas used for analysis and projections.

Percent of one nm blocks		Fishing year			
Fishing time greater than 50 hours per year?	Inside RMA?	1998	1999	2000	Grand Total
No	No	14.91%	17.44%	17.75%	16.70%
	Yes	65.07%	59.14%	61.55%	61.96%
No Total		79.98%	76.58%	79.29%	78.66%
Yes	No	1.04%	0.19%	0.29%	0.51%
	Yes	18.98%	23.23%	20.42%	20.83%
Yes Total		20.02%	23.42%	20.71%	21.34%
Grand Total		100.00%	100.00%	100.00%	100.00%

Some fishing effort occurs outside of rotation management areas, 16.7 percent for one nautical mile blocks having less than 50 hours of fishing time and 0.51 percent for one nautical mile blocks having more than 50 hours of fishing time. Although there are habitat impacts in these areas, less than three percent of the intensively fished one nautical mile blocks occur there and the majority of habitat impacts occur within areas designated as rotation management areas for purposes of analysis and scallop biomass dynamics projection. It would be inappropriate to compare the projected effort distributions in rotation management areas with effort distributions for all areas, so a separate comparison with the EFH metrics was completed, using all 1998 – 2000 scallop fishing time derived from VMS reports within the boundaries of the rotation management areas.

The projected area swept within rotation management area was then distributed by ten-minute square in proportion to the amount of 1998 – 2000 scallop fishing effort within the rotation management area. With regard to Georges Bank closed area access, this method actually works out well, because the projection model rotation management areas coincide with the boundaries for access, and the historic fishing effort distributions were also analyzed using these boundaries.

Thus historic and future projected shifts in fishing effort under area rotation toward ten-minute squares having a greater proportion of bedrock, gravel, and gravelly sand are deemed to have greater habitat impact than shifts in effort that favor sand, mud, or muddy sand. Likewise, shifts in fishing effort toward ten-minute squares with greater amounts of EFH designations are also deemed to have greater habitat impacts than those that would favor ten-minute squares with fewer EFH designations.

The area-swept distributions for four future time periods were compared to the historic effort distributions, to examine the effect that area rotation and area access might have on habitat impacts, as measured by the two EFH metrics. These four periods are described in the table below:

Table 258. Summary of projected effects on habitat impacts, measured by changes in overlap of sediment and EFH designation habitat metrics.

Time period	Scallop management status
2004 fishing year without Georges Bank area access	Applies to period before implementation of Framework Adjustment 39
2004 fishing year with access	Applies to period after implementation of Framework Adjustment 39, allowing access to the Framework 13 portions of the Nantucket Lightship Area and Closed Area I
2005 – 2007 fishing year averages	Southern part of Closed Area II open; Nantucket Lightship Area and Closed Area I closed
Long-term	Long term effects of area rotation and access to the Framework Adjustment 13 portions of the three Georges Bank closed areas

8.5.7.2.1.1.2 Results

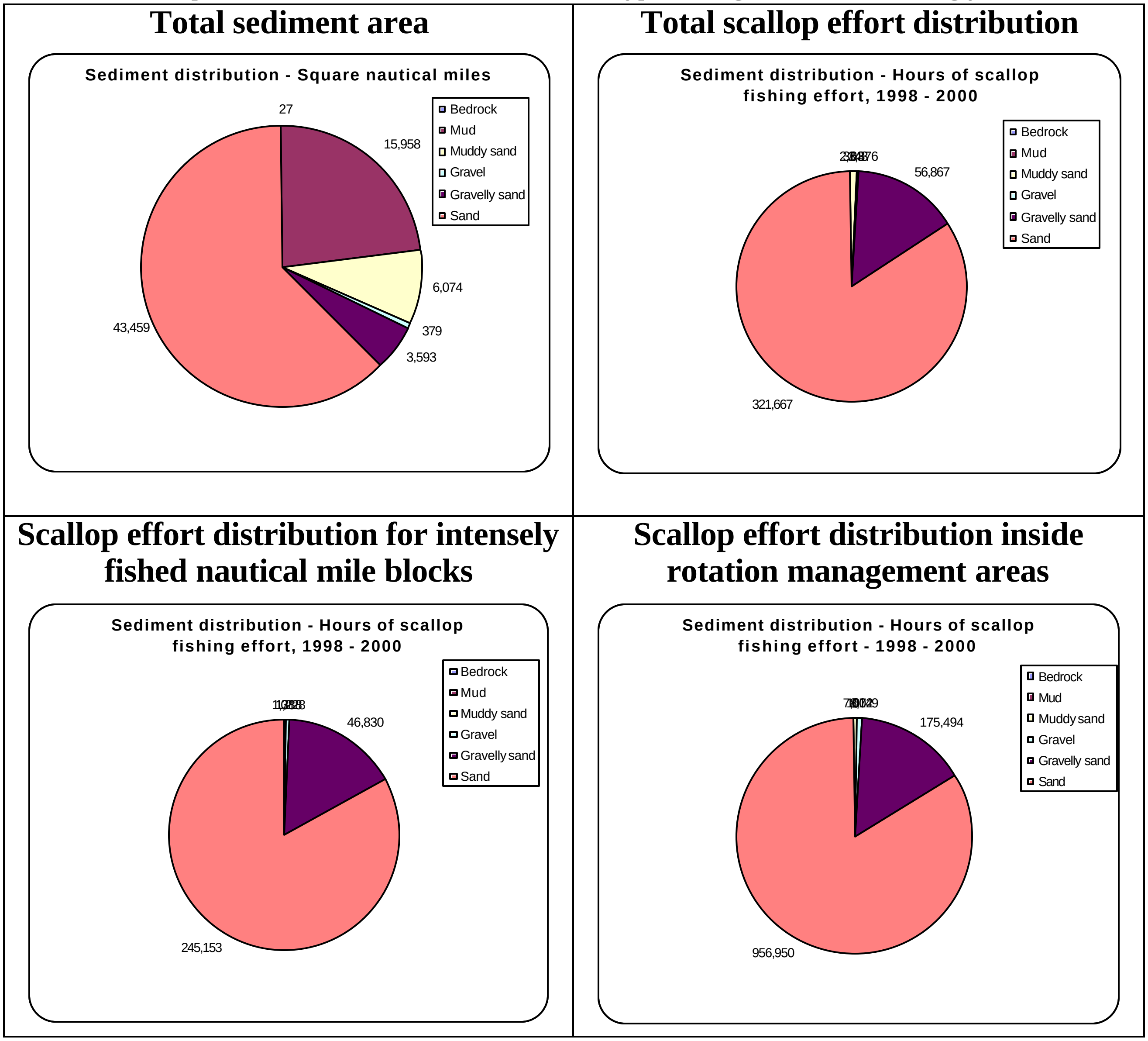
8.5.7.2.1.1.2.1 Sediment Analysis

Overall, sand is the primary sediment type in the total Northwest Atlantic Analysis Area (NAAA). It is also the primary sediment type where total scallop effort took place in 1998-2000, and was the primary sediment in areas that were intensely fished by the scallop fleet in 1998 and 2000, as well as areas inside rotational management areas (RMAs). Gravelly sand was the second most common sediment type associated with scallop fishing effort. Table 259 shows that the majority of scallop fishing activity took place over sandy bottoms and some gravelly sand. The percent of sediment types do not change significantly when comparing the total area of scallop fishing activity, the area with high intensity of scallop effort, and the areas within RMAs. Figure 136 describes the amount of each sediment type in the same four areas in square nautical miles.

Table 259. Sediment distribution in the total Northwest Atlantic Analysis Area (NAAA), total scallop effort distribution, scallop effort distribution for intensely fished nautical mile blocks, and scallop effort distribution inside rotation management areas (RMAs).

	Sediment distribution in the NAAA (nm2)	Sediment Distribution in the NAAA (Percent)	All 1998-2000 effort distribution (hours fished)	High intensity effort distribution, 2000 only (hours fished)	Scallop effort in rotation management areas (hours fished)
Bedrock	0	0.0%	0.0%	0.0%	0.0%
Gravel	6074	0.5%	0.5%	0.4%	0.7%
Gravelly sand	379	5.2%	14.8%	15.9%	15.3%
Sand	3593	62.5%	84.0%	83.2%	83.3%
Muddy sand	15958	8.7%	0.6%	0.4%	0.7%
Mud	27	23.0%	0.1%	0.1%	0.0%
TOTAL	26033	100%	100%	100%	100%

Figure 136. Distribution of sediment classifications derived from Poppe et. al. 1989 and limited access scallop effort distributions over those sediment types during 1998 – 2000 fishing years.

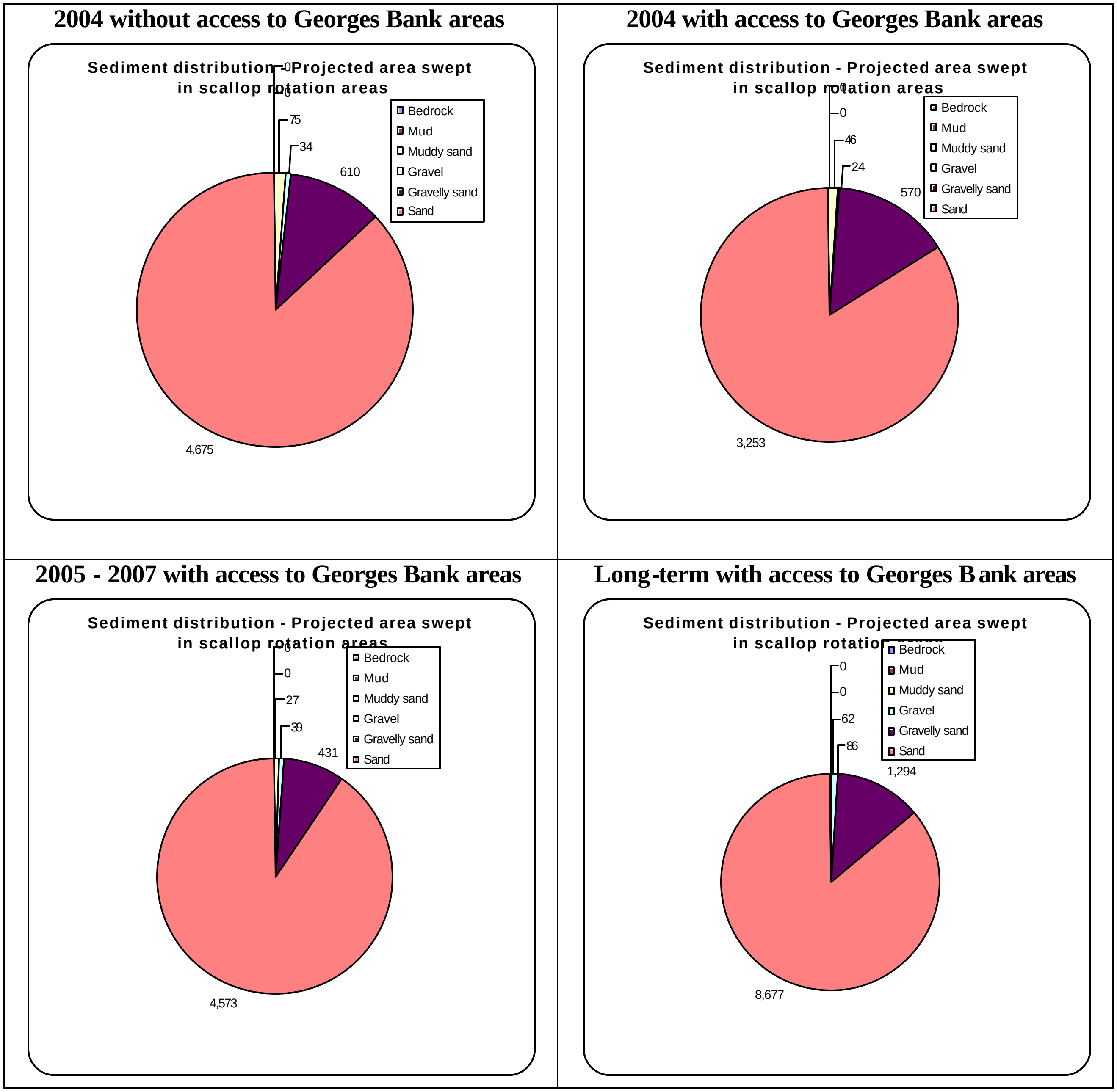


As predicted by the simulation model, area rotational management will shift effort during the next ten years into specific areas where scallop biomass is expected to be highest. The sediment compositions of these areas are presented below (Table 260). Once again, the sediment composition does not differ significantly for areas projected to be available for scallop fishing in 2004 without access to the groundfish closed areas on Georges Bank, as well as with access to portions of these areas. Over 80% of projected effort is expected to be in sandy areas in either case, and less effort is expected over gravelly sand as compared to the amount of gravelly sand within all the RMAs. The shift of scallop fishing effort into sandy bottom areas that is projected to occur during 2005-2007 and over the long-term is actually greater than in 2004. This projected reduction in effort over gravel is significantly greater for both these time periods, compared to 2004. Figure 137 describes the swept area for each sediment type in the projected 2004 RMAs, the 2005-2007 RMAs, as well as the long term rotational management area strategy, and the percent change from the 1998-2000 effort distribution in the RMA's (column 1). The sediment distribution of sediments associated with projected fishing effort is mot significantly different from those associated with current fishing effort. Although total effort on muddy sand remains low, there is a 100% increase (0.7% to 1.4%). ON the other hand, there is a 26% decrease of effort on gravelly sand and an 11% decrease of effort on gravel.

Table 260. Sediment distribution in the 2004 projected scallop effort areas, 2005-2007 projected scallop effort areas, and the long term projected scallop effort areas with access to Georges Bank. The projected change in sediment distribution from the historic (1998-2000) scallop effort within rotation management areas is presented as well.

	Scallop effort in rotation management areas (hours fished)	2004 projected effort distribution without access (total area swept)	Projected change	2004 projected effort distribution with access (total area swept)	Projected change	2005-2007 effort distribution (total area swept)	Projected change	Long-term with access to Georges Bank areas	Projected change
Bedrock	0.0%	0.0%		0.0%		0.0%		0.0%	
Gravel	0.7%	0.6%	-11.1%	0.6%	-14.4%	0.8%	9%	0.8%	20%
Gravelly sand	15.3%	11.3%	-26.0%	14.3%	-6.6%	8.5%	-44%	12.8%	-16%
Sand	83.3%	86.7%	4.0%	83.9%	0.7%	90.2%	8%	85.8%	3%
Muddy sand	0.7%	1.4%	109.2%	1.2%	75.0%	0.5%	-21%	0.6%	-9%
Mud	0.0%	0.0%	-70.6%	0.0%	-74.8%	0.0%	-89%	0.0%	-57%
TOTAL	100%	100%		100%		100%		100%	

Figure 137. Estimated distribution of projected limited access scallop effort over each sediment type.



The distribution of sediment types associated with projected scallop fishing effort within rotational management varies depending on which RMAs are open, and which are closed. The figures below describe which areas are expected to have more effort than the historical (1998-2000) average, and which areas are expected to have less effort for several different rotational management strategies. Figure 138 and

Figure **139** show the specific RMAs that are expected to have more scallop effort than the 1998-2000 average without access to Georges Bank closed areas, and with access to Georges Banks closed areas. Several of the RMAs in the Mid-Atlantic region will receive more effort than the 1998-2000 average with or without access, particularly MA5, MA7, MA8, and MA9. Table 261 describes where each of these RMAs are located, and Table 263 describes the sediment distribution of each RMA. MA5 and MA8 are over 90% sand, and MA7 is over 75% sand, and MA9 is about 68% sand. Therefore, and increase in effort in these RMAs may not have a significant negative impact on sensitive sediment types. GB2 and GB6 are predicted to have more effort than the historical effort without access to Georges Bank, and GB6 is over 90% sand, while GB2 is about 50% sand and 45% gravelly sand (Table 263). On the other hand, GB12 and GB9 are expected to have increased scallop effort in 2004 with access to Georges Bank closed areas, and both of these areas are made up of about 50% sand and 50% gravelly sand. In general, the RMAs in the Georges Bank area are made up of more complex bottom types, but none of the RMAs contain bedrock, and only two in the Georges Bank area have over 20 nautical miles of gravel (GB4 and GB7), and MA6 is the only RMA in the Mid-Atlantic region with gravel (about 3.4% of the area) (Table 263).

