AMENDMENT 9 (DRAFT)
TO THE
ATLANTIC MACKEREL, SQUID, AND BUTTERFISH
FISHERY MANAGEMENT PLAN

(Includes Draft Supplemental Environmental Impact Statement, Preliminary Regulatory Economic Evaluation and Essential Fish Habitat Assessment)

VOLUME 1

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Mid Atlantic Fishery Management Council
in cooperation with
the National Marine Fisheries Service

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1.0 EXECUTIVE SUMMARY

Regulatory Basis for the Amendment: Amendment 9 is being developed in accordance with the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) and the National Environmental Policy Act (NEPA), the former being the primary domestic legislation governing fisheries management in the U.S. Exclusive Economic Zone (EEZ). In 1996 Congress passed the Sustainable Fisheries Act (SFA), which amended and reauthorized the MSFCMA and included a new emphasis on precautionary fisheries management. New provisions mandated by the SFA require managers to end overfishing and rebuild overfished stocks within specified time frames, minimize bycatch and bycatch mortality to the extent practicable, and describe and identify essential fish habitat (EFH). This draft amendment and draft supplemental environmental impact statement (DSEIS) presents and evaluates management alternatives and measures to achieve specific goals and objectives for the Atlantic mackerel, squid and butterfish fisheries (Section 4.0). The DSEIS was prepared by the Mid-Atlantic Fishery Management Council (Council) in consultation with the National Marine Fisheries Service (NMFS, NOAA Fisheries).

Although this amendment has been prepared primarily in response to the requirements of the MSFCMA and NEPA, it also addresses the requirements of the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA). When preparing a Fishery Management Plan or FMP amendment, the Council also must comply with the requirements of the Regulatory Flexibility Act (RFA), the Administrative Procedure Act (APA), the Paperwork Reduction Act (PRA), the Coastal Zone Management Act (CZMA), the Information Quality Act (IQA), and Executive Orders 13132 (Federalism), 12898 (Environmental Justice), 12866 (Regulatory Planning), and 13158 (Marine Protected Areas). These other applicable laws and Executive Orders help ensure that in developing an FMP/amendment, the Council considers the full range of alternatives and their expected impacts on the marine environment, living marine resources, and the affected human environment. This integrated document contains all required elements of the FMP amendment, including a DSEIS as required by NEPA, and information to ensure consistency with other applicable laws and executive orders.

Purpose and Need of the Amendment: This amendment is needed to remedy deficiencies in the FMP and to address other issues that have arisen since Amendment 8 (MAFMC 1998) became effective in 1998. Although Amendment 8 was partially approved in 1998, NOAA Fisheries noted that the amendment inadequately addressed some important Magnuson-Stevens Act requirements for Federal FMPs. Specifically, the amendment was considered deficient with respect to: 1) consideration of gear impacts on EFH as they relate to the management unit, 2) designation of EFH for *Loligo* eggs, and 3) the reduction of bycatch and discarding of target and non-target species in the squid, mackerel and butterfish (SMB) managed fisheries. In addition, this amendment is needed to address new scientific information, promote long-term planning for harvesters, processors and fishing communities, and to minimize the potential for over-exploitation of the *Illex* resource.

The purpose of this amendment is to achieve the six management objectives of the Atlantic mackerel, squid and butterfish FMP as outlined in Section 4.3 of this document, as well as to evaluate measures that would designate and protect EFH, reduce bycatch and discards, incorporate new scientific advice from the *Loligo* stock assessment, and consider a multi-year specification setting process and the moratorium on entry into the directed *Illex* fishery. The full range of management issues that are addressed in this amendment, which either correct existing FMP deficiencies, or help to better achieve the existing FMP management objectives are described under the enumerated potential management actions below.

Potential Management Actions: There are ten proposed management actions in this Amendment. The proposed management actions could:

1) allow for specification of management measures for multiple years,
2) extend or eliminate the moratorium on entry to the directed *Illex* fishery,
3) revise the current overfishing definition for *Loligo pealeii*, and
4) establish a requirement for electronic daily reporting in the directed *Illex* fishery.

Two proposed actions in this amendment could designate and reduce impacts to EFH by:

1) designating EFH for *Loligo* eggs, and
2) implementing area closures to reduce gear impacts from SMB fisheries on EFH.

Four proposed actions in this amendment could reduce bycatch and discarding of non-target species in SMB fisheries by:

1) increasing the minimum codend mesh size requirement in the *Loligo* fishery,
2) establishing gear restricted areas that are seasonally closed to small-mesh gear,
3) reducing regulatory discarding of *Loligo* in the *Illex* fishery during *Loligo* fishery closures, and by
4) modifying the exemption of the *Illex* fishery from the minimum codend mesh size requirement of the *Loligo* fishery.

At its March 2006 meeting in Cape May, NJ the Council identified several of its preferred alternatives, and is currently conducting public hearings to allow for review of the proposed management actions by fishery participants and concerned members of the public. After the 45 day public comment period ends, the comments will be compiled and presented to the Council. The Council's response to public comments will determine its final selection of preferred management actions. The final suite of recommendations will then be presented to the National Marine Fisheries Service for implementation via rulemaking under the authority of the Secretary of Commerce.

The following summary lists the specific management measures under consideration, indicates the basis for their inclusion, the Council's preferred alternatives (when applicable) and its rationale, and a brief review of the likely meaningful impacts of the management alternatives:

1 Multi-year specifications:

Alternatives:

1A: no action (3 year specifications for *Loligo*, annual specifications for all other species).