The sediment distribution and overlap with future scallop effort under a rotational management strategy was also analyzed for the short-term (2005-2007) and long term. Figure 140 and Figure 141 show which RMAs are expected to have more effort in both time periods, as compared to the historical average of scallop effort in each area. In 2005-2007 GB6, GB7, MA5, MA6, MA8, and MA9 are expected to have more effort than the historical average, particularly MA5 and MA6 (200% increase). GB7 and MA6 do contain more gravel than most of the other RMAs, but all the areas that will have increased effort levels are mostly sand. For the long term, the analysis predicts that GB1, GB5, GB6, GB7, MA5, MA8, and MA9 will have increased effort levels. GB1 and GB6 increase the most, and according Table 263, GB1 is mostly sand and muddy sand and mud, while GB6 is over 90% sand. MA9 is expected to have increased effort levels, and this are is mostly sand and muddy sand.

Figure 138. Percent change in limited access scallop fishing effort by rotation management area in 2004 without access to Georges Bank closed areas, relative to the average effort distribution during 1998-2000.

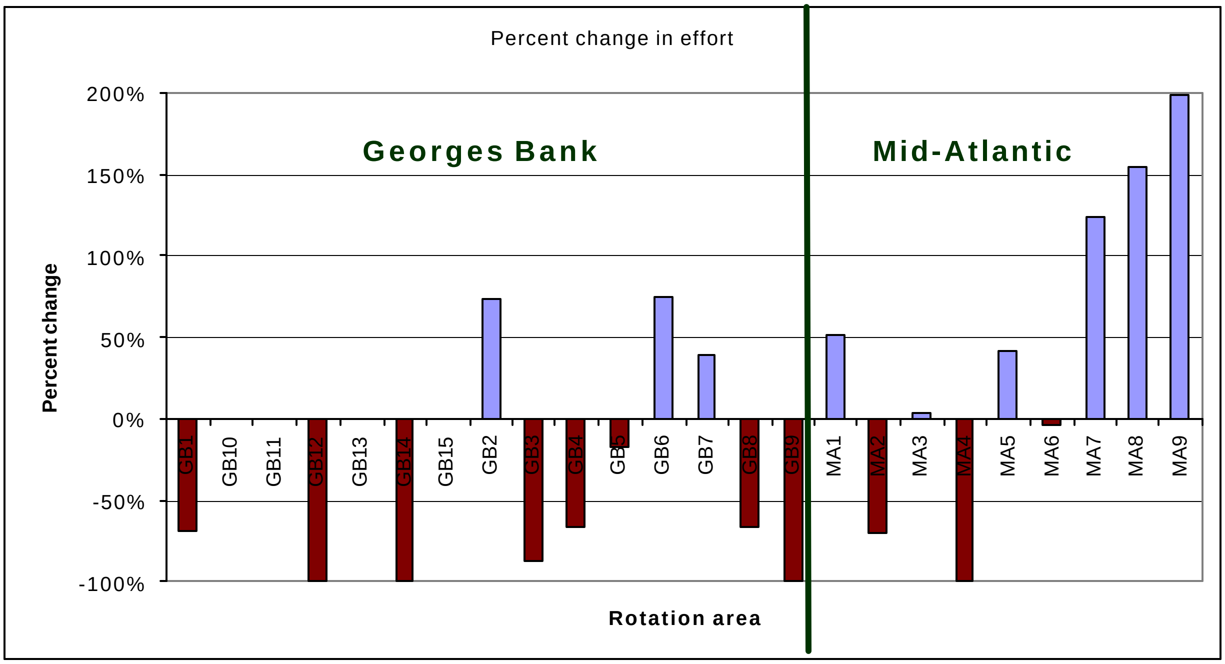


Figure 139 - Percent change in limited access scallop fishing effort by rotation management area in 2004 with access to Georges Bank closed areas, relative to the average effort distribution during 1998-2000.

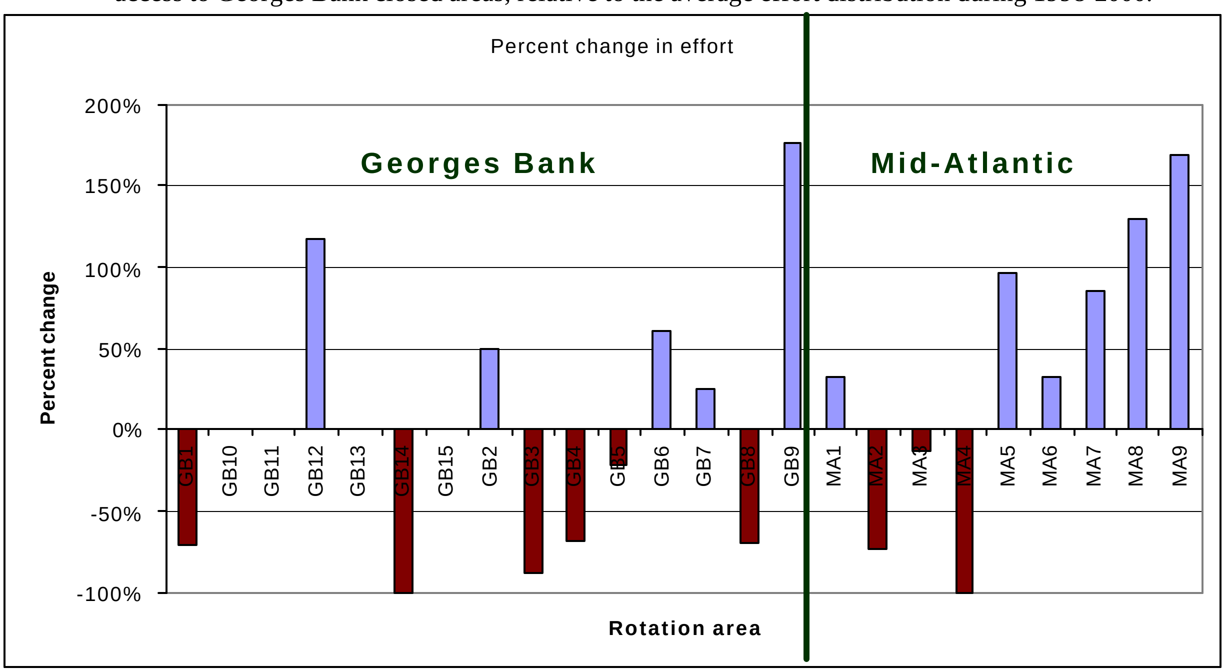


Figure 140. Percent change in limited access scallop fishing effort by rotation management area in 2005 - 2007 with access to Georges Bank closed areas, relative to the average effort distribution during 1998-2000.

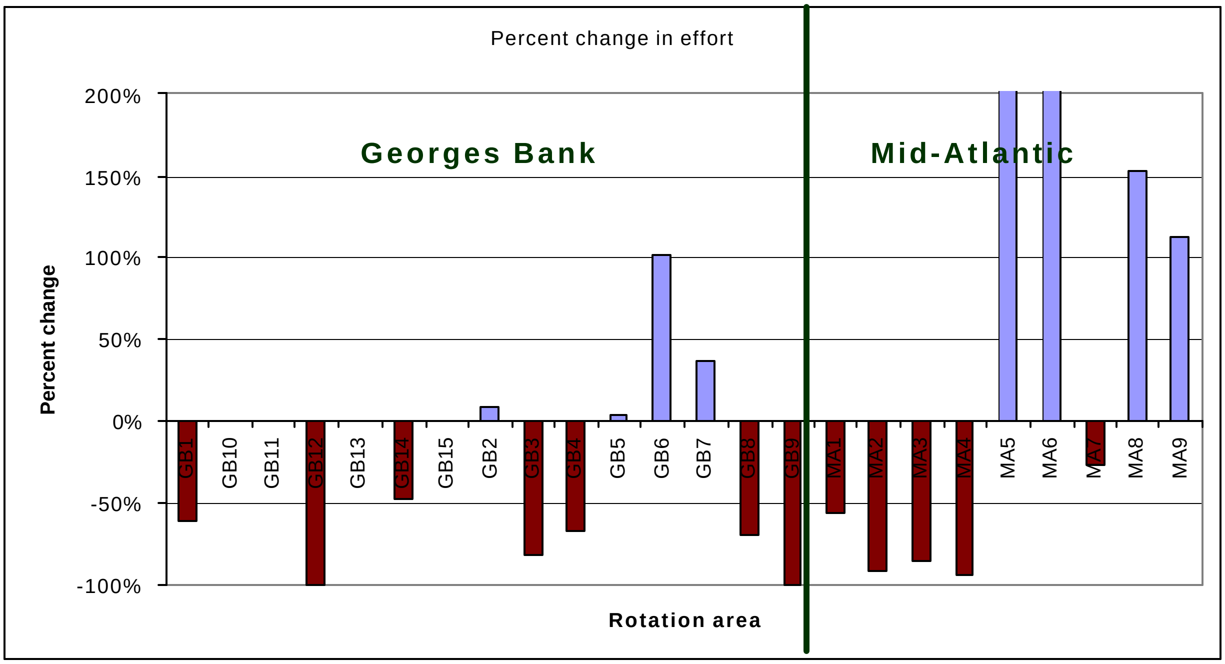


Figure 141 - Percent change in limited access scallop fishing effort by rotation management area for the long-term without access to Georges Bank closed areas, relative to the average effort distribution during 1998-2000.

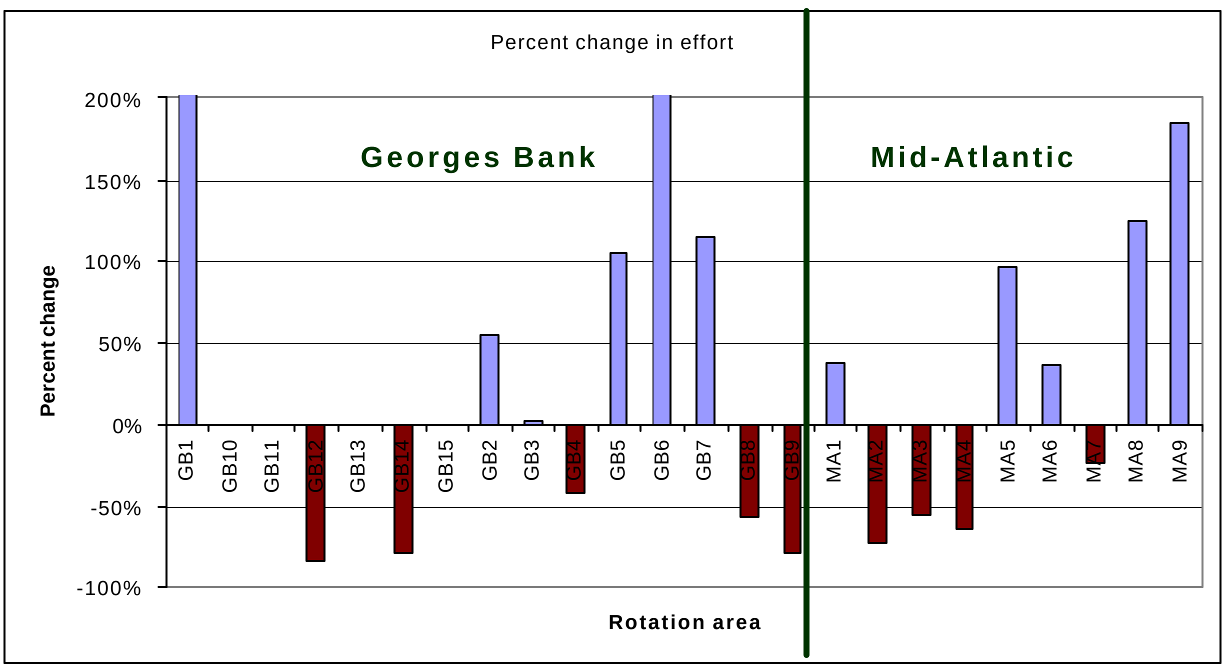


Table 261 - Description of general locations of rotation management areas used to project effects of area rotation. See Map 7.

Rotation management area designation	General location
MA1	East of NC/VA boundary; contains former VA/NC Area.
MA2	Delmarva region of the Mid-Atlantic
MA3	Delmarva region of the Mid-Atlantic
MA4	Delmarva region of the Mid-Atlantic; overlaps the proposed Mid-Atlantic closure area
MA5	NY bight region of the Mid-Atlantic; overlaps the proposed Mid-Atlantic closure area and the Hudson Canyon Area
MA6	NY bight region of the Mid-Atlantic; overlaps the Hudson Canyon Area
MA7	NY bight region of the Mid-Atlantic; overlaps the Hudson Canyon Area
MA8	NY bight region of the Mid-Atlantic
MA9	NY bight region of the Mid-Atlantic
GB1	South Channel region of Georges Bank
GB2	South Channel region of Georges Bank
GB3	South Channel region of Georges Bank
GB4	South Channel region and Southeast Part of Georges Bank
GB5	Southeast Part of Georges Bank
GB6	Southeast Part of Georges Bank
GB7	Northeast Edge and Peak of Georges Bank
GB8	Northeast Edge and Peak of Georges Bank
GB9	South Channel region of Georges Bank; coincides with the Framework 13 access area in Closed Area I
GB10 & 11	South Channel region of Georges Bank; coincides with portions of Closed Area I that remained closed to scallop fishing
GB12	South Channel region of Georges Bank; coincides with the Framework 13 access area in Nantucket Lightship Area
GB13	South Channel region of Georges Bank; coincides with portions of Nantucket Lightship Area that remained closed to scallop fishing
GB14	Southeast Part of Georges Bank; coincides with the Framework 13 access area in Closed Area II
GB15	Northeast Edge and Peak of Georges Bank; coincides with portions of Closed Area II that remained closed to scallop fishing

8.5.7.2.1.1.2.2 EFH Analysis

When the EFH designations of the species with vulnerable EFH are combined, almost all the ten-minute squares within the Northwest Atlantic Analysis Area contain EFH for at least one species. According to Table 262, about 47% of the entire NAAA contains EFH for 6 or more juvenile species with vulnerable EFH, as well as about 43% for adult species with vulnerable EFH. Almost 48% of all scallop fishing time occurs over areas with 6 or more juvenile EFH designations that are deemed vulnerable to bottom tending gear, and about 35% of the area fished is over EFH designations for 6 or more adult species with vulnerable EFH. The percent of area that overlaps with both juvenile and adult EFH designations for "intense" scallop fishing is lower than the percent of overlap for all scallop fishing. For example, about 38% of "intense" scallop fishing effort is over areas with 6 or more EFH designations for juvenile species with vulnerable EFH, while about 48% of all scallop fishing is over areas with 6 or more EFH designations for juvenile species with vulnerable EFH. Although "intense" scallop fishing effort occurs frequently over areas with 6 or more EFH designations (38% for juveniles, 27% for adults), the percent of effort for both life stages is significantly less than the percent of scallop effort over areas with 6 or more EFH designations for species with vulnerable EFH and it appears that intense scallop fishing effort favors areas with lower EFH ranks for both juvenile and adult stages as compared to the entire NAAA. Scallop fishing time in rotational management areas for 1998-2000 is distributed very similarly to the areas with "all scallop fishing", in terms of percent of effort in areas with vulnerable EFH. The percent of area for scallop fishing time in rotation management areas over EFH for 6 or more juvenile species with vulnerable EFH is 47%, and 34% overlap for adult species.

For FY2004 (with or without access to Georges Bank), the percent of area for scallop effort that overlaps with 6 or more juvenile species with vulnerable EFH increases compared to the historical scallop fishing effort within RMAs (1998-2000 baseline). On the other hand, the percent of area for scallop effort over adult EFH designations (6 or more) is less than the baseline average for effort in RMAs. The only projection estimate that has less effort over areas with 6 or more EFH designations, as compared to the baseline amount of effort in RMAs, is the 2005-2007 estimates with access to Georges Bank. The long-term averages with Georges Bank access are higher than the baseline in terms of percent of area that overlaps with 6 or more EFH designations for both adults and juveniles. According to the analysis, effort under a rotational area management strategy has a bias toward areas having more than 6 EFH designations for species with vulnerable EFH, since the percent of projected effort over these areas increases with all projections, except for the 2005-2007 with access to Georges Bank.

Bedrock, gravel, and gravelly sand are considered more complex than the other three sediment types in the data set. Since bedrock is such a small percentage of the total area, only gravel and gravelly sand have been included in the summary table below. A very small percentage of historic and projected scallop effort for each of the categories occurs over areas with gravel substrate (Table 262). About 15% of historic scallop effort (all, intense, and in RMAs) is in areas that are considered to be gravelly sand bottom. All of the projected effort values estimated for 2004, 2005-2007, and the long-term projections are in areas with less gravelly sand bottom than in the scallop effort within RMAs for 1998-2000 (15.3%). For example, the percent of area over gravelly sand bottom in RMAs for 1998-2000 was 15.3%, and the percent of area that is projected to contain scallop effort in the long-term within RMAs with access to Georges Bank is only 8.5%. Therefore, rotation area management is projected to shift effort onto less complex sediment types such as sand, with each of the projected rotational management area time periods (2004, 2005-2007, and long-term). For example, 15.3% of intense scallop fishing time is over gravelly sand bottom, while the percent of projected scallop effort in all three time periods ranges from 8.5% to 14.7%.

Table 262 – Comparison of percent of area in NAAA and percent of effort for historic baselines and rotation management area projections.

Note: It was realized later that the EFH values for juvenile whiting was inadvertently left out of this analysis. The values in this table would not change significantly with or without whiting EFH values because the EFH distribution of juvenile EFH is very widespread .

	Percent of area or fishing area swept within boundaries of EFH sediment classification		Percent of area or fishing area swept meeting EFH designation criterion	
			Juvenile	Adult
	Gravel	Gravelly sand	6 or more species	6 or more species
EFH Designation area (Total NAAA)	0.5%	5.2%	47.0%	42.6%
Historic baselines				
All scallop fishing time	0.5%	14.8%	47.6%	34.9%
Scallop fishing time in square nautical mile blocks with 50+hours of annual fishing time (“intense” scallop fishing)	0.4%	15.9%	37.8%	27.3%
Scallop fishing time in rotation management areas (1998 - 2000 Baseline; 2002 = 6,773 nm^2; 2003 = 7,485 nm^2)	0.7%	15.3%	47.0%	33.9%
Rotation management area projections				
2004 without Georges Bank access (5,395 nm^2)	0.6%	11.3%	52.9%	28.0%
2004 with Georges Bank access (3,892 nm^2)	0.6%	14.7%	52.8%	31.4%
2005 - 2007 with Georges Bank access (5,070 nm^2)	0.8%	8.5%	42.8%	22.6%
Long-term averages with Georges Bank access (10,119 nm^2)	0.8%	12.8%	57.0%	36.6%

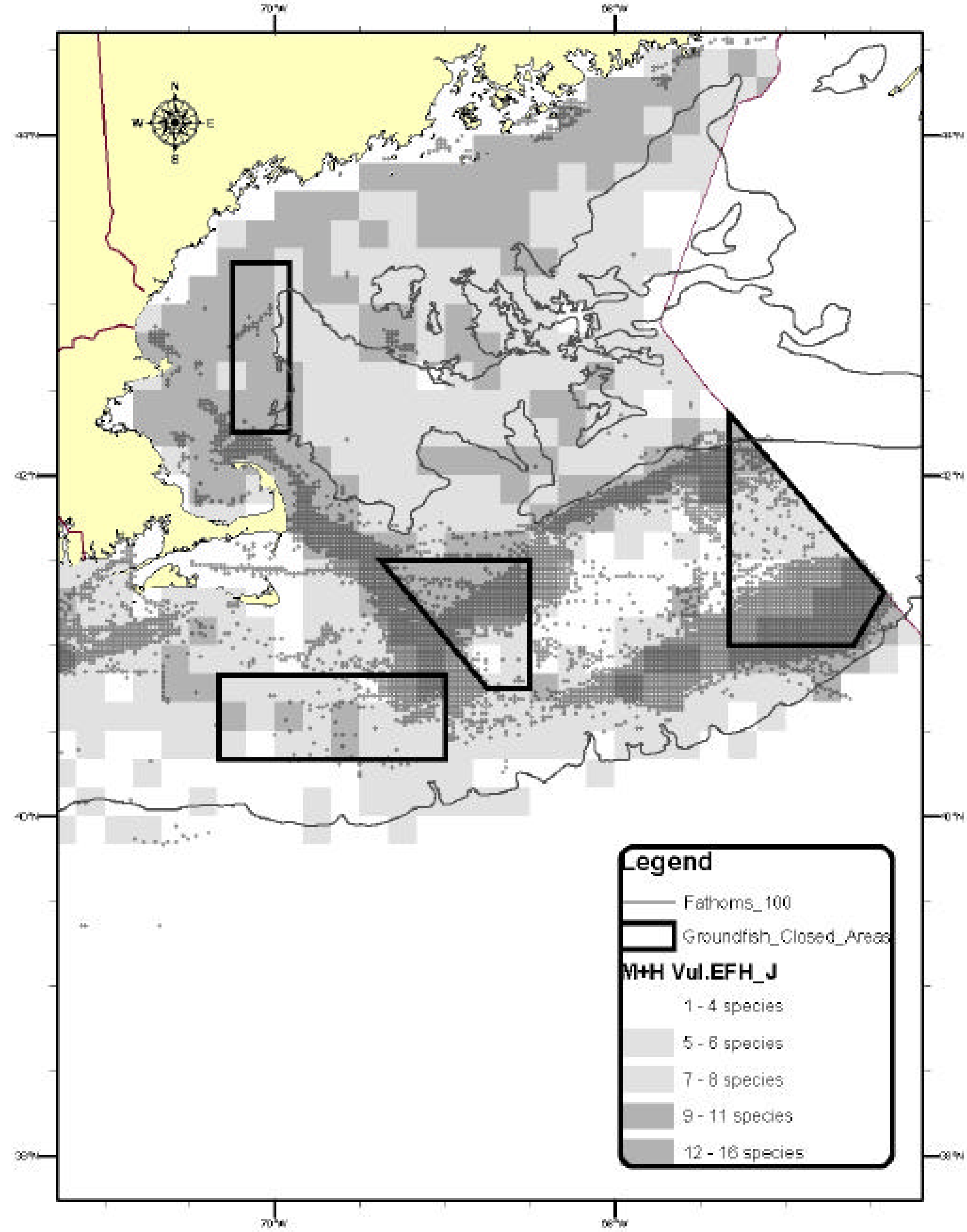
Map 64 and Map 65 show the overlap of all scallop fishing effort in 1998-2000 and the ten-minute squares with vulnerable juvenile EFH. The squares with nine or more EFH designations are shaded darker than the rest, and there does not seem to be as much direct scallop effort over these areas. According to Map 64, the majority of the effort in the Gulf of Maine region is distributed in the Great south channel and the southern portion of Closed Area II; these areas also have more juvenile EFH designations than the other areas (over 9 species in each ten-minute square). It is important to keep in mind that scallop vessels were only permitted inside the Framework 13 Access Areas of the groundfish mortality closures (the southern portion of Closed Area II, the middle of Closed Area I, and the northeast corner of the Nantucket Lightship closure) for some of the time during 1998-2000. Therefore, the effort is distributed differently depending on what areas were available to the scallop fleet. According to Map 65, the effort is more evenly distributed throughout the Mid-Atlantic region, but there are fewer ten-minute squares with over 9 juvenile EFH designations for species with vulnerable EFH. In fact, there are only about 15 ten-minute squares in this entire region that have over 9 juvenile EFH designations for species with vulnerable EFH.

Total fishing time, plotted in Map 64 and Map 65, can be a little misleading, however. Fishing time was determined from the number of 30-minute successive VMS pollings for a vessel that were 5 or less nautical miles apart from one another. Some of the fishing effort locations, plotted in Map 64 and Map 65 represent a mischaracterization of the VMS data as 'fishing'. For example, these data include times when vessels might be steaming slowly or making turns within the 30-minute intervals. The also include cooperative research trips that were conducted within areas otherwise closed to scallop fishing.

Examples in Map 64 of effort data that is probably not scallop fishing are points that are near New Bedford, MA (a major scallop port) and points running through Nantucket Sound, an important transit area for scallop boats from New Bedford. Also, closed portions of the Georges Bank groundfish areas include recorded VMS points from scallop vessels conducting research or surveys, as well as transiting. On the other hand, fishing effort points inside of Cape Cod Bay, on Stellwagen Bank, north of Cape Ann, MA on Fippinees Bank in the Gulf of Maine and along coastal Maine are accurate.

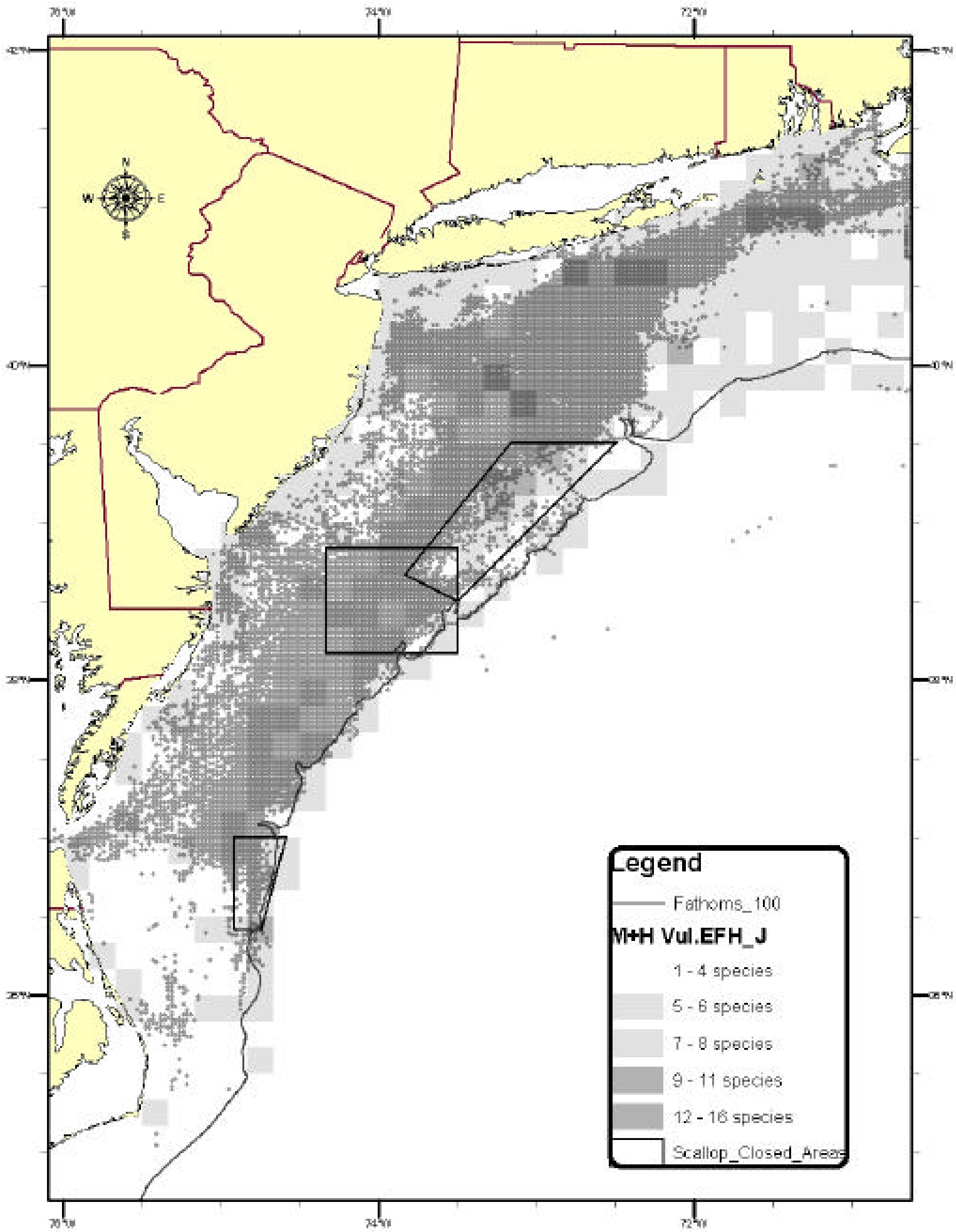
Examples in Map 65 of effort data that is probably not scallop fishing are points offshore of Oregon Inlet, NC; off of Chesapeake Bay, off Ocean City, MD and Cape May, NJ. Also points appear in the Hudson Canyon and VA/NC Areas which came from scallop vessels authorized to do research or special surveys during the time period (1998 – 2000). Because of uniform shading for EFH comparisons, these data represent low amounts of fishing time that cannot be distinguished from actual scallop fishing activity.

Map 66 and Map 67 depict the areas of *intense* scallop effort overlapped with vulnerable juvenile EFH. Intense is defined as areas of one nautical mile blocks that have more than 50 hours of scallop fishing time. Once again, in the Gulf of Maine, most of the intense effort in 1998-2000 was in the Great south channel and the southern portion of Georges Bank (Map 66). In the Mid-Atlantic region, the intense scallop effort is not in areas with over 9 EFH designations of species with juvenile EFH vulnerable to bottom tending gear, very few of these areas overlap spatially (Map 67).



Map 64. Overlap of direct scallop effort in 1998-2000 with juvenile EFH designations for species with EFH vulnerable to bottom tending gear (Gulf of Maine region only).

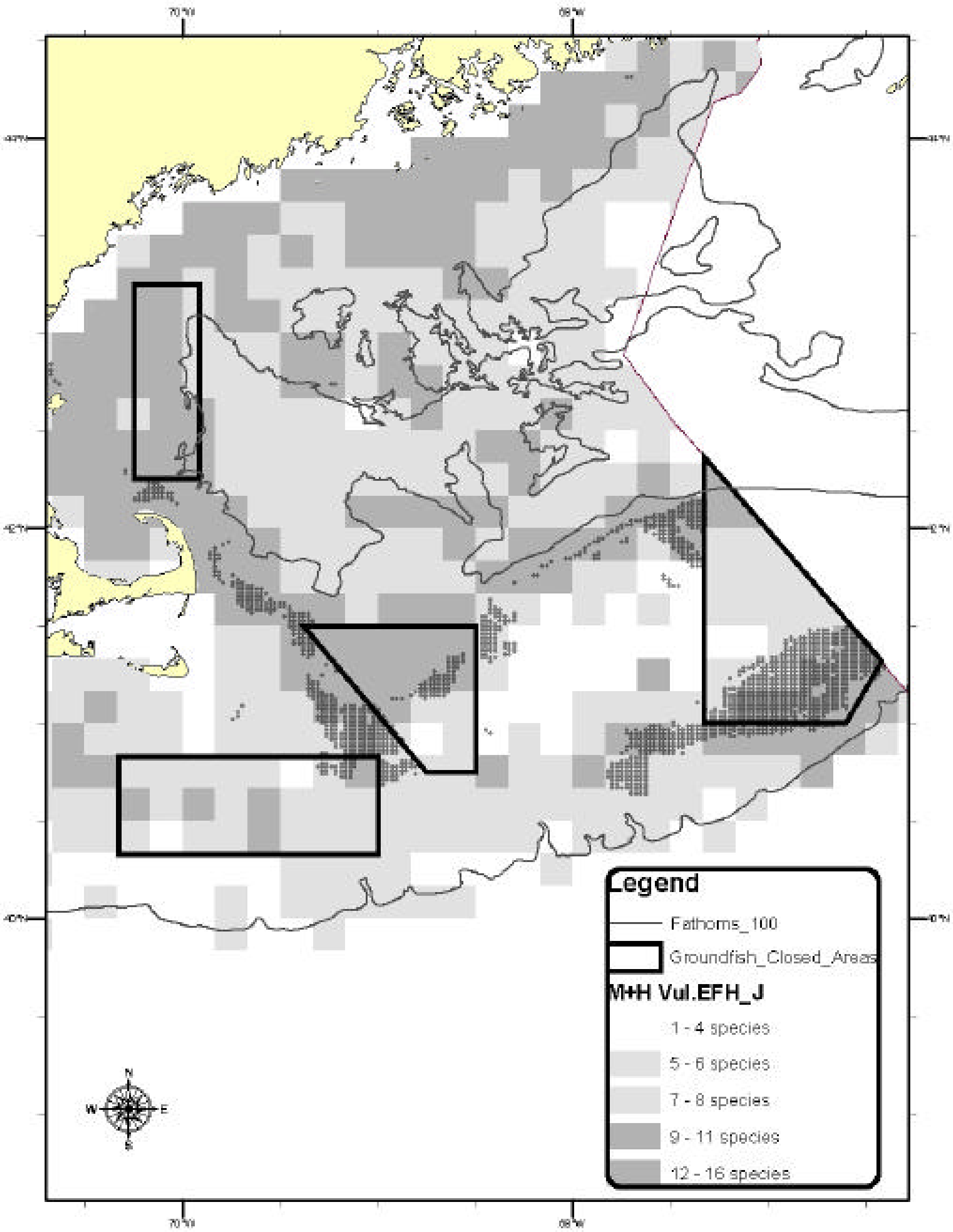
Note: Dots represent 1 nmi2 squares with >50 hours of fishing effort per year.
EFH designations are broken down into 5 categories in the legend, but for display purposes the map only has three categories (1-4 species (white), 5-8 species (light gray), and 9-16 species (dark gray)).