1B: allow multi-year specifications (up to 3 years) for all four species (Preferred Alternative).

1C: allow multi-year specifications (up to 5 years) for all four species.

Problem statement: The action alternatives are intended to streamline the administrative and regulatory processes involved in the specification of management measures, while, at the same time, maintaining consistency with the Magnuson-Stevens Act. Annual specification of management measures currently places an administrative burden on the Council, Council staff, and NOAA Fisheries. Implementation of either Alternative 1B or 1C would not affect the annual stock status review procedures that were established in the FMP. In other words, the Council would be free to respond to changes in stock status in any given year by potentially increasing or decreasing the quota, as appropriate. If these changes are not needed, however, the Council would be free from having to annually specify quotas that, for these fisheries, generally don't change much from year to year - with the recent exception of butterfish. In the case of butterfish, the Council would not be obligated to recommend multi-year specifications, but could revisit the quota yearly until the stock has recovered.

Council recommendation: The Council chose 1B as its preferred alternative because it will achieve the administrative streamlining objectives. Additionally, the Council agreed that management based on three-year stock projections was considered more appropriate for the species managed under this FMP (based on their brief life spans) compared to the five-year time span in Alternative 1C.

Impact analysis: This is an administrative action and no impacts to natural resources are expected. Benefits to fishery participants may come about, however, in that the time horizon for planning their harvesting/processing activities would be expanded.

2 Moratorium on entry into the directed *Illex* fishery:

Alternatives:

2A: No action (The moratorium on the issuance of *Illex* permits expires July 1, 2009)

2B: Extend the moratorium on entry to the *Illex* fishery without sunset provision (Preferred Alternative)

2C: Terminate the moratorium on entry to the *Illex* fishery

2D: Extend the moratorium on entry to the *Illex* fishery without sunset provision and allow new entry into fishery through permit transfer system

Problem statement: Extension of the moratorium (Alternatives 2B or 2D) is being considered as a means to protect the *Illex* stock from increases in fleet capacity, and avoid negative economic impacts to historic fishery participants that may occur if the existing constraints on harvest capacity for this fishery are removed. Excess capacity is currently considered to exist in the directed *Illex* fishery; that is, the size of the existing fishing fleet is greater than that needed to harvest at optimum yield in any given year. The *Illex* quota was exceeded by 24% in 1998 and by 8.7% in 2004. Given this circumstance, there appears to be no justification in allowing the fleet to expand (Alternatives 2A or 2C). Control over expansion of harvest capacity is currently maintained by the existing moratorium, but is scheduled to expire July 1, 2009. Control of *Illex* exploitation levels by the directed fishery is currently maintained by the quota management system.

Council recommendation: The Council chose 2B as the preferred alternative because it agreed that the directed *Illex* fishery is currently overcapitalized. Furthermore, the Council felt that compared to the other alternatives, this alternative offered the greatest degree of protection to historic participants in the directed *Illex* fishery.

Impact analysis: A detailed economic analysis of the alternatives was conducted and is provided in Appendix 10. The results, though somewhat ambiguous, point out that there is clearly excess capacity in the fishery. The costs and benefits of maintaining, or removing the moratorium, however, are limited to historic participants and individuals wishing to enter the fishery. Additionally, these costs and benefits are difficult to predict as they are related to the ebb and flow of world market demand. In terms of risks to natural resources (e.g., overexploitation of the *Illex* stock, bycatch, and habitat damage), they could be greater under the removal of the moratorium, but not considerably so, since the existing quota system provides for a means for controlling harvest.

3 Revise the biological reference points for *Loligo pealeii*

Alternatives: 3A: No action

3B: Adopt SARC 34 (34th Stock Assessment Review Committee) Recommendation for the F_{target} and $F_{threshold}$ biological reference points for *Loligo pealeii* (Preferred Alternative)

Problem statement: This action is being considered in order to keep the FMP in compliance with the Magnuson-Stevens Act. National Standard 2 of the Magnuson-Stevens Act requires that management measures be based on the best scientific information available. The most recent peer-reviewed *Loligo* stock assessment (SAW 34 – NEFSC 2002) included specific revisions to the biological reference points for *Loligo*. These reference points are used by fishery managers in setting harvest targets and thresholds such that optimum yield can be achieved. The analytical advice provided through peer-reviewed scientific stock assessments is generally accepted as being consistent with the best scientific information available, and is, therefore, consistent with National Standard 2.

The status quo definition for F_{target} is 75% of the F_{max} proxy for F_{msy} whenever estimated *Loligo* biomass is equal to or greater than the biomass target (B_{msy}). However, when estimated *Loligo* biomass is less than B_{msy}, then F_{target} decreases linearly such that, at the biomass threshold (½ of B_{msy}), the F_{target} is zero. The status quo definition for $F_{threshold}$ is defined as the F_{max} proxy for F_{msy}.

Under Alternative 3B, the definitions for F_{target} and $F_{threshold}$ would be modified as recommended by SAW 34. Accordingly, the quarterly F_{target} would be defined as the mean of quarterly F values during 1987-2000 (F=0.24). Additionally, the quarterly $F_{threshold}$ would be defined as the 75th percentile of quarterly F values during the period 1987-2000 (F=0.31).

Council recommendation: The Council chose 3B as the preferred alternative because it considered this alternative as being consistent with the best scientific information available.

Impact analysis: The differences in impacts between Alternatives 3A and 3B are difficult to evaluate because the quarterly *Loligo* quotas are essentially set under a "constant harvest" approach. This approach is founded on the observation that an average catch (landings plus discards) of around 20,000 mt occurred from 1967 to 2000, and stock biomass, though variable from year to year, remained stable over the long term. In other words, although achieving the quarterly F target is the implicit goal of quota setting, whether or not that has occurred is evaluated through a post hoc analysis of removals (landings and discards) and biomass estimates. Therefore, adjusting the quarterly F target definition from the sliding scale (Alternative 3A) to a constant of 0.24 (Alternative 3B) will not, at least in the short term, affect harvest quotas, and would not impact natural resources or fisheries. Nevertheless, if future analyses of *Loligo* population dynamics suggests that adjustment of the quarterly quotas is justified then it is possible that harvest will be affected.

4 Designation of essential fish habitat (EFH) for *Loligo pealeii* eggs

Alternatives: 4A: No action (No designation of *Loligo* EFH)
4B: EFH designation based on documented observations of egg mops

Problem statement: This action is being considered in order to bring the FMP into compliance with the Magnuson-Stevens Act, which states that FMPs must describe and identify EFH for each life history stage of the species. The FMP currently identifies and describes EFH for all life stages of the management unit for which information is available, with the exception of *Loligo* squid eggs. *Loligo* eggs masses, or "egg mops", are found at various times of the year attached to rocks and small boulders on sandy/muddy bottom and on aquatic vegetation. Locations of fishery encounters with *Loligo* egg mops are reported in Hatfield and Cadrin (2002; Figure E-1). Under Alternative 4B, the locations from this figure would be used to add a description of EFH for *Loligo* squid eggs to the FMP.

Council recommendation: No "Preferred Alternative" has been selected at this time. Some Council members expressed concern that the proposed *Loligo* egg EFH areas are based on anecdotal information (interviews with fishermen). Also, they considered it likely that the proposed EFH areas are not constant, but instead, shift from year to year.

Impact analysis: To the degree that EFH is vulnerable to damage by fishing and/or non-fishing activities, management oversight of these activities in areas designated as EFH for a given life stage of any managed resource will allow for direct and indirect benefits for that resource. Alternative 4B identifies EFH for *Loligo* eggs based upon documented observations (i.e., commercial encounters with *Loligo* egg mops). By implementing Alternative 4B, future impacts to EFH for *Loligo* eggs can be identified and mitigated. Under Alternative 4B fishing and/or non-fishing activities would not be restricted. However, a requirement would be established whereby NOAA Fisheries must be consulted for future Federal fishing and non-fishing activities in those areas. In other words, designating EFH does not automatically mean mitigation. EFH mitigation, if necessary would be done under a separate amendment/framework. The no action alternative (4A) is in contradiction with the mandates of the Magnuson-Stevens Act.

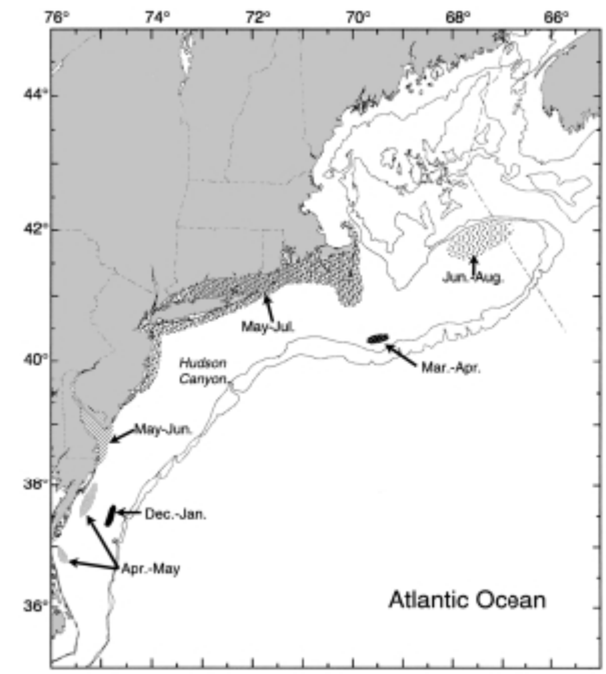

Figure E-1. Locations of fishery encounters with *Loligo* egg mops. Figure taken from Hatfield and Cadrin (2002).

5 Area closures to reduce gear impacts on EFH

Four alternatives:

5A: No Action
5B: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in the area surrounding the head of the Hudson Canyon
5C: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in tilefish habitat area of particular concern (HAPC)
5D: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in Lydonia and Oceanographer Canyons (Preferred Alternative)

Problem Statement: This action is being considered in order to bring the FMP into compliance with the Magnuson-Stevens Act. The FMP currently lacks adequate analysis of the effects of SMB fishery activity on EFH for federally-managed species within the geographic scope of the management unit. Such an analysis has been conducted as part of the preparation of this DSEIS (Section 6.3 in Volume 1). The results of the analysis indicate that actions could be taken that would reduce impacts to EFH related to the activities of the Atlantic mackerel, squid, and butterfish fisheries by closing certain areas to the use of bottom otter trawl fishing for these species.

Council recommendation: The Council chose Alternative 5D as its preferred alternative because it is expected to have little or no adverse economic impact to the fisheries, and would make the FMP consistent with the New England Fishery Management Council's monkfish FMP which closed Lydonia and Oceanographer Canyons to bottom trawl activity.