Map 65. Overlap of direct scallop effort in 1998-2000 with juvenile EFH designations for species with EFH vulnerable to bottom tending gear (Mid-Atlantic region only).

Note: Dots represent 1 nmi2 squares with >50 hours of fishing effort per year.

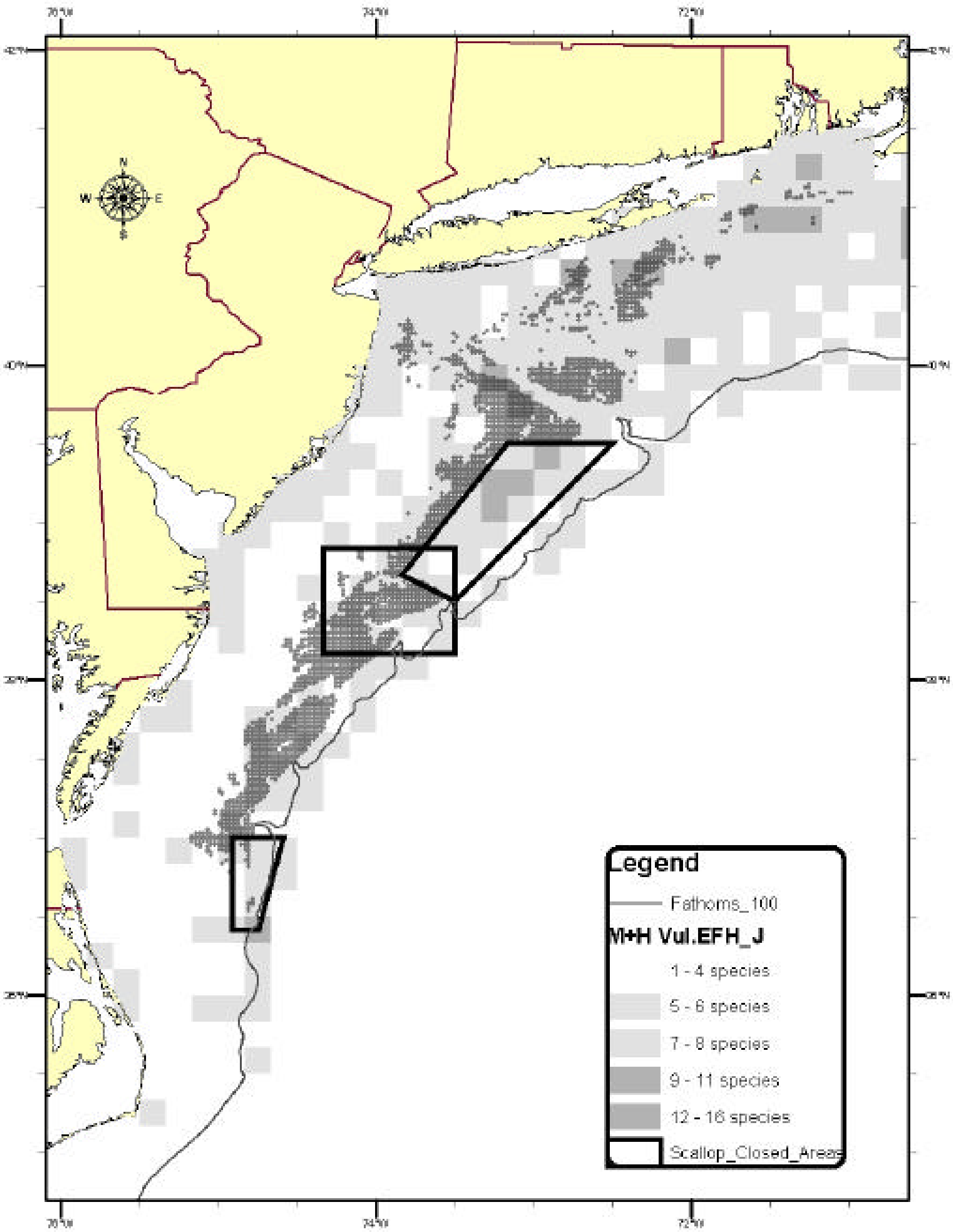
EFH designations are broken down into 5 categories in the legend, but for display purposes the map only has three categories (1-4 species (white), 5-8 species (light gray), and 9-16 species (dark gray)).



Map 66. Overlap of INTENSE scallop effort in 1998-2000 with juvenile EFH designations for species with EFH vulnerable to bottom tending gear (Gulf of Maine region only).

Note: Dots represent 1 nmi2 squares with >50 hours of fishing effort per year.

EFH designations are broken down into 5 categories in the legend, but for display purposes the map only has three categories (1-4 species (white), 5-8 species (light gray), and 9-16 species (dark gray)).



Map 67. Overlap of INTENSE scallop effort in 1998-2000 with juvenile EFH designations for species with EFH vulnerable to bottom tending gear (Mid-Atlantic region only).

Note: Dots represent 1 nmi2 squares with >50 hours of fishing effort per year.

EFH designations are broken down into 5 categories in the legend, but for display purposes the map only has three categories (1-4 species (white), 5-8 species (light gray), and 9-16 species (dark gray)).

The effort distribution under a rotational management area plan will shift into specific areas. The overlap of effort and EFH has been analyzed for fishing year 2004, 2005-2007, and the long-term projections for each area. For 2004 without access to Georges Bank, more effort is expected in GB2, GB6, and MA7-9, where sand sediments predominate. GB2 and GB6 have above average number of juvenile EFH designations, averaging 8 to 10 species per ten-minute square (compared to a mean of 6.8 for all rotation management areas). GB2 has above average number of adult EFH designations (10.5 vs. 5.8 species per ten-minute square for all rotation management areas). For more information on the percent of EFH in each rotation management area by individual species, please refer to Table 264 to Table 266.

For the 2005-2007 time period, more effort is expected in GB6, GB7, MA5, MA6, MA8, and MA9 are expected to have more effort than the historical average, particularly MA5 and MA6 (200% increase). Like 2004, the rotation management areas where higher effort is expected have predominately sand substrates. The number of EFH designations per ten-minute square is slightly higher than average in GB6 and GB7 for both juvenile and adult life stages of vulnerable species.

For the long term, the analysis predicts that GB1, GB2, GB5, GB6, GB7, MA5, MA8, and MA9 will have increased effort levels. The majority of these rotation management areas are predominately sand, with the exception of GB2, which is 50% sand, 45% gravelly sand and 3% gravel. GB1 and GB2 exhibit higher than average number of EFH designations per ten-minute square for both juvenile and adult life stages, roughly 10 to 12 species per ten-minute square. GB7 also has a higher than average number of adult EFH destinations per ten-minute square (9.0).

8.5.7.2.1.2 Sediment and EFH contained within RMA's

The sediment and EFH characteristics of the rotational management areas (RMA's) have been compiled for descriptive purposes. The distribution of sediment types contained within the 24 RMA's is described in Table 263. Furthermore, the percent of EFH contained within each RMA for species and life stages that have been determined to have EFH vulnerable to the bottom tending mobile gear have been calculated. Table 264 provides percent EFH values for the rotational areas in the Mid-Atlantic, while Table 265and Table 266 provide the same information for the rotational management areas on Georges Bank.

RMA	Size (nm^2)	Bedrock		Gravel		Gravely Sand		Sand		Muddy Sand		Mud	
		%	nm^2	%	nm^2	%	nm^2	%	nm^2	%	nm^2	%	nm^2
MA1	800	0.0	0	0.0	0	1.5	12	80.6	645	1.0	8	16.8	135
MA2	868	0.0	0	0.0	0	0.0	0	71.5	621	8.6	75	19.9	173
MA3	1433	0.0	0	0.0	0	0.0	0	83.3	1195	1.5	21	15.2	218
MA4	1659	0.0	0	0.0	0	0.0	0	69.4	1154	1.5	24	29.1	483
MA5	2124	0.0	0	0.0	0	0.1	3	90.7	1924	5.6	118	3.6	77
MA6	2058	0.0	0	3.4	69	8.9	181	86.3	1771	0.1	1	1.4	29
MA7	2897	0.0	0	0.0	0	10.5	304	76.5	2224	11.1	323	1.9	55
MA8	2465	0.0	0	0.0	0	2.3	57	97.6	2405	0.1	3	0.0	0
MA9	1830	0.0	0	0.0	0	1.2	21	67.9	1239	30.3	558	0.5	10
GB1	467	0.0	0	0.0	0	6.3	29	51.1	239	26.2	122	16.4	76
GB2	459	0.0	0	2.7	12	45.2	207	49.1	225	3.1	14	0.0	0

RMA	Size (nm²)	Bedrock		Gravel		Gravely Sand		Sand		Muddy Sand		Mud	
		%	nm²	%	nm²	%	nm²	%	nm²	%	nm²	%	nm²
GB3	504	0.0	0	0.2	1	43.7	220	56.1	283	0.0	0	0.0	0
GB4	905	0.0	0	3.2	29	21.5	194	75.2	682	0.0	0	0.0	0
GB5	1701	0.0	0	0.0	0	2.6	45	96.7	1646	0.6	11	0.0	0
GB6	849	0.0	0	0.0	0	1.1	10	90.6	769	8.1	68	0.2	1
GB7	801	0.0	0	4.0	32	13.1	105	80.3	644	0.0	0	2.6	21
GB8	749	0.0	0	0.0	0	16.5	124	82.5	619	0.0	0	1.0	7
GB9*	357	0.0	0	1.5	5	48.9	174	49.6	177	0.0	0	0.0	0
GB10*	395	0.0	0	3.9	15	56.5	223	39.6	157	0.0	0	0.0	0
GB11*	398	0.0	0	0.0	0	36.9	147	63.1	252	0.0	0	0.0	0
GB12*	330	0.0	0	1.3	4	46.3	153	52.4	173	0.0	0	0.0	0
GB13*	1488	0.0	0	0.0	0	0.0	0	81.9	1222	17.0	253	1.1	16
GB14*	1124	0.0	0	0.4	4	4.1	46	95.5	1074	0.0	0	0.0	0
GB15*	873	0.0	0	0.0	0	21.2	184	78.8	687	0.0	0	0.0	0

*indicates RMA inside current groundfish year-round closed area.

Table 263. Total area and distribution of each sediment type contained within each of the rotational management areas (in percent and square nautical miles).

The rotational management areas in the Mid-Atlantic region range from roughly 800-2900 nm². By far the majority of these areas are made up of sandy bottom. The rotational management areas on Georges Bank range from roughly 330-1700 nm². The RMA's on Georges Bank are more diverse in terms of sediment type, but sand is still a significant portion of each area. None of the RMA's on Georges Bank contain bedrock, and only five of them are made up of one to four percent of gravel. A significant number of the RMA's on Georges Bank do contain gravelly sand; for example, over 40% of GB2, GB3, GB9, GB10, and GB12 are gravelly sand. GB14 and GB15 make up Closed Area II, and these areas are primarily sandy bottom. Furthermore, GB9, GB10 and GB11 make up Closed Area I, and these areas are mostly sand and gravelly sand. The Nantucket Lightship closed area is made up of GB12 and GB13, and according to the analysis GB 12 is mostly sand and gravelly sand while GB13 is mostly sand and muddy sand.

The percentage of EFH contained within each of the RMA's was also calculated for descriptive purposes. Table 264 describes the percent of EFH contained within each of the RMA's for species that have been determined to have EFH vulnerable to bottom tending gear. MA7 and MA8 contain a significant portion of juvenile Scup, Yellowtail flounder, and Winter flounder EFH. Furthermore, MA6, MA7, MA8, and MA9 contain a substantial portion of Ocean pout EFH for all three life stages (egg, larvae, and adult).

Table 264. Percent of EFH contained within each rotational management area in the Mid-Atlantic region as compared to the entire Northwest Atlantic Analysis Area (for species that have been identified as having EFH vulnerable to bottom tending gear)

	Rotational Management Areas in the Mid-Atlantic								
	MA1	**MA2**	**MA3**	**MA4**	**MA5**	**MA6**	**MA7**	**MA8**	**MA9**
AREA (nm2)	**800**	**868**	**1433**	**1659**	**2124**	**2058**	**2897**	**2465**	**1830**
American Plaice (A)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
American Plaice (J)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Atlantic Halibut (A)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Atlantic Halibut (J)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barndoor Skate (A)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Barndoor Skate (J)	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1.7	3.0
Black Sea Bass (A)	1.3	1.7	6.7	4.4	5.6	5.1	9.5	3.0	2.3
Black Sea Bass (J)	1.5	1.1	2.7	1.6	2.8	1.8	7.1	3.7	5.5
Clearnose Skate (A)	3.8	2.6	3.1	1.0	1.6	1.9	2.2	0.5	0.7
Clearnose Skate (J)	3.9	2.9	3.4	2.1	0.4	2.4	1.6	0.7	0.4
Cod (A)	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2
Cod (J)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haddock (A)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haddock (J)	0.0	0.0	0.0	0.3	0.7	1.3	1.6	0.7	1.0
Little Skate (A)	0.4	0.3	1.2	0.9	2.6	2.6	4.9	4.9	3.9
Little Skate (J)	0.6	1.2	2.2	2.3	3.4	3.4	4.6	4.1	3.1
Ocean Pout (A)	0.0	0.0	0.0	0.2	1.7	4.3	6.8	6.9	5.2
Ocean Pout (E)	0.0	0.0	0.0	0.2	2.0	21.6	5.9	5.7	4.3
Ocean Pout (J)	0.0	0.0	0.0	0.0	2.0	5.1	7.7	7.7	5.3
Pollock (A)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Red Hake (A)	0.3	0.1	0.9	1.8	1.8	1.5	4.0	3.2	3.4
Red Hake (J)	0.4	0.7	0.6	0.9	1.7	2.6	4.2	4.0	3.3
Redfish (A)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Redfish (J)	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
Rosette Skate (A)	0.0	0.0	0.0	0.0	0.0	0.0	10.2	0.0	0.6
Rosette Skate (J)	7.3	6.1	8.8	8.8	8.8	5.7	4.3	3.6	0.0
Scup (J)	1.9	1.4	0.5	0.0	2.8	2.6	5.4	6.5	3.9
Silver Hake (J)	0.1	0.2	1.1	1.3	2.3	3.0	3.9	3.9	3.0
Smooth Skate (A)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Smooth Skate (J)	0.2	0.0	0.0	0.2	0.0	0.0	0.2	0.2	0.0
Thorny Skate (A)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thorny Skate (J)	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0
Tilefish (A)	2.6	3.2	0.0	0.0	0.0	0.0	7.7	0.0	0.0
Tilefish (J)	0.0	0.0	5.4	2.7	5.4	0.0	1.6	5.4	2.5
White Hake (J)	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.3	0.3
Winter Flounder (A)	0.0	0.0	0.0	0.3	1.0	2.2	5.6	4.3	2.5
Winter Skate (A)	0.0	0.0	0.8	0.8	1.8	2.7	4.1	3.3	2.5
Winter Skate (J)	0.3	0.2	0.5	1.3	1.9	3.1	4.6	3.9	3.3
Witch Flounder (A)	0.0	0.4	0.3	0.0	0.0	0.0	0.3	0.3	0.3
Witch Flounder (J)	1.1	1.4	1.7	2.1	1.3	0.1	1.3	0.2	0.9
Yellowtail Flounder (A)	0.0	0.0	0.0	0.3	2.5	5.3	8.1	7.4	5.0
Yellowtail Flounder (J)	0.0	0.0	0.3	0.6	4.5	6.5	8.1	7.5	4.4

The percent of EFH contained in the Georges Bank RMAs is obviously more than the percent of EFH contained in the Mid-Atlantic RMAs. For example, almost five percent of Atlantic halibut juvenile and adult EFH is contained in GB7. Adult and juvenile Barndoor skate have a significant portion of their

EFH in GB5. Closed area II (GB14 and GB15) contains more cod and haddock EFH than most of the other RMA's on Georges Bank, in terms of percent inside the RMA versus the entire analysis area. GB5 seems to contain more EFH than the other areas in the region, but note that it is significantly larger than the other RMA's on Georges Bank.