Impact analysis: The action alternatives would benefit habitat in the closed areas by decreasing localized damage from bottom-tending gear. Decreased fishery encounters with the managed stocks, non-target species, and protected and endangered species in the closed areas are also expected, and this would correspond to localized benefits to these resources. In general, the magnitude of any of these benefits is related to the size of the closed area. As such, the largest closure area (tilefish HAPC –Alternative 5C) would be expected to generate substantial protection for tilefish EFH, both for juvenile and adult life stages. This area also represents greater than 10% of the total EFH for juvenile and adult rosette skates, juvenile silver hake, and adult summer flounder. In the head of Hudson Canyon area (Alternative 5B), the amount of EFH for a given species' life stage exceeds 5% for juvenile Atlantic scallops, juvenile rosette skate, and juvenile silver hake, but is 5% or less for all other species. Lydonia and Oceanographer Canyons comprise approximately 3% of EFH for juvenile tilefish, but no more than 2% for any other species. The closure of Lydonia and Oceanographer Canyons (alternative 5D GRA) to bottom otter trawling in the Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries affords the least protection to EFH from adverse fishing effects of the action alternatives. However, the Council determined that the other Alternatives would not be practicable.

The no action alternative (5A) is in contradiction with the mandates of the Magnuson-Stevens Act.

Costs to fishery participants are, at least in the short term, also related to the size of the closure area. Closing tilefish HAPC to bottom otter trawling is likely to reduce annual revenue for all species by 10% or more for about 201 bottom otter trawl vessels and losses of around $100,000 for 123 vessels. For ports, revenue losses of around 45% are expected for Montauk and Hampton Bays. Closing the Head of Hudson Canyon to bottom otter trawling is likely to reduce revenue by 10% or more for about 65 bottom otter trawl vessels and losses of $70,000 to $140,000 for about 27 vessels. Ports that would experience the greatest percentage of revenue loss consist of Belford, NJ (21% or $310 thousand), Pt Pleasant, NJ (13% or $1.2 million), and Shinnecock, NY (12% or $590 thousand). The major ports that would experience revenue losses include, in descending order, Point Judith, RI (7% or $746 thousand), North Kingstown, RI (3% or $210 thousand), Cape May, NJ (2% or $875 thousand). The closure of Lydonia and Oceanographer Canyons is likely to have a minimal impact on revenues both for individuals and ports.

6 *Loligo* minimum mesh size requirements

Four alternatives:

6A: No Action (Maintain 1 $^{7/8}$ inch minimum codend mesh requirement)
6B: Increase minimum codend mesh size to $2^{1/8}$ inches
6C: Increase minimum codend mesh size to $2^{1/2}$ inches
6D: Increase minimum codend mesh size to 3 inches
(all mesh size alternatives represent inside stretched mesh measurements)

Problem Statement: These actions are being considered to reduce the bycatch and discarding of finfish species in the *Loligo pealeii* fishery, as part of the Magnuson-Stevens Act requirement to minimize bycatch to the extent practicable and minimize mortality of unavoidable byctch. Of the four SMB fisheries, the small-mesh *Loligo* fishery has the highest level of discarding (Table 11A, 11B, and 12), especially with respect to overfished stocks (e.g., butterfish, which became overfished in 2005, and scup) and the southern silver hake stock that is in the process of rebuilding. With respect to butterfish, the most recent assessment (NEFSC 2004) indicated that butterfish discards, though difficult to estimate, are likely more than twice the commercial landings and that butterfish are discarded frequently in the squid (*Loligo* and *Illex*), mixed groundfish, silver hake and fluke fisheries. Additional analyses provided herein indicate that overall, the *Loligo* fishery produces the highest level of butterfish discards due to year round co-occurrence of the two species and the use of small codend mesh sizes (minimum of 1 $^{7/8}$ inches or 48 mm, inside stretched mesh measurement). Other federally managed, commercial species are also discarded in the *Loligo* fishery. During 1989-2003, the *Loligo* fishery was responsible for 27%, 26%, 16%, 10%, and 3% of the all Observer Program discards of scup, silver hake, red hake, spiny dogfish and skates, respectively.

Council recommendation: No "Preferred Alternative" has been selected at this time. At its March 2006 meeting, some members of the Council were concerned with the potential for confusion regarding mesh sizes reported in vessel logs and the influence of this confusion on analyses of butterfish discarding. Additionally, the Council moved to re-establish for consideration a 3 inch minimum mesh (Alternative 6D), which had been previously rejected by the SMB Committee.

Impact analysis: This is the only set of bycatch reduction alternatives that have the potential to reduce SMB fishery discards for multiple species on a year-round basis. Alternatives 3B, 3C and 3D would reduce year-round discard mortality of butterfish, silver hake, red hake, and scup in the *Loligo* fishery and the no action alternative would not address the discard-related fishing mortality on the stocks comprised of these species. Selectivity analyses by Meyer and Merriner (1976) provide evidence for increased escapement of juvenile butterfish (<4 $^{3/4}$ inches in length) at codend mesh sizes above the current minimum. Additionally, their analyses suggest that the probability of escapement is 50% for reproductively mature fish (>4 $^{3/4}$ inches fork length) (O'Brien et al. 1983) at a codend mesh size of 2 $^{5/8}$ inches (67 mm). However, when accounting for the diamond mesh bottom trawl gear used by the *L. pealeii* fishery, a larger mesh size of 3.0 inches (76 mm) would be required to accomplish this same objective. As such, the alternative that will most benefit butterfish (and also silver hake, scup, and red hake) is Alternative 6D, with the other action alternatives providing decreasing degrees of benefit to these species. Since the *Loligo* fishery is responsible for 26% of all Observer Program discards of silver hake and 27% of the total discards of scup, a codend mesh size increase in the *Loligo* fishery is likely to aid in rebuilding of the scup and southern silver hake stocks.

There are no published studies of *Loligo pealeii* selectivity. Therefore, it is unknown whether *Loligo* retention is reduced at the proposed codend mesh size increases, and if so, the percent losses associated with such increases are unknown. Consequently, it is also unknown whether the proposed mesh size increases will result in an increase in *Loligo* fishing mortality (i.e., from increased fishing effort due to reduced retention rates). However, scientific studies show that the magnitude of any increase in fishing mortality will be partially mitigated by the fact that a reduction in the retention of squid will decline over time as squid increase in body size over their lifespan. Growth rates of *L. pealeii* are rapid and squid hatched during June-October (squid caught during the offshore winter *L. pealeii* fishery) have significantly faster growth rates, in both length and weight, than squid hatched during November-May (squid caught during the summer and fall *L. pealeii* fishery). Increased codend mesh sizes in the *Loligo* fishery should not increase fishing mortality on the *Loligo* stock because harvesting is currently controlled by seasonal quotas. Impacts from increased fishing mortality as a result of increased squid escapement or loss are unknown because escapement survival rates for *Loligo pealeii* are unknown. However, any potential increase in fishing effort would be time-limited by fuel capacity and daylight hours when the squid are available to bottom trawls.

7 Exemptions from *Loligo* minimum mesh requirements for *Illex* vessels

Four alternatives:

7A: No Action (*Illex* vessels are exempt from *Loligo* minimum mesh requirements in the months of June – September - Preferred Alternative)

7B: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding month of September from current mesh exemption for *Illex* fishery

7C: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding months of August and September from current mesh exemption for *Illex* fishery

7D: Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels

Problem Statement: These modifications are being considered as a means of reducing discarding of finfish, especially butterfish, by the directed *Illex* fishery which, for some vessels, involves using mesh sizes smaller than 1 $^{7/8}$ inches (inside stretched mesh measurement) because there is no minimum codend mesh size requirement. Large butterfish discard events in the *Illex* fishery have been identified through analysis of vessels trip reports and fishery Observer Program data. While there is no minimum mesh requirement for vessels retaining *Illex*, there is a 1-7/8 inches mesh requirement for vessels retaining *Loligo*. Because this species can seasonally co-occurr, the exemption was established for the offshore area where Loligo is less often present.

Council's recommendation: The Council has chosen Alternative 7A as the preferred alternative because it received anecdotal information that the *Illex* fishery is for the most part a clean fishery with few finfish discarding issues.

Impact analysis: For codend mesh sizes ≤ 2.5 inches, the mesh size range in which most of the butterfish discards occur, the *Illex* fishery accounted for 30% of the butterfish discards (by weight) recorded by the Observer Program during 1996-2003. Butterfish discard rates (in terms of weight) are fairly high in the *Illex* fishery and the overall discard rate was 94.5% during 1989-2003. A primary reason for the bycatch of butterfish is due to the co-occurrence of *Illex* and butterfish during September and October when butterfish migrate into deeper offshore waters which constitute *Illex* habitat (Hendrickson and Holmes 2004). Among the alternatives under consideration, the most beneficial alternative for the butterfish managed resource is 7D, because this Alternative would maximize the use of larger mesh codends by the *Illex* fishery and is directly linked to a higher probability of butterfish escapement throughout most of the *Illex* fishing season. Due to a rapid increase in the growth rate of *Illex* between June and October (Dawe and Beck 1997), the percent loss of *Illex* catches due to an increase in codend mesh size, declines as the fishing season progresses. Increased effort related to the increased codend mesh size in the September *Illex* fishery (Alternative 7B) is not expected because a bottom trawl selectivity study indicates that losses of *Illex* are nearly zero in October for a codend mesh size of 60 mm and only 1-2% for a mesh size of 90 mm (Amaratunga *et al*. 1979). Consequently, a codend mesh size increase during September, while aiding in reducing butterfish bycatch, is not expected to increase *Illex* fishing mortality. The action alternatives are not expected to negatively impact the *Illex* stock during any time of the year, even if fishing effort increases, because fishing mortality in the directed fishery is controlled by an annual quota.

8 *Loligo* possession limit for the directed *Illex* fishery during closure of the directed *Loligo* fishery

Four alternatives:

8A: No Action (For *Illex* moratorium permitted vessels, the *Loligo* possession limit during closures of the directed *Loligo* fishery is consistent with the incidental catch allowance for all vessels – currently 2,500 pounds)

8B: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of retained squid catch onboard, with a maximum limit of up to 30,000 pounds of *Loligo*

8C: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 5% of the total weight of retained squid catch onboard, with a maximum limit of up to 20,000 pounds of *Loligo*

8D: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of retained squid catch onboard, with a maximum limit of up to 10,000 pounds of *Loligo*

Problem Statement: When *Loligo* fishery closures have occurred during the end of the *Illex* fishing season (Sept.-Oct.), regulatory discarding of *Loligo* has occurred in the *Illex* fishery. This discarding occurs as a result of the co-occurrence of both species on the *Illex* fishing grounds during Sept-Oct, the low *Loligo* possession limit (2,500 lbs per trip per calendar day during *Loligo* fishery closures, and the large-volume squid catches that occur in the *Illex* fishery. The modifications under consideration are meant to apply only to the directed *Illex* fishery (i.e., *Illex* moratorium-permitted vessels in possession of *Illex*). The current possession limit during closure periods that applies to all vessels is 2,500 pounds of *Loligo*. The modifications would allow for increases in the possession limit of incidentally captured *Loligo*. Each of the action alternatives (8B-8D) is intended to reduce regulatory discarding of *Loligo* by the directed *Illex* fishery during *Loligo* fishery closure periods. The modifications were not intended by the SMB Committee to provide an incentive to the *Illex* fishery to direct fishing effort on *Loligo* during closure periods.