Table 265. Percent of EFH contained within each of the (1 through 10) rotational management areas in the Georges Bank region as compared to the entire Northwest Atlantic Analysis Area (for species that have been identified as having EFH vulnerable to bottom tending gear)

	Rotational Management Areas on Georges Bank (1-10)									
	GB1	**GB2**	**GB3**	**GB4**	**GB5**	**GB6**	**GB7**	**GB8**	**GB9***	**GB10***
AREA (nm^2)	**467**	**459**	**504**	**905**	**1701**	**849**	**801**	**749**	**357**	**395**
American Plaice (A)	1.55	0.49	0.03	0.00	0.00	0.31	0.85	0.80	0.82	0.00
American Plaice (J)	1.94	0.57	0.00	0.00	0.00	0.00	0.98	0.93	0.95	0.00
Atlantic Halibut (A)	1.66	1.26	1.80	0.62	0.66	0.00	4.91	0.42	1.51	0.31
Atlantic Halibut (J)	1.66	1.26	1.80	0.62	0.66	0.00	4.91	0.42	1.51	0.31
Barndoor Skate (A)	0.00	1.49	0.00	1.52	6.57	2.98	0.03	1.48	0.00	0.00
Barndoor Skate (J)	0.24	1.12	0.44	2.96	8.14	4.58	1.59	1.96	2.03	1.13
Black Sea Bass (A)	0.61	0.22	0.00	0.00	0.54	0.00	0.23	0.00	0.00	0.00
Black Sea Bass (J)	0.48	1.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Clearnose Skate (A)	0.00	0.10	0.00	0.00	0.00	0.00	0.05	0.57	0.59	0.00
Clearnose Skate (J)	0.42	0.42	0.42	0.00	0.00	0.00	0.04	0.47	0.48	0.00
Cod (A)	1.29	1.36	1.49	1.31	1.37	0.57	2.38	2.23	1.06	1.16
Cod (J)	1.20	2.24	2.45	2.44	1.90	1.09	2.64	1.86	0.52	0.93
Haddock (A)	1.53	0.95	0.76	1.31	1.16	0.62	1.53	1.51	1.28	1.41
Haddock (J)	1.56	1.41	1.24	2.55	5.41	3.02	2.17	1.63	1.49	0.78
Little Skate (A)	0.40	0.99	1.14	2.06	3.75	1.87	1.84	1.57	0.82	0.91
Little Skate (J)	0.36	0.76	0.86	1.54	2.88	1.42	1.38	1.28	0.61	0.67
Ocean Pout (A)	1.26	1.46	1.10	2.10	4.40	2.34	1.28	1.64	1.13	1.24
Ocean Pout (E)	1.03	1.20	0.90	1.73	3.62	1.92	1.05	1.35	0.93	1.02
Ocean Pout (J)	1.46	0.81	0.27	0.00	1.28	0.61	0.00	0.00	0.38	0.52
Pollock (A)	1.37	1.45	1.74	0.21	0.31	0.00	2.06	0.68	0.60	0.36
Red Hake (A)	1.14	0.28	0.17	0.73	3.06	2.03	0.68	0.82	0.77	0.09
Red Hake (J)	0.88	0.14	0.87	1.82	2.86	1.44	1.59	1.38	0.73	0.65
Redfish (A)	1.39	0.60	0.65	0.24	0.24	0.88	1.39	0.77	0.89	0.00
Redfish (J)	1.25	0.56	0.39	0.14	0.91	1.38	1.26	0.56	0.42	0.08
Rosette Skate (A)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rosette Skate (J)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Scup (J)	0.66	0.56	0.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Silver Hake (J)	0.77	0.12	0.24	0.92	2.74	0.52	1.21	1.09	0.61	0.32
Smooth Skate (A)	2.18	0.69	0.79	0.00	0.00	0.37	1.24	1.50	1.43	0.23
Smooth Skate (J)	1.46	1.05	0.92	0.01	0.65	1.28	1.21	0.90	0.79	0.13
Thorny Skate (A)	1.88	1.38	0.90	0.49	0.00	0.68	1.63	1.28	1.36	0.33
Thorny Skate (J)	1.17	1.14	0.90	0.88	2.42	1.97	1.53	1.15	0.83	0.50
Tilefish (A)	0.00	0.00	0.00	0.00	6.08	0.00	0.00	0.00	0.00	0.00

	Rotational Management Areas on Georges Bank (1-10)									
	GB1	**GB2**	**GB3**	**GB4**	**GB5**	**GB6**	**GB7**	**GB8**	**GB9***	**GB10***
AREA (nm^2)	**467**	**459**	**504**	**905**	**1701**	**849**	**801**	**749**	**357**	**395**
Tilefish (J)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
White Hake (J)	1.64	0.71	0.75	1.19	1.94	0.78	1.98	1.40	0.99	0.13
Winter Flounder (A)	0.58	1.85	2.13	1.71	0.16	0.00	2.23	2.38	1.15	1.51
Winter Skate (A)	0.95	1.54	1.68	2.48	3.14	0.78	2.57	2.48	1.13	1.31
Winter Skate (J)	0.85	0.98	1.07	1.91	3.40	1.61	1.73	1.61	0.76	0.84
Witch Flounder (A)	1.13	0.09	0.00	0.29	1.55	0.73	0.78	0.73	0.00	0.00
Witch Flounder (J)	1.05	0.00	0.00	0.42	0.10	0.69	0.30	0.08	0.00	0.00
Yellowtail Flounder (A)	0.91	0.93	1.07	3.29	4.04	1.95	1.12	0.87	1.25	1.45
Yellowtail Flounder (J)	1.05	1.07	1.23	3.16	4.66	2.90	1.29	1.00	1.10	1.09

*indicates RMA inside current groundfish year-round closed area.

Table 266. Percent of EFH contained within each of the (11 through 15) rotational management areas in the Georges Bank region as compared to the entire Northwest Atlantic Analysis Area (for species that have been identified as having EFH vulnerable to bottom tending gear)

Rotational Management Areas on Georges Bank (11-15)					
	GB11*	**GB12***	**GB13***	**GB14***	**GB15***
AREA (nm^2)	**398**	**330**	**1488**	**1124**	**873**
American Plaice (A)	1.59	0.00	0.00	0.33	1.16
American Plaice (J)	1.52	0.00	0.00	0.00	0.22
Atlantic Halibut (A)	0.70	0.00	1.23	0.01	1.50
Atlantic Halibut (J)	0.70	0.00	1.23	0.01	1.50
Barndoor Skate (A)	0.00	2.33	3.61	1.49	2.92
Barndoor Skate (J)	1.61	1.33	5.34	4.26	3.02
Black Sea Bass (A)	0.00	0.00	1.11	0.00	0.00
Black Sea Bass (J)	0.03	0.00	1.08	0.00	0.00
Clearnose Skate (A)	1.36	0.00	0.00	0.00	0.31
Clearnose Skate (J)	1.19	0.00	0.00	0.00	0.00
Cod (A)	1.18	0.56	0.32	2.30	2.38
Cod (J)	1.26	0.37	2.54	2.60	3.19
Haddock (A)	1.43	0.68	0.11	2.97	2.88
Haddock (J)	1.73	0.66	0.64	4.22	2.32
Little Skate (A)	0.27	0.75	3.39	2.58	1.91
Little Skate (J)	0.58	0.56	2.52	1.92	1.42
Ocean Pout (A)	1.02	0.80	4.16	2.63	2.24
Ocean Pout (E)	1.04	0.66	3.42	2.16	1.84
Ocean Pout (J)	0.87	0.27	1.76	1.10	0.39
Pollock (A)	1.10	0.17	0.13	0.33	0.33
Red Hake (A)	0.93	0.00	2.55	1.27	0.14
Red Hake (J)	0.81	0.31	2.45	1.68	1.40
Redfish (A)	1.24	0.00	0.00	0.00	0.61
Redfish (J)	1.13	0.00	0.22	0.06	0.66

Rotational Management Areas on Georges Bank (11-15)					
	GB11*	**GB12***	**GB13***	**GB14***	**GB15***
AREA (nm^2)	**398**	**330**	**1488**	**1124**	**873**
Rosette Skate (A)	0.00	0.00	0.00	0.00	0.00
Rosette Skate (J)	0.00	0.00	0.02	0.00	0.00
Scup (J)	0.00	0.00	3.19	0.00	0.00
Silver Hake (J)	0.56	0.45	2.48	1.45	1.26
Smooth Skate (A)	2.31	0.00	0.00	0.49	1.07
Smooth Skate (J)	1.28	0.24	0.24	0.22	0.59
Thorny Skate (A)	1.70	0.00	0.00	0.00	0.47
Thorny Skate (J)	0.99	0.33	0.78	1.29	1.63
Tilefish (A)	0.00	0.00	0.10	0.00	0.00
Tilefish (J)	0.00	0.00	0.05	0.00	0.00
White Hake (J)	1.08	0.26	1.83	1.53	0.95
Winter Flounder (A)	0.78	0.80	3.92	0.65	3.47
Winter Skate (A)	0.64	1.09	3.14	3.69	2.92
Winter Skate (J)	0.69	0.70	3.13	2.40	1.87
Witch Flounder (A)	0.57	0.00	1.72	0.00	0.17
Witch Flounder (J)	0.00	0.00	0.00	0.00	0.00
Yellowtail Flounder (A)	0.71	1.21	5.40	4.14	2.24
Yellowtail Flounder (J)	0.78	1.39	4.95	4.46	1.17

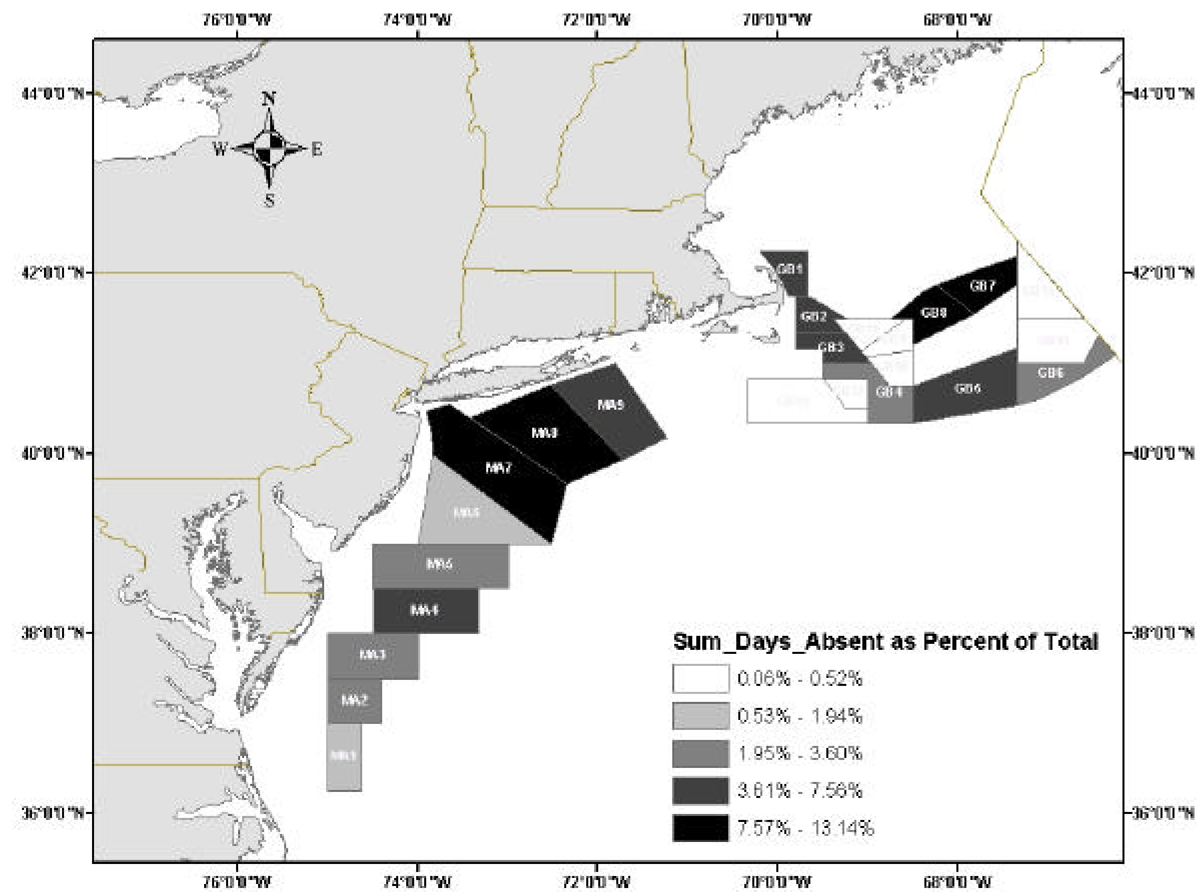
*indicates RMA inside current groundfish year-round closed area.

8.5.7.2.1.3 Baseline levels of otter trawl effort within RMA's

Rotational area management applies only to the scallop fishery. In order to qualitatively consider possible impacts to habitat through closure and re-opening of RMA's, it is critical to understand the level of non-scallop fishing pressure applied to these areas.

Otter trawl fishing pressure is highly variable throughout the RMA's, but it can generally be stated that intensity and frequency of otter trawling is greater in the Georges Bank areas than in the Mid Atlantic areas. While overall the Mid-Atlantic areas may see greater amounts of fishing days (Map 68), when scaled per-square-nautical-mile, the intensity of effort in the GB areas is clear (Table 267).

It can be inferred that the RMA's with the greatest amount of otter trawl fishing intensity will have see the smallest impacts from temporal and spatial changes in the scallop fishery.



Map 68. VTR data (1995 – 2001) for otter trawl trips reported inside the RMA's

Table 267. VTR data (1995 – 2001) for otter trawl trips reported inside the RMA's, Days Absent per square nautical mile.

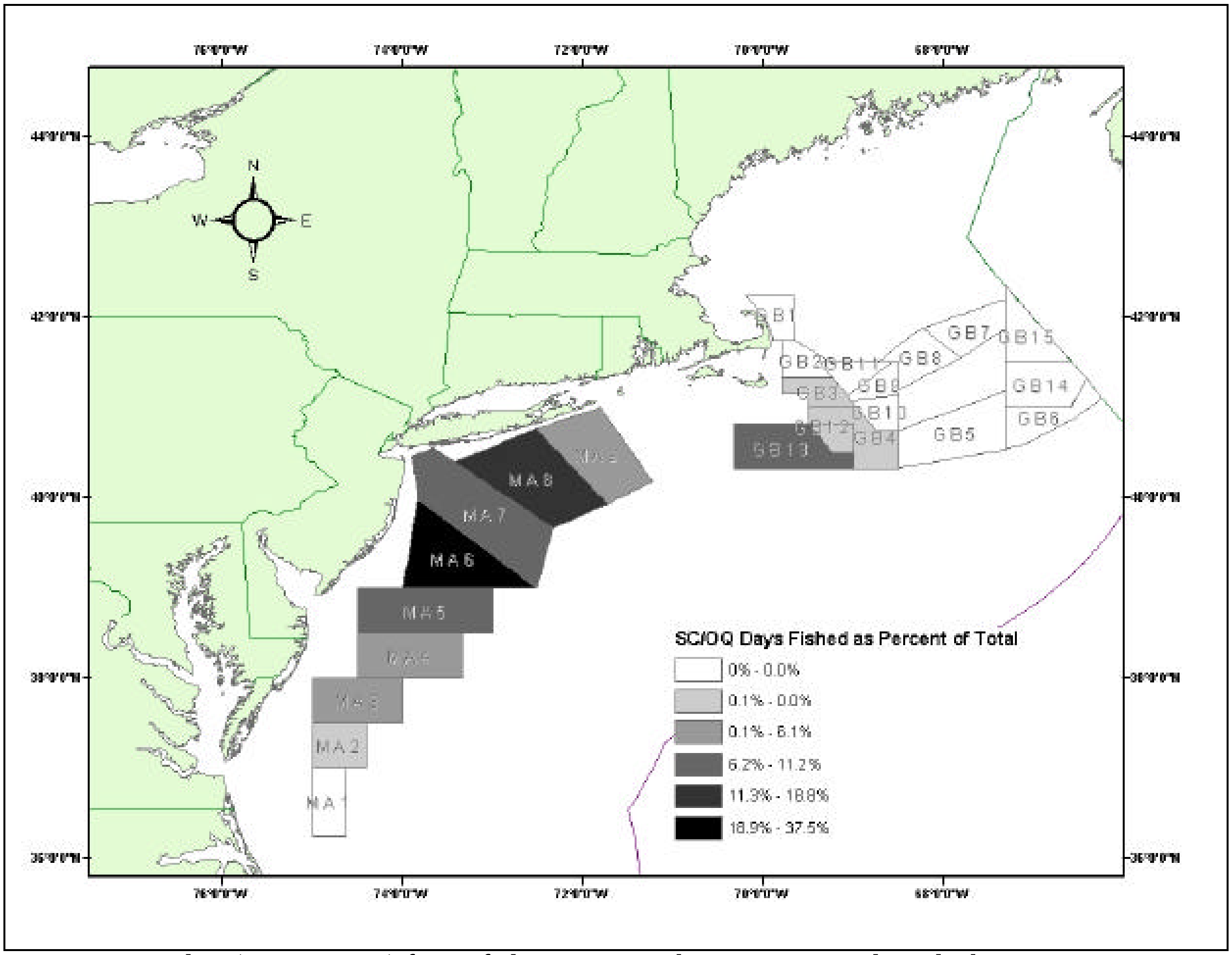
RMA	Avg. Days Absent Per Year (95-01)	Area (nm^2)	Avg DA/nm^2
MA1	299.6	800	0.3744
MA2	481.4	868	0.5546
MA3	466.8	1433	0.3257
MA4	976.7	1659	0.5887
MA5	653.4	2124	0.3076
MA6	332.8	2058	0.1617
MA7	2129.3	2897	0.7350
MA8	1488.5	2465	0.6038
MA9	1217.0	1830	0.6650
GB1	1146.1	467	2.4541
GB2	858.5	459	1.8703
GB3	1101.6	504	2.1858
GB4	429.9	905	0.4750
GB5	900.2	1701	0.5292