Council's recommendation: No "Preferred Alternative" has been selected at this time. The Council proposed implementing a similar management action as part of the specification of management measures for the 2007 fishing year but it was not implemented because NMFS was unable to effectively administer the measure as proposed by the Council.

Impact analysis: Under the no action alternative, continued regulatory discarding of *Loligo* will have a negative impact on the *Loligo* stock. An increase in the *Loligo* trip limit in the *Illex* fishery during *Loligo* fishery closures would be beneficial to the *Loligo* stock because it would allow regulatory discards to be converted to landings. This would allow for more accurate quantification of fishery removals, and thus more accurate management of the resource. As worded, the action alternatives do not just pertain to the directed *Illex* fishery. Rather, the alternatives allow any vessel with an *Illex* moratorium permit and catches of squid onboard (entirely *Illex*, *Loligo* or a mixture of both species), regardless of what species they are targeting, to increase their allowable *Loligo* landings during *Loligo* fishery closures. A resulting increase in fishing mortality could have a negative impact on the *Loligo* stock.

9 Requirement for electronic daily reporting in the directed *Illex* fishery

Two alternatives: 9A: No Action
9B: Require electronic daily reporting in the directed *Illex* fishery

Problem Statement: *Illex* is a sub-annual species for which recruitment predictions are not currently possible. As such, estimates of absolute or relative stock biomass typically available for other managed resources are generally lacking for the *Illex* stock during a given harvest season. The action alternative would provide fast (real-time), high-resolution fisheries data that would greatly improve the quality of data used in assessing the condition of the *Illex* stock. An improvement in the quality of this information would better equip managers and industry in identifying optimal harvest goals and adjusting harvest strategy when necessary. In addition, real-time, tow-based reporting may be useful in determining when and where *Loligo* bycatch occurs in the *Illex* fishery during periods when the *Loligo* fishery is closed (Alternative 8).

Council recommendation: The Council does not currently have a preferred alternative under this issue. The *Illex* industry has been strongly in favor of extending this tool into the management of the resource, however, the Council has recently expressed concern about mandating electronic daily reporting at a time when NOAA fisheries does not have the necessary infrastructure to process the transmitted data. At its October 2006 meeting, the Council was advised by NERO to remove mandatory electronic reporting options from consideration under another FMP (Surfclams and Ocean Quahogs). However, the Regional Office does have the authority to implement vessel electronic reporting programs and expects the electronic trip report system to be fully operational in the Northeast Region in 2008.

Impact analysis: The action alternative (9B) would result in the need for *Illex* moratorium-permitted vessels to have vessel monitoring system (VMS) equipment installed in order to electronically transmit harvest and other data. It has not been decided at this time whether *all* moratorium-permitted vessels would be required to have VMS - a large portion of the permitted fleet does not actively participate in the fishery. Costs to industry are expected to be minimal, consisting primarily of minor per-message costs. This is because most of the active *Illex* fleet is already equipped with VMS. Currently, there are three vendors that have been certified by NERO to provide vessel monitoring systems that meet the technical and legal requirements of fishery management programs off the Northeastern United States:

1) Boatracs
2) SkyMate
3) Thrane & Thrane (pronounced "Tron & Tron")

Communication and information services offered by one or more of the three available VMS vendors include e-mail, weather, fax, voice messaging and emergency SOS broadcasts to the US Coast Guard and/or vessel owners. Each vendor offers a range of subscription plans that include varying amounts of characters transmitted for a set price.

For example, SkyMate offers up to 8,000 characters sent or received under its "Silver VMS" plan for a fee of $19.99 per month. The "Gold VMS" plan includes up to 20,000 characters for $38.99 per month, and the "Platinum VMS" plan includes up to 50,000 characters for $73.99 per month. (Prices quoted off SkyMate.com web site as of November 6, 2006).

Devices may be installed on vessels that transmit location data ("pings") at specified intervals or on demand. The data are transmitted via satellite to the service providers and can be relayed on to government agencies, vessel owners, etc. No specific data reporting requirements have been identified thus far under the action alternative. Reasons for this include uncertainty as to when reporting would be required, and therefore when VMS units would have to be powered up. The range of possibilities for VMS power-on requirements includes but is not limited to:

1) At all times, whether dockside or underway,
2) Anytime the vessel is in the EEZ,
3) At all times during the *Illex* fishing season (i.e., June – September),
4) At the captain's discretion upon initiation of a directed *Illex* trip.

Specific electronic reporting elements that could be reported using onboard VMS would likely consist of those that would improve the ability of assessment scientists to make estimates of relative stock size and would inform managers and industry about fleet harvest of *Illex* and other species relative to regulatory limits. The range of reporting elements includes but is not limited to:

1) Beginning and end-of-tow identifier, time, date, lat/long,
2) Depth,
3) Surface and bottom temperatures,
4) Remarks on gear configurations and/or problems,
5) Pounds kept and pounds discarded by species.