RMA	Avg. Days Absent Per Year (95-01)	Area (nm^2)	Avg DA/nm^2
GB6	467.9	849	0.5512
GB7	1565.6	801	1.9546
GB8	1545.4	749	2.0633
GB9*	67.5	357	0.1891
GB10*	15.5	395	0.0393
GB11*	84.6	398	0.2125
GB12*	10.3	330	0.0313
GB13*	79.5	1488	0.0534
GB14*	62.1	1124	0.0553
GB15*	70.0	873	0.0802

*Indicates RMA's wholly or partly inside current year-round closed areas

8.5.7.2.1.4 Baseline levels of clam dredge effort within RMA's

Surf Clam/Ocean Quahog fishing pressure is concentrated in the Mid Atlantic areas. This level of fishing pressure, however, is dramatically less (on a per-square-nautical-mile basis) than either scalloping or trawling. It can be inferred that the RMA's with the greatest amount of clam dredge fishing intensity will have see the smallest impacts from temporal and spatial changes in the scallop fishery.



Map 69. VTR data (1995 – 2001) for surf clam/ocean quahog trips reported inside the RMA's

	Avg. Days Fished Per Year (95-01)	Area (nm^2)	Avg DA/nm^2
All Surf Clam/Ocean Quahog Trips	2306.0	N/A	N/A
All SC/OQ Trips Inside RMA's	1546.6	27534	0.0562
MA 1	0.0	800	0.0000
MA 2	0.7	868	0.0008
MA 3	87.2	1433	0.0608
MA 4	30.4	1659	0.0183
MA 5	243.1	2124	0.1145
MA 6	623.2	2058	0.3028
MA 7	215.1	2897	0.0742
MA 8	308.6	2465	0.1252
MA 9	74.7	1830	0.0408
GB1	0.0	467	0.0000
GB2	0.0	459	0.0000
GB3	0.9	504	0.0018
GB4	0.3	905	0.0003

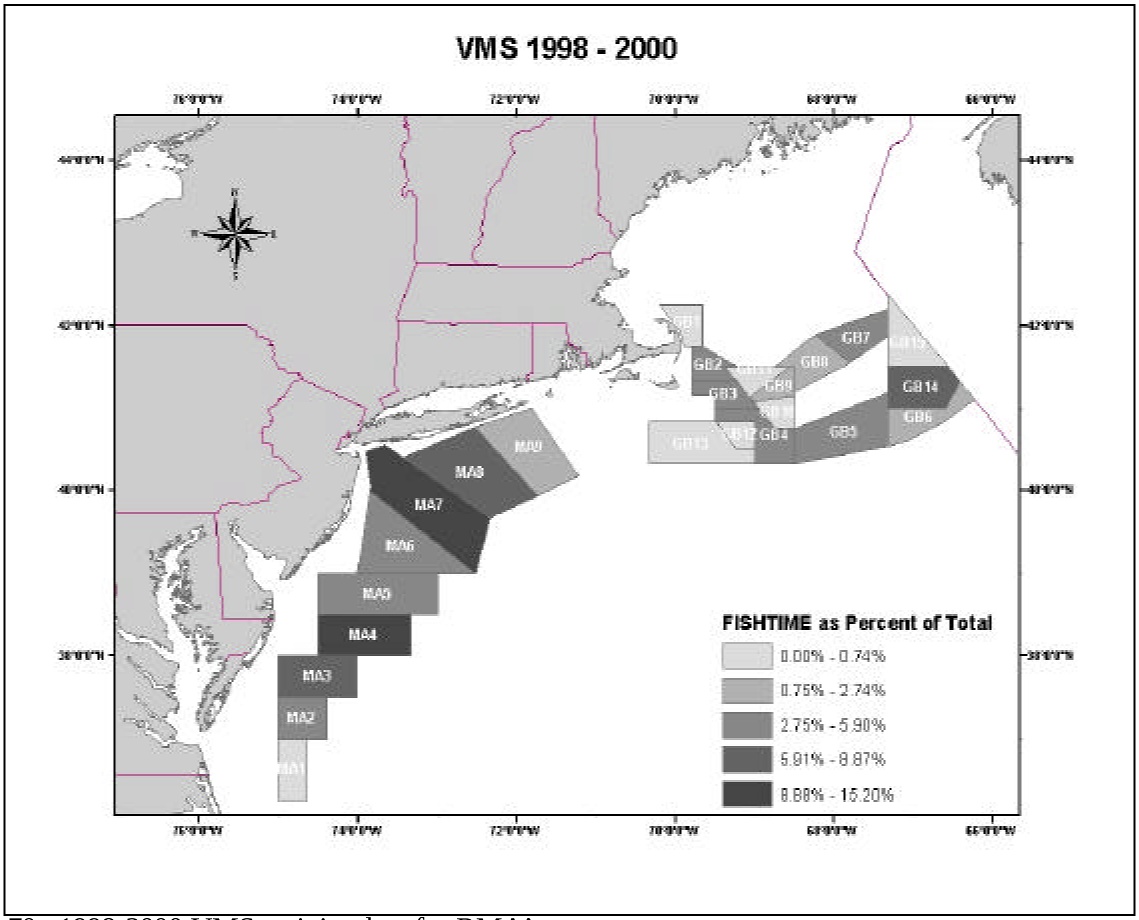
	Avg. Days Fished Per Year (95-01)	Area (nm^2)	Avg DA/nm^2
GB5	0.0	1701	0.0000
GB6	0.0	849	0.0000
GB7	0.0	801	0.0000
GB8	0.0	749	0.0000
GB9*	0.0	357	0.0000
GB10*	0.0	395	0.0000
GB11*	0.0	398	0.0000
GB12*	4.4	330	0.0134
GB13*	135.6	1488	0.0912
GB14*	0.0	1124	0.0000
GB15*	0.0	873	0.0000

*Indicates RMA's wholly or partly inside current year-round closed areas

Table 268. VTR data (1995 – 2001) for surf clam/ocean quahog trips reported inside the RMA's, Days Absent per square nautical mile.

8.5.7.2.1.5 Baseline levels of scallop dredge effort within RMA's

Scallop fishing activity is currently greatest in the mid-Atlantic RMA's. Closures of certain RMA's will trigger shifts in fishing effort that will centralize impacts on open and newly re-opened areas. Map 70 provides a gross-scale look at the amount of scalloping effort potentially displaced by closures of one or another RMA.



Map 70. 1998-2000 VMS activity data for RMA's.

NAME	Avg FishTime	Avg FishDays	area (nm^2)	Avg FishDays/nm^2
MA1	2839.8	145.6	1830	0.0796
MA2	19361.2	992.9	2465	0.4028
MA3	33953.6	1741.2	2897	0.6010
MA4	58216.1	2985.4	2058	1.4507
MA5	19875.3	1019.2	2124	0.4799
MA6	20883.6	1071.0	1659	0.6455
MA7	54453.0	2792.5	1433	1.9487
MA8	25716.4	1318.8	868	1.5193
MA9	8365.2	429.0	800	0.5362
GB1	2071.2	106.2	1488	0.0714
GB2	14258.8	731.2	330	2.2158
GB3	13347.0	684.5	1124	0.6090
GB4	22606.3	1159.3	873	1.3279
GB5	14631.0	750.3	395	1.8995
GB6	4540.4	232.8	398	0.5850
GB7	13655.2	700.3	357	1.9615
GB8	10475.7	537.2	749	0.7172
GB9*	7102.4	364.2	801	0.4547
GB10*	1505.5	77.2	849	0.0909

GB11*	341.0	17.5	1701	0.0103
GB12*	2722.6	139.6	905	0.1543
GB13*	16.7	0.9	504	0.0017
GB14*	31275.6	1603.9	459	3.4943
GB15*	693.5	35.6	467	0.0762

*Indicates RMA's wholly or partly inside current year-round closed areas

Table 269. VMS data (1998 – 2000) for scallop trips reported inside the RMA's, Average FishDays per square nautical mile. FishDays defined as FishTime (measured in hours) divided by 19.5.

	VTR 95-01 Avg Days Absent – Otter Trawl	VTR 95-01 Avg Days Absent – Clam Dredge	VMS 98-00 Avg Days Fishing – Scallop Dredge
All trips	51,669.1	2,306.0	16,498.4
Trips occurring inside RMA's	15,875.5	1,546.6	15,954.5
%	30.73%	67.06%	96.70%

Table 270. Summary table of Otter trawl (VTR), clam dredge (VTR) and scallop (VMS) trips inside and outside of the RMA's

8.5.7.2.2 Mechanical area rotation with fixed area boundaries

Four of the six rotational area management permutations employ fixed rotational area boundaries. These boundaries are included in Map 68 to Map 70.

8.5.7.2.2.1 Potential habitat impacts of mechanical area rotation with fixed boundaries

It is not possible at this time to draw conclusions regarding the habitat impacts of the effort shifts anticipated by rotational area management strategies. Closure options ranging from 3 years closed and 3 years open (3/3) to 5 years closed and 1 year open (5/1) are proposed. Based upon the information summarized in Section 8.2.1, it can be stated that longer-term closure options (5/1) offer a better chance of habitat recovery than shorter-term (3/3) scenarios. This conclusion is mitigated somewhat by the implications of data contained in Table 267, which show that certain RMA's are intensely fished and are not likely to benefit substantially even from longer-term closures to scallop gears.

The sensitivity and recovery rates of affected habitats are not known, but are significant factors in determining actual impacts of rotational management on habitat. It is generally believed that sandy, "high-energy" environments will recover faster from fishing impacts (NEREFHSC 2002). Such environments comprise large percentages of the MA RMA's as well as GB5, GB6, GB14, GB13 and GB12.

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

This alternative utilizes the same RMA's as described above. RMA closure durations range from 3/3 to 5/1 as well. With no currently defined closure scenarios, impacts to EFH are assumed to be identical.

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

This alternative utilizes the same RMA's as described above. Under this alternative, RMA's will open and close based upon pre-defined biological conditions. The minimum closure/opening time is 1 year, and there is no defined maximum. Impacts on habitat do not differ significantly from those summarized in Section 8.5.7.2.2.1.

	No Action Alt			Status Quo			Adaptive RAM		
	SweptAr	DAS	Land(MT)	**SweptAr**	DAS	Land(MT)	**SweptAr**	DAS	Land(MT)
2003	**5,871.8**	30,532.5	23,439.3	**5,871.8**	30,532.5	23,439.3	**5,871.8**	30,532.5	23,439.3
2004	**6,684.7**	30,686.0	24,566.9	**6,684.7**	30,686.0	24,566.9	**6,684.7**	30,686.0	24,566.9
2005	**1,281.4**	9,259.1	9,668.5	**7,632.5**	30,972.1	23,758.9	**2,243.9**	13,115.4	13,177.6
2006	**1,318.2**	9,285.5	9,650.2	**8,168.3**	30,304.7	20,653.0	**2,312.7**	11,746.0	11,419.4
2007	**1,467.2**	10,291.3	10,759.6	**9,151.3**	30,100.6	16,991.1	**2,637.1**	12,180.5	11,444.1
2008	**1,436.1**	10,308.5	10,867.9	**9,781.2**	30,780.9	17,285.9	**1,808.4**	13,110.8	13,582.8
Total:	**18,059.4**	100,363.0	88,952.4	**47,289.7**	183,376.9	126,695.1	**21,558.6**	111,371.2	97,630.0

Table 271. Projections based on this alternative reveal a significant decrease in swept area relative to the Status Quo.

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

See Habitat Alternative 13 for the habitat impacts of this alternative.

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

This alternative does not employ fixed boundaries for area closure. Criteria are set for minimum closure area sizes and maximum percentages of total fishing area/biomass closed to scalloping. However, no conclusions can be drawn regarding habitat impacts beyond the general statements in Sections 8.5.7.2.1 and Section 8.5.7.2.5.

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

This alternative relies on area-specific differential effort allocations, rather than area closures, to prevent targeting strong year classes. The concept of differential effort allocations may reduce localized overfishing and the consequent adverse impacts of localized high fishing intensity. It is unclear how effort allocations are likely to be made, which areas/habitat types would likely be affected, and how the effort allocations may change fishing patterns relative to the No Action Alternative, Status Quo, or Rotational area management alternatives. Therefore, specific impacts of this alternative on EFH cannot be assessed. Given the relatively constrained geographic range of the fishery, the impact of this alternative is not likely to be significantly different than the impacts of other management alternatives. This alternative is not expected to increase fishing intensity or frequency, nor are expansions of fishable bottom (aside from potential access to the year-round closed areas) expected.

8.5.7.2.8 Georges Bank access to groundfish closed areas

This alternative allows for periodic access to the current year-round closed areas, either as part of a rotational strategy (similar to past closed area access programs) or as a regular rotation management area. Three options are proposed under this alternative: access to all non-HAPC areas, access to areas opened by Framework Adjustment 13, and no access.

Access to the groundfish closed areas would reduce, to an unknown degree, benefits accrued over the duration of the area closures. These benefits have been mitigated by authorized surf clam/ocean quahog dredging in the NLCA as well as the Framework Adjustment 13 scallop access program, which permitted scalloping in portions of the NLCA, CAI and CAII. On the other hand, access to the groundfish closed areas has the potential to greatly reduce total fishing effort and area swept in other areas that may or may not have sensitive habitat. In general, the area access program is designed to reduce overall effort and area swept by fishing in areas where the scallop catch per tow is high. Summaries of the affected habitats, including the sediment and EFH contained inside these areas, can be found in Section 7.3.2.3.

Scallop biomass inside the closed areas has increased to the point where relatively little bottom contact time is required to capture a large amount of scallops. Swept area projections (Table 272) for scalloping inside these areas demonstrate that fishing in these areas, relative to fishing in less productive areas, would affect much less area per day spent fishing and metric ton harvested.

Table 272. Projected impacts of fishing inside current groundfish closed areas.

Year	CA region	Bms	CatchMT	LPUE	DAS	AreaSwpt (nm^2)
2005	CLII-S	33583	10348	2759	8258	292
2005	CLII-N	4373	1127	2130	1089	244
2005	CLI-Acc	8759	1082	2758	850	117
2005	CLI-S	27185	2430	2667	1893	82
2005	NLS-AR	23116	941	2835	686	37
2005	NLS	5719	1283	2297	1120	209
2005	**TOTAL**	**16453**	**17214**	**2724**	**13898**	**984**
2006	CLII-S	30184	9374	2817	7340	297
2006	CLII-N	4153	1050	2101	1051	242
2006	CLI-Acc	7569	918	2651	752	116
2006	CLI-S	24514	2160	2649	1715	82
2006	NLS-AR	19234	775	2795	574	37
2006	NLS	5006	1111	2240	1004	210
2006	**TOTAL**	**14732**	**15390**	**2723**	**12438**	**986**
2007	CLII-S	27184	8335	2825	6551	297
2007	CLII-N	4048	1006	2084	1029	241
2007	CLI-Acc	6702	797	2537	682	115
2007	CLI-S	22558	1955	2627	1587	81
2007	NLS-AR	16324	646	2749	490	36
2007	NLS	4431	971	2161	921	209
2007	**TOTAL**	**13322**	**13713**	**2686**	**11263**	**982**
2008	CLII-S	24811	7497	2804	5992	296
2008	CLII-N	4022	985	2072	1023	239
2008	CLI-Acc	6103	711	2434	632	113

2008	CLI-S	21151	1810	2609	1495	81
2008	NLS-AR	14187	551	2701	431	36
2008	NLS	3962	865	2078	857	208
2008	**TOTAL**	**12246**	**12423**	**2636**	**10432**	**977**

The closed areas that were not opened up under the FW 13 access program and the traditional clam dredge fishing grounds in the NLCA have not been trawled by bottom tending mobile gear since their closure in December 1994. Even though less bottom time would be required to harvest the same amount of scallops in previously-closed areas on Georges Bank than in areas that have remained open to scallop fishing and scallop fishing would be reduced in open areas as effort shifts into the previously-closed areas, impacts to habitat that has not been disturbed in 7 years (1995-2002) could be substantial. It is impossible, however, to quantify the impacts of opening these areas, or to estimate how severe they could be.

The impacts of opening only those areas previously opened in the FW 13 access program are likely to be less severe due to the fact that scallop fishing has been active in these areas for 2-3 years. In fact, the transfer of effort from less productive (open area) grounds to these more productive grounds would result in a substantial reduction in bottom contact time and may have a positive impact on the EFH found within traditional scallop grounds outside the closed areas.

Additional analysis of the impacts of opening the year-round closed areas to scalloping is contained in Framework Adjustment 14 to the Atlantic Sea Scallop FMP (NEFMC 1999).

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

See Habitat Alternative 11 for impacts of this alternative on EFH.

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

This alternative proposes to allocate DAS between authorized trawl and dredge scallop vessels at a differential rate. The magnitude of this DAS differential is not addressed. The potential impacts of scallop trawl and dredge gear on EHF are not known at this time. Therefore, it is not possible to reach any conclusions on potential impacts of this alternative on EFH. Given the relatively constrained geographic range of the fishery, the impact of this alternative is not likely to be significantly different than the impacts of other management alternatives. This alternative is not expected to increase fishing intensity or frequency, nor are expansions of fishable bottom (aside from potential access to the year-round closed areas) expected. It is not expected to have a direct effect on the habitat of the region.

8.5.7.3 Alternatives for allocating effort (Section 5.3.3)

These alternatives are intended to apply to the approved alternative from the Alternatives to Improve Scallop Yield.

Individual day-at-sea allocations by management area

This alternative allocates separate DAS to recently re-opened areas and open areas, allowing vessels greater flexibility in how they chose to fish their allocated DAS while taking advantage of closed area access programs. Potentially affected areas, durations of fishing activities, and potential magnitudes of DAS allocations in the different areas are undetermined at this time. It is not clear how this alternative could re-distribute fishing effort, and what the potential impacts of these shifts on EFH may be. Given the relatively constrained geographic range of the fishery, the impact of this alternative is not likely to be significantly different than the impacts of other management alternatives. This alternative is not expected to increase fishing intensity or frequency, nor are expansions of fishable bottom (aside from potential access to the year-round closed areas) expected. It is not expected to have a direct effect on the habitat of the region.

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

This alternative is similar to present management of the Hudson Canyon and VA/NC scallop areas. A complete analysis of the habitat impacts of this management structure was performed for Framework Adjustment 14 to the Atlantic Sea Scallop FMP (NEFMC 2001).

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

This alternative allows vessel owners to exchange area-specific DAS or trip allocations on a one-to-one basis. No specific impacts can be anticipated at this time. In general terms, however, the impacts of one-to-one DAS or trip exchanges will differ slightly by area. Vessel production is limited in the scallop fishery by the shucking capacity of the vessels; therefore, exchanges of fishing effort between vessels of differing harvesting capabilities will have a reduced impact on bottom contact time and swept area relative to a fishery that is limited by resource abundance/harvesting capability. In the current scenario, where scallop abundance is relatively high, effort shifts from vessels with less harvesting capabilities (less horsepower, smaller vessels) to those with greater harvesting capabilities may actually decrease bottom contact time. The impact of this would be greater in areas of less resource abundance, as harvesting rates become more similar amongst different vessels with greater resource abundance. Therefore, the impacts of effort exchanges on habitat are likely to be greater in the open areas than in newly re-opened areas or under closed area access programs. If effort shifts from less to more efficient vessels, these impacts would likely be positive (reduced bottom contact time and swept area). However, if effort shifts from more to less efficient vessels, these impacts would likely result in increases in bottom contact time and swept area. The magnitude of these impacts cannot be gauged. Similarly, the degree to which these impacts are felt varies tremendously by substrate type and natural disturbance regime.

8.5.7.4 Alternatives for reducing bycatch and bycatch mortality (Section 5.3.5)

Increase minimum twine top mesh to 10 inches in all or select areas, and/or specify how twine tops should be installed in dredges

This alternative is not likely to have any impact on the intensity or frequency of fishing effort, nor is it likely to have any appreciable impact on bottom contact time or swept area. It is not expected to have a direct effect on the habitat of the region.

Gear modifications based on recent research

This alternative would require the use of a finfish excluder device if further research proves such a modification would be appropriate to this fishery. This alternative is not likely to have any impact on the intensity or frequency of fishing effort, nor is it likely to have any appreciable impact on bottom contact time or swept area. It is not expected to have a direct effect on the habitat of the region.

Area-specific possession limits for some finfish species

This alternative is not likely to have any impact on the intensity or frequency of fishing effort, nor is it likely to have any appreciable impact on bottom contact time or swept area. It is not expected to have a direct effect on the habitat of the region.

Area-specific TAC's for some finfish species

This alternative is not likely to have any impact on the intensity or frequency of fishing effort, nor is it likely to have any appreciable impact on bottom contact time or swept area. It is not expected to have a direct effect on the habitat of the region.

Area-specific seasons to avoid bycatch

This alternative provides for seasonal closure of six RMA's and 9 one-degree blocks to scallop gears in order to minimize bycatch. The proposed closures range in duration from 3 to 9 months. Ambient levels of trawling effort in these areas (see Map 70 and Table 269) will mitigate to a large degree any benefits to habitat that may be imparted by these seasonal closures, with the exception of impacts on RMA's GB9 (inside CAI) and GB15 (inside CAII), which are closed to all bottom tending mobile gears. More significantly, the proposed closure areas are, with the exception of RMA's GB7, GB8 and MA9, either areas of low scalloping effort or areas entirely bounded by year-round closed areas. High levels of otter trawl effort in those areas, and the potential adverse impacts of the displaced scalloping effort mitigate any potential benefits from a seasonal closure of RMA's GB7 and GB8 (closure is proposed to run from July to December for these areas).

Long-term, indefinite closures to avoid areas with high bycatch levels

The areas targeted by this alternative, GB10, GB11, GB13 and GB15, are currently part of the year-round groundfish closed areas. This alternative applies only to scallop dredge gear; if these areas were to open to groundfish fishing in the future, there would be little consequent impact on the habitat of the region.

Develop a proactive protected species program

This alternative is not likely to have any impact on the intensity or frequency of fishing effort, nor is it likely to have any appreciable impact on bottom contact time or swept area. It is not expected to have a direct effect on the habitat of the region.

8.5.7.5 Alternatives for managing scallop fishing by vessels fishing with a general category permit or fishing for scallops when not on a day-at-sea (Section 5.3.6)

Incidental catch permit with a reduced possession limit; General category permit for targeting scallops and enhanced reporting requirements and area-specific or overall TAC's

This alternative would create a new general category permit for vessels targeting scallops that renders current limited access scallop permit holders ineligible for a general category permit. A second permit would enable vessels to retain a small amount of scallop bycatch, and to sell it commercially.

The combined impacts of these two new permits on fishing time or effective effort are unclear. The intention of the former is to tighten restrictions on the general category (open access) scallop fishery, but the tradeoff for this may be increased DAS allocated to limited access vessels. With no data on general category scalloping effort, and no specifics on potential increases in effort allocations for limited access permits, impacts (positive, negative or neutral) cannot be ascertained.

This permit would require VMS for all general-category scallop vessels, which would provide valuable effort data for this fishery. Such information would be very valuable in attempting to understand the potential impacts of this fishery on EFH.

Increased scallop bycatch quotas and authorized commercial sale of bycatch scallops, the second permit created by this alternative, are not likely to have any appreciable impact on bottom contact time for mobile gear fisheries. This second permit is not anticipated to have a direct effect on the habitat of the region.

Open access for vessels to obtain either an incidental or general category scallop permit; no TAC would apply except possibly in re-opened scallop management areas; possession limits for each open access permit

Similar to the above alternative, two open access permits would be created: an incidental catch permit with a low scallop possession limit and a newly-defined general category permit for vessels that target sea scallops while not on a scallop day-at-sea.

Vessels with a limited access scallop permit may or may not be eligible for the new general category permit. TAC's may apply to general-category scalloping within RMA's, depending on management options selected by the Council. VMS would be required for vessels fishing more than 45 days under this permit.

The use of VMS for certain general-category scalloping vessels may provide valuable effort data for this fishery. The number of vessels intending to participate in this fishery is unknown, as is the number likely to be impacted by an additional VMS requirement. The use of a RMA-specific TAC's for the general category fishery may create derby-style incentives, increasing fishing pressure for a limited duration. Without data on the number of vessels likely to participate, the magnitude of such an impact, if it is even likely, cannot be quantified.

Increased scallop bycatch quotas and authorized commercial sale of bycatch scallops are not likely to have any appreciable impact on bottom contact time for mobile gear fisheries. This second permit is not anticipated to have a direct effect on the habitat of the region.

Bag tags and standard bags – Alternative 1

This alternative is not likely to have any impact on the intensity or frequency of fishing effort, nor is it likely to have any appreciable impact on bottom contact time or swept area. It is not expected to have a direct effect on the habitat of the region.

Bag tags and standard bags – Alternative 2

This alternative is not likely to have any impact on the intensity or frequency of fishing effort, nor is it likely to have any appreciable impact on bottom contact time or swept area. It is not expected to have a direct effect on the habitat of the region.

Require vessels to make daily reports of vessel trip report (VTR) data through the vessel monitoring system

This alternative is not likely to have any impact on the intensity or frequency of fishing effort, nor is it likely to have any appreciable impact on bottom contact time or swept area. It is not expected to have a direct effect on the habitat of the region.

Replacement of vessel trip reports with effort reporting via VMS, real-time landings reporting by dealers, and discard characterization by enhanced observer coverage

This alternative is not likely to have any impact on the intensity or frequency of fishing effort, nor is it likely to have any appreciable impact on bottom contact time or swept area. It is not expected to have a direct effect on the habitat of the region.

Require all limited access vessels to operate a vessel monitoring system (VMS)

Currently occasional scallop permits are not required to operate a VMS unit when fishing for scallops on a limited access permit. This alternative would provide valuable effort data for this fishery. Such information could be very valuable in attempting to understand the potential impacts of the occasional scallop fishery on EFH.

Scientific resource surveys conducted with industry vessels and crew, funded by the TAC/day-at-sea set-aside and authorized as scientific research

This alternative is designed primarily to increase sampling intensity and support area rotation. It is unclear what, if any, benefits to habitat may result, though research targeting habitat concerns is not expressly prohibited and may occur.

8.5.7.6 Alternatives for enabling scallop research (Section 5.3.8)

While there may be some benefit to habitat through the research itself, and research may result in additional bottom contact time for fishing gears, these alternatives address only mechanisms for enabling research. They have direct effect on the habitat of the region.

8.5.7.7 Alternatives for adjusting management measures (Section 5.3.9)

These alternatives are intended to streamline the framework adjustment process. They have no direct effect on the habitat of the region.

8.5.8 EFH Assessment

8.5.8.1 Description of the Action

For a full description of the action, please refer to Section 5.1.

8.5.8.2 Assessing Potential Adverse Impacts

8.5.8.2.1 Experts Opinion

See Section 7.2.6.2.4 (Types of Gear Effects in Gear Effects Evaluation) and Section 7.2.6.2.4.5 (Vulnerability of Benthic EFH to Bottom-Tending Fishing Gears). To summarize, positive and negative effects of otter trawls, scallop dredges, and hydraulic clam dredges from 32 of these publications are listed by substrate type in Table 273 - Table 276 along with recovery times (when known). Without more information on recovery times, it is difficult to be certain which of the negative effects listed in these tables last for, say, more than a month or two. In fact, it is difficult to conclude in some cases (e.g., furrows produced by trawl doors) whether the habitat effect is positive, negative, or just neutral. Despite these shortcomings in the information, the scientific literature for the NE region does provide some detailed results that confirm the previous determinations of potential adverse impacts of trawls and dredges that were based on the ICES (2001), NRC (2002), and Morgan and Chuenpagdee (2003) reports.

Table 273. Effects and Recovery Times of Bottom Otter Trawls on Mud Substrate in the Northeast Region as Noted By Authors of Eight Gear Effect Studies.

Physical Effects	**Recovery**
Doors produce furrows/berms	2-18 months
Repeated tows increase bottom roughness	
Re-suspension/dispersal of fine sediments	
Rollers compress sediments	
Smoothing of surface features	
Biological Effects	
Reduced infaunal abundance	Within 3 ½ months (1 of 2 studies)
Reduced number of infaunal species	Within 3 ½ months
Reduced abundance of polychaete/bivalve species	Within 3 ½ months (1 of 2 studies)
Increased food value of sediments	
Increased chlorophyll production of surface sediments	
Removal/damage of epifauna	
Reduced abundance of brittlestars	
Increased number of infaunal species	
Increased abundance of polychaetes	
Decreased abundance of bivalves	
Altered community structure	18 months

Table 274. Effects and Recovery Times of Bottom Otter Trawls on Sand Substrate in the Northeast Region as Noted By Authors of Twelve Gear Effect Studies.

Physical Effects	Recovery
Doors produce furrows/berms	Few days – a year
Smoothing of surface features	Within a year
Re-suspension/dispersal of fine sediments	No lasting effects
Biological Effects	
Mortality of large sedentary and/or immobile epifaunal species	
Reduced density of attached macrobenthos	
Removal/damage of epifauna	
Reduced abundance of polychaetes	
Reduced abundance/biomass of epibenthic organisms	
Reduced biomass/average size of many epibenthic species	
Epifauna (sponges/anemones) less abundant in closed areas	

Table 275. Effects and Recovery Times of Bottom Otter Trawls on Gravel and Rock Substrate in the Northeast Region as Noted By Authors of Three Gear Effect Studies.

Physical Effects	Recovery
Displaced boulders	
Removal of mud covering boulders and rocks	
Groundgear leave furrows	
Biological Effects	
Reduced abundance of attached organisms (sponges, anemones, soft corals)	
Damaged sponges, soft corals, brittle stars	12 months

Table 276. Effects and Recovery Times of Chain Sweep Scallop Dredges on Sand Substrate in the Northeast Region as Noted By Authors of Three Gear Effect Studies.

Physical Effects	Recovery
Disturbed physical/biogenic structures	
Loss of fine surficial sediments	More than 6 months
Reduced food quality of sediments	Within 6 months
Biological Effects	
Reduction in total number of infaunal individuals	Within 6 months
Reduced abundance of some species (polychaetes/amphipods)	
Decreased densities of two megafaunal species	

The following conclusions can therefore be reached:

1. Adverse and potentially adverse habitat impacts from bottom trawling occur throughout most of the NE region on a variety of substrates;

2. Adverse and potentially adverse habitat impacts from scallop dredging occur primarily in the Mid-Atlantic and secondarily on Georges Bank on sand, gravelly sand, and gravel substrates;

8.5.8.2.2 Determinations

New Bedford scallop dredges and Otter trawls will have a potential adverse effect on the EFH of species and benthic habitat types listed in Table 277. These species and life stages have been determined to be moderately or highly vulnerable to these gear types. In some cases the adverse effects may be significant (high vulnerability) and are denoted in Table 277 as well. For a detailed look at the full gear effects evaluation and adverse impacts determination, refer to 7.2.6.2.

Table 277. Summary species and life stage's EFH adversely impacted by otter trawling and scallop dredging (gears that adversely impact EFH used in the Scallop fishery).