Real-time electronic reporting of tow-based fishing effort, catch by species, and location data has been successfully implemented on a voluntary basis in the *Illex* fishery since 2002 and has been shown to improve the quality of data available for stock assessments (Hendrickson et al. 2003). In this example, vessel operators sent signals through the VMS e-mail messaging unit at the beginning and end of each tow, with a satellite signal indicating fishing location, along with a date, time, and vessel messaging unit identification number.

10 Seasonal gear restricted areas (GRAs) to reduce butterfish discards

Four alternatives: **10A: No Action (No butterfish GRAs - Preferred Alternative)**
10B: Minimum of 3 inch codend mesh size in Butterfish GRA1
10C: Minimum of 3 inch codend mesh size in Butterfish GRA2
10D: Minimum of $3^{3/4}$ inch codend mesh size in Butterfish GRA1
10E: Minimum of $3^{3/4}$ inch codend mesh size in Butterfish GRA2
(Minimum mesh sizes for each of the above Alternatives represent inside stretch measurements of the codend, or liner if the latter is utilized)

Problem Statement: Vessel Trip Reports and NEFSC Observer Program data indicate that butterfish discarding is highest in the small-mesh SMB bottom trawl fisheries, particularly during January through April, and is associated with areas of high small-mesh fishing effort. In addition, Observer Program data also indicate that the small-mesh *Loligo* and butterfish fisheries are associated with high discards of silver hake, red hake, and spiny dogfish and that both fisheries combined account for 53%, 48%, and 22% of the total amount of discards recorded in the Observer Program database for each species, respectively. The southern silver hake stock is in the process of rebuilding.

Four alternative gear restricted areas (GRAs) are being considered that could reduce discarding of butterfish in small-mesh otter trawl fisheries during Jan-April by either 50% (Butterfish GRA1, either < 3.0 in. or < 3.75 in.) or 90% (Butterfish GRA2, either <3.0 in. or < 3.75 in.). The GRA boundaries and closure periods were identified through a quantitative, spatial analysis of fishing effort and butterfish discarding in the small-mesh bottom trawl fisheries. Within these GRAs, the use of bottom otter trawl gear would be subject to minimum codend mesh size requirements of either 3.0 in. or 3.75 in. during the period January 1 through April 30.

Council recommendation: The Council has chosen 10A (No Action Alternative) as its preferred alternative. A majority of the Council's members indicated that the benefit to the butterfish stock provided by the GRAs was outweighed by the economic cost to the industry.

Impact analysis: Implementation of any of the action Alternatives will reduce discard mortality on multiple species that are currently being discarded in the small-mesh fisheries, including the overfished stocks of butterfish and scup, and may also aid in rebuilding of the southern stock of silver hake. The areas described by the GRAs reflect high levels of both small-mesh fishing effort and high butterfish discard rates. The GRAs are likely to be effective at reducing butterfish discards during the GRA effective period. The GRAs are also likely to reduce the high levels of discards of silver hake, red hake, and spiny dogfish that occur in the *Loligo* and butterfish fisheries, particularly the GRAs associated with Alternatives 10D or 10E because the winter distributions of red hake and silver hake (Sosebee and Cadrin 2006) and spiny dogfish (Sosebee and Rago 2000) overlap with the proposed GRA boundaries during the effective time period. Of the action alternatives, Alternative 10E, followed by Alternative 10D will provide the most benefit to the butterfish, silver hake, red hake, and spiny dogfish stocks because discards of these species occur in both the *Loligo* and butterfish fisheries and a 3-inch codend mesh size is the current mesh requirement in the butterfish fishery.

The GRAs may not comprehensively solve the issue of small-mesh fishery discarding of butterfish during winter if the small-mesh fishing effort shifts to other areas. According to NEFSC surveys, butterfish distribution is widespread along the shelf break in the winter. A portion of the southern part of butterfish population is currently protected during January through March 15 by an existing small-mesh GRA for scup (prohibition on fishing with trawl gear with codends < 4.5 inches). Because the GRAs are of limited geographic scope, the expected shifts in the spatial distribution of small-mesh fishing effort (particularly in the *Loligo* fishery) may supplant current butterfish discard patterns, resulting in butterfish discarding in other time/area combinations. However, the prediction of spatial shifts in fishing effort and the amount of non-target species discarding associated with such effort shifts are difficult if not impossible to accurately predict, so the impacts of any fishing effort shifts are unknown. In addition, fishing within the GRAs with codend mesh sizes greater than 3.0 or 3.75 inches will still be permitted.

Shifts in the spatial distribution of fishery effort are also likely to have a primarily economic basis. Based on total value (all species landed on the affected trip), the rank of alternatives from most significant revenue impact to least significant economic impact is: Alternative 10E, Alternative 10C, Alternative 10D, then Alternative 10B. Based simply on actual revenue, there is the potential for losses up to $7.5 million. However, given the ability for fishing vessels to employ a number of strategies, these losses will most likely not be fully realized. This is evidenced by analyses which show that a large portion of the relevant landings occur outside the bounds (time and space) of the proposed butterfish GRAs.

<u>Overall Impacts</u>

Regardless of the uncertainty as to which actions will be implemented through this amendment, it is expected that the overall long term impacts should be positive for all aspects of the human environment. This is because, barring some unexpected natural or human-induced catastrophe, the regulatory mandates under which Federal fishery management operates require that management actions be taken in a manner that will optimize the long term condition of managed resources, non-target species, habitat, protected resources, and human communities. Consistent with NEPA, the SFA requires that management actions be taken only after consideration of impacts to the biological, physical, economic, and social dimensions of the human environment. This document functions to identify the likely outcomes of various management alternatives. Any alternative that would compromise resource sustainability would be in contradiction with the mandates of the MSFCMA/SFA and would not be implemented. Additional scrutiny of the management alternatives during the Public Hearing Process will serve to further characterize the potential costs and benefits associated with the various alternatives.