Species	Lifestage	Vulnerability to Otter Trawling	Vulnerability to Scallop Dredging	Depth in meters (EFH Designation)	Substrate (EFH Designation)
American Plaice	A	High	High	45-150	sand or gravel
American Plaice	J	Mod	Mod	45-175	sand or gravel
Atlantic Cod	A	Mod	Mod	25-75	cobble or gravel
Atlantic Cod	J	High	High	10-150	rocks, pebble, gravel
Atlantic Halibut	A	Mod	Mod	20-60	sand, gravel, clay
Atlantic Halibut	J	Mod	Mod	100-700	sand, gravel, clay
Barndoor Skate	A	Mod	Mod	0-750, mostly <150	mud, gravel, and sand
Barndoor Skate	J	Mod	Mod	0-750, mostly <150	mud, gravel, and sand
Black Sea Bass	A	High	High	20-50	structures, sand and shell
Black Sea Bass	J	High	High	1-38	rough bottom, shell and eelgrass beds, structures and offshore clam beds in winter
Clearnose Skate	A	Mod	Mod	0-500, mostly <111	soft bottom along shelf and rocky or gravelly bottom
Clearnose Skate	J	Mod	Mod	0-500, mostly <111	soft bottom along shelf and rocky or gravelly bottom
Haddock	A	High	High	35-100	pebble gravel

Species	Lifestage	Vulnerability to Otter Trawling	Vulnerability to Scallop Dredging	Depth in meters (EFH Designation)	Substrate (EFH Designation)
Haddock	J	High	High	40-150	broken ground, pebbles, smooth hard sand, smooth areas between rocky patches
Little Skate	A	Mod	Mod	0-137, mostly 73-91	sand or gravel or mud
Little Skate	J	Mod	Mod	0-137, mostly 73-91	sand or gravel or mud
Ocean Pout	A	High	High	<110	soft sediments
Ocean Pout	J	High	High	<80	smooth bottom near rocks or algae
Ocean Pout	L	High	High	<50	close to hard bottom nesting areas
Ocean Pout	E	High	High	<50	hard bottom, sheltered holes
Pollock	A	Mod	Mod	15-365	hard bottom, artificial reefs
Red Hake	A	Mod	Mod	10-130	sand and mud
Red Hake	J	High	High	<100	shell and live scallops
Redfish	A	Mod	Mod	50-350	silt, mud, or hard bottom
Redfish	J	High	High	25-400	silt, mud, or hard bottom
Rosette Skate	A	Mod	Mod	33-530, mostly 74-274	soft substrates including sand/mud and mud
Rosette Skate	J	Mod	Mod	33-530, mostly 74-274	soft substrates including sand/mud and mud
Scup	J	Mod	Mod	0-38	inshore sand, mud, mussel and eelgrass beds
Silver Hake	J	Mod	Mod	20-270	all substrate types
Smooth Skate	A	High	High	31-874, mostly 110-457	soft mud, sand, broken shells, gravel and pebbles
Smooth Skate	J	Mod	Mod	31-874, mostly 110-457	soft mud, sand, broken shells, gravel and pebbles
Thorny Skate	A	Mod	Mod	18-2000, mostly 111-366	sand gravel, broken shell, pebble, and soft mud
Thorny Skate	J	Mod	Mod	18-2000, mostly 111-366	sand gravel, broken shell, pebble, and soft mud
Tilefish	A	High	Low	76-365	rough, sheltered bottom
Tilefish	J	High	Low	76-365	rough, sheltered bottom

Species	Lifestage	Vulnerability to Otter Trawling	Vulnerability to Scallop Dredging	Depth in meters (EFH Designation)	Substrate (EFH Designation)
White Hake	J	Mod	Mod	5-225	pelagic during pelagic stage and mud or fine sand during demersal stage
Winter Flounder	A	Mod	Mod	1-100	estuaries with mud, gravel, or sand
Winter Skate	A	Mod	Mod	0-371, mostly <111	sand, gravel, or mud
Winter Skate	J	Mod	Mod	0-371, mostly <111	sand, gravel, or mud
Witch Flounder	A	Mod	Low	25-300	fine-grained sediment
Witch Flounder	J	Mod	Low	50-450	fine-grained sediment
Yellowtail Flounder	A	Mod	Mod	20-50	sand and mud
Yellowtail Flounder	J	Mod	Mod	20-50	sand and mud

8.5.8.3 Minimizing or Mitigating Adverse Impacts

In order to minimize and mitigate the adverse effects of the fishery on EFH the Council will implement Habitat Alternative 2 (Benefits of other Amendment 10 alternatives), Alternative 6 (Closed areas consistent with the Framework 13 Scallop Closed Area Access Program) Alternative 11 (Increasing dredge ring size to 4-inches in all areas) and Alternative 12 (Habitat research funded through scallop TAC set-aside) under Amendment 10 to the Atlantic Sea Scallop fishery. Habitat Alternative 6 will prohibit scallop gear from fishing in vulnerable areas containing the above benthic habitat types. Additionally, Alternative 2, 11 and 12 will be implemented to further mitigate the adverse effects of the fishery on EFH.

8.5.8.3.1 Habitat Alternative 2

Table 278. Characterization and summary of potential impacts of Amendment 10 management measures on EFH.

Management Measure	Impact[93]	Explanation
Status quo overfishing definition	– w/o access + with access	Use of SQ definition will increase scallop fishing effort in open access areas, which could lead to resource depletion, reduced catch rates and increase in bottom time, but not if fleet has access to closed areas; with access, total bottom time will probably decrease because of high catch rates in closed areas.

[93] Impacts are evaluated for juvenile scallops and other federally-managed species relative to the status quo as positive (+), negative (-), none (0), or unknown (unk). Ranks in parentheses indicate impacts relative to the no action alternative, i.e., the provisions of Amendment 7 to the Scallop FMP, which was implemented in 1998.

Management Measure	Impact[93]	Explanation
Flexible boundary (adaptive) area rotation based on survey data	unk	Opening and closing criteria are based solely on scallop biomass and growth parameters, not habitat values. Impacts of area rotation will vary depending on the type and vulnerability of habitat types present in the area, its size, the intensity of scallop fishing prior to closure, recovery times for critical habitat features, etc. Habitat impacts will have to be evaluated on a case-by-case basis.
Controlled access to Framework 13 areas in Closed Area I and Nantucket Lightship Area in 2004 and Closed Area II in 2005-2007[94]	–	These areas were closed to groundfish gear (including scallop dredges) in 1995 and opened to scallop dredging on a limited basis in 1999 and 2000. Opening them to scallop dredging will negatively affect EFH, particularly in Closed Area I because hard bottom habitat in this area is more vulnerable to fishing than sandy bottom in other areas. [3]
Continue controlled access to Hudson Canyon Area in 2004/2005	0 (-)	On one hand, continuing controlled access in the Hudson Canyon Area will reduce bottom contact time and allow fishing effort to be more concentrated than outside the area. This may reduce EFH impacts where EFH is more complex outside of the Hudson Canyon Area. Relative to the no action alternative where the Hudson Canyon Area would open to general scallop fishing, however, this action decreases scallop fishing effort. Effort therefore would be higher elsewhere than without controlled access, potentially increasing effort where more complex EFH exists.
Open VA/NC Area closed area to regular scallop fishing in 2004	0 (-)	This area has been open to controlled access scallop fishing since 2001; Amendment 10 will open it to regular scallop fishing in 2004. Relative to the status quo, this change in status will have no habitat impact because scallops are not currently being harvested there. Relative to no action, the impacts, may be positive if the effort would have occurred in areas with more complex EFH.
Initial area rotation area closure in Mid-Atlantic in 2004 for three years	0	Closure will benefit EFH in this area, but benefits will be negligible due to high energy nature of the environment and because effort will be displaced into other areas[95]
Area-specific DAS allocations	unk	Effects may be both positive or negative, depending on the area. Positive impacts occur when the result is to reduce fishing effort by lower bottom contact time, while negative impacts may occur from access in areas with more sensitive habitat.
Exchange of DAS and trips between vessels	0	No predictable effect on EFH.
Broken trip DAS and trip adjustments	+	Could reduce effort in controlled access areas. Under a broken trip adjustment, vessels will actually loose some controlled access DAS allocations as part of the penalty. They would not be able to finish the trip, unless they had sufficient days remaining.
Four inch rings and 10 inch twine tops	+	Four inch rings will slightly increase dredge efficiency for larger scallops, thus reducing bottom contact time in recently-opened areas where large scallops are abundant, but will reduce catch rates and increase bottom time in areas where medium-small sized scallops are prevalent. Ten-inch twine tops will reduce by-catch, but have no direct habitat effects.

[94] Georges Bank area access alternatives will be implemented in a later management action (Framework Adjustment 16/39).

[95] There is no analysis of habitat attributes in the EIS to support a quantitative evaluation of the habitat impacts of this management measure.

Management Measure	Impact[93]	Explanation
Reduced possession limit for limited access vessels fishing outside of scallop DAS	+	Vessels with limited access permits are currently allowed to possess and land up to 400 lbs per trip of shucked scallop meats when not required to use allocated DAS; this measure will reduce possession limit to 40 lbs/trip) and reduce fishing effort by vessels that have been targeting scallops under the higher general category possession limit. Scallops harvested under this provision cannot be sold.
Access for general category vessels to controlled access areas	0	General category vessels will be allowed to fish in controlled access areas, subject to a 400 lbs/trip possession limit. Previously, the limit was 100 lbs. for the Hudson Canyon and VA/NC Areas and zero for the Georges Bank area access programs in past framework actions. This measure will increase fishing effort in certain areas that are accessible to general category vessels, but the incremental effect on EFH will probably be negligible given much higher effort by limited access vessels.
Framework measures for controlled access	0	Do not include adjustable habitat management measures.
2% set-aside from TAC and/or DAS allocations to fund research and surveys	+	Could indirectly benefit habitat when habitat research is funded and provides better information for future management decisions
Mandatory observer coverage on a suitable number of trips	0	Objective is to monitor by-catch and capture of protected resources, not assess or monitor habitat effects that would be difficult to do without special expensive equipment.
Bi-annual framework mechanism for setting DAS allocations and making other management adjustments	0	No habitat effects; Council can take action under a framework action to protect EFH.

8.5.8.3.2 Habitat Alternative 6

In this alternative the year-round groundfish closed areas (WGOM, CA I, CA II and NLCA) that were in place during the 2001 fishing year are considered habitat closures with the exception of those areas opened under the Scallop FW 13 Closed Area Access Program (See Map 71).

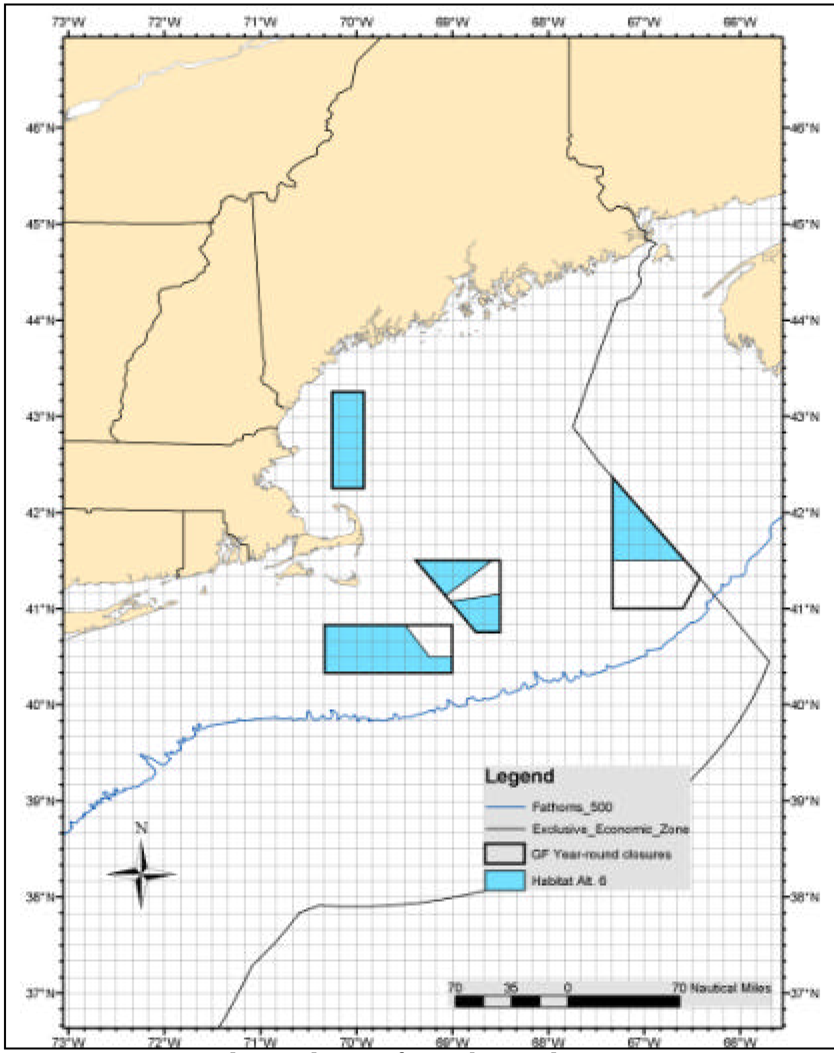


Table 279

	LONGITUDE (°W) deg	LONGITUDE (°W) min	LATITUDE (°N) deg	LATITUDE (°N) min
CAI	69	1.2	41	4.5
	68	30	41	9
	68	30	40	45
	68	45	40	45
	69	23	41	30
	68	35	41	30
	69	4.3	41	8
CAII	67	20	42	22
	66	34.8	41	30
	67	20	41	30
Nantucket Lightship	69	0	40	20
	69	0	40	30
	69	14.5	40	30
	69	29.5	40	50
	70	20	40	20
	72	20	40	50
WGOM	69	55	42	15
	69	55	43	15
	70	15	43	15
	70	15	42	15

Map 71. Map and Coordinates for Habitat Alternative 6. Current Groundfish closed areas included for reference.

8.5.8.3.3 Habitat Alternative 11

Scallop dredge ring size would be required to be at 4-inches everywhere. This measure will reduce mortality on small scallops where scallops are of mixed sizes. Research has determined that the efficiency for catching larger scallops (e.g., greater than 110 mm shell height) also improves. Thus the improved dredge efficiency has the potential for reducing bottom time, non-catch mortality, bycatch, and possibly habitat effects. Option 2 is proposed because requiring the use of 4-inch rings throughout the resource could actually increase fishing time in areas where fewer large scallops are available.

8.5.8.3.4 Habitat Alternative 12

Scientists conducting habitat research that is related to the effects of scallop fishing could apply for funding through the research TAC/day-at-sea set aside. Research is needed to quantify or evaluate the long-term effects of scallop fishing on the essential fish habitat and to estimate habitat recovery rates. Some of the funds from a TAC set-aside would promote such research. This alternative would broaden the range of research types that could be funded through the scallop research TAC set aside (Section 5.1.8.3). Research funded through this mechanism could identify fishing gear or methods that have fewer habitat impacts, or might be useful to identify ways that fishing is managed to minimize related habitat impacts.

8.5.8.3.5 Analysis of Alternatives to Minimize Adverse Effects of Fishing on EFH

For a full analysis of the alternatives selected to minimize or mitigate adverse effects from fishing on EFH in Amendment 10 to the Atlantic Sea Scallop FMP, see Section 8.5

8.5.8.4 Conclusion

The management measures, implemented through this action, minimize the adverse effects of fishing on EFH, to the extent practicable pursuant to Section 303(A)(7) of the MSA).

8.6 Scallop Research via Experimental Fishing Permits

Some types of scallop research, conducted with legal commercial scallop gear or equipment that does not cause additional scallop mortality or environmental effects, could be conducted by obtaining an Experimental Fisheries Permit (EFP) and requesting an allocation of scallops from the TAC set aside. Since this activity as described would otherwise occur during a normal scallop fishing day-at-sea, the Regional Administrator may approve the EFP without an associated Environmental Assessment or Environmental Impact Statement, provided that the applicant can show no additional environmental effects or scallop mortality beyond that that would occur during the course of a normal scallop fishing trip.

Reliance on this analysis in this SEIS document does not prevent the Regional Administrator from approving research in an otherwise closed area or with non-compliant gear – provided that the research applicant satisfactorily demonstrates that it would cause no more scallop mortality or environmental effects than if those scallops were caught in open fishing areas with legal commercial fishing gear.