Areas of Controversy: The public hearing process for Amendment 9 will be used to allow affected members of the public to comment on issues and alternatives that concern them. During this time, some of the management alternatives under consideration may be identified as controversial to affected members of the fishing community and other concerned citizens. During the scoping process that preceded the development of the DSEIS for Amendment 9, comments from stakeholders indicated several areas of controversy.

1) Moratorium on entry into the *Illex* fishery: Some parties were concerned about the fairness of preventing their entry into the fishery.

2) Designation of EFH areas for *Loligo* eggs: The primary concern was the possibility that fishing activities in those areas would be restricted and stakeholders would lose an important source of revenue.

3) EFH Closure Areas: The primary concern expressed by stakeholders was the size of some of the potential area closures, and the potential for negative impacts on the profitability of their fishing operations.

4) Increasing the minimum mesh for *Loligo*: A concern expressed by stakeholders was the inefficiency in the ability of the nets to catch squid if the mesh size is increased. Additionally, industry was interested in investigating the use of a square mesh codend that would still meet the status quo 1 $^{7/8}$ inch inside stretch minimum, but would maintain a larger opening when the nets are in use.

5) Increasing the *Loligo* possession limit for *Illex* vessels during closures: The primary concern was that if increased *Loligo* harvest occurred during the closure period harvest, then reductions in directed harvest quota would occur and reduce revenues for fishermen that harvest later in the year.

6) Butterfish GRAs: Concern was expressed that the GRAs would have a severe negative impact on *Loligo* fishing operations that harvest in the beginning of the year when the GRAs would be in effect.

Impacts of the Alternatives: Table E-1 is provided below to list all of the management alternatives and qualitatively summarize the anticipated impacts of each of the management alternatives.

Cumulative Effects: A preliminary cumulative effects assessment (CEA) was conducted for this draft document. The information from that assessment is provided in Section 8.0. Table E-2 contains a qualitative summary of the cumulative effects from that assessment.

Table E-1 Management alternatives under consideration in Amendment 9 and expected impacts on the "valued ecosystem components" (VECs). For each issue, the Council's preferred alternatives (where applicable) are in bold.

Management Measure		**VECs**				
		Managed resource	**Non-target species**	**Habitat including EFH**	**Protected Resources**	**Human Communities**
MULTI-YEAR SPECIFICATIONS FOR ALL SPECIES MANAGED UNDER THE FMP	Alternative 1A: No action	No Impact	No Impact	No Impact	No Impact	No Impact
	Alternative 1B: Allow for specification of management measures for a period of up to three years (Preferred Alternative)	No Impact	No Impact	No Impact	No Impact	Potentially Low Positive
	Alternative 1C: Allow for specification of management measures for a period of up to five years	No Impact	No Impact	No Impact	No Impact	Potentially Low Positive
MEASURES TO ADDRESS OVERCAPACITY IN THE DIRECTED *ILLEX* FISHERY	Alternative 2A: No action	Negative	Potentially Negative	Negative	Negative	Potentially Negative
	Alternative 2B: Extend the moratorium without sunset provision (Preferred Alternative)	Positive	Positive	Neutral	Positive	Potentially Positive
	Alternative 2C: Terminate the moratorium	Negative	Potentially Negative	Negative	Negative	Potentially Negative
	Alternative 2D: Extend the moratorium without sunset provision and allow new entry into fishery through permit transfer system	Positive	Positive	Neutral	Positive	Potentially Positive

Table E-1 (continued)

Management Measure		VECs				
		Managed resource	**Non-target species**	**Habitat including EFH**	**Protected Resources**	**Human Communities**
REVISED BIOLOGICAL REFERENCE POINTS FOR *LOLIGO PEALEII*	Alternative 3.A: No action	Potentially negative	Neutral	Neutral	Neutral	Neutral
	Alternative 3.B: Adopt SARC 34 Recommendation (Preferred Alternative)	Potentially positive	Neutral	Neutral	Neutral	Neutral
DESIGNATION OF EFH FOR *LOLIGO* EGGS	Alternative 4A: No action	Potentially Negative	Potentially Negative	Potentially Negative	Potentially Negative	Potentially Negative
	Alternative 4B: EFH designation based on documented observations of egg mops	Potentially Positive	Potentially Positive	Positive	Potentially Positive	Potentially Negative Short-term, Positive Long-term
AREA CLOSURES TO REDUCE GEAR IMPACTS TO EFH	Alternative 5A: No Action	Neutral	Neutral	Low Negative	Neutral	No Impact
	Alternative 5B: Prohibit fishing with bottom otter trawls in the area surrounding the head of the Hudson Canyon	Potentially Positive	Potentially Positive	Positive	Low Positive	High Negative
	Alternative 5C: Prohibit fishing with bottom otter trawls in tilefish HAPC	Potentially Positive	Potentially Positive	Positive	Positive	High Negative
	Alternative 5D: Prohibit fishing with bottom otter trawls in Lydonia and Oceanographer Canyon (Preferred Alternative)	Low Positive	Low Positive	Low Positive	Low Positive	No Impact

Table E-1 (continued)

Management Measure		VECs				
		Managed resource	**Non-target species**	**Habitat including EFH**	**Protected Resources**	**Human Communities**
LOLIGO MINIMUM MESH SIZE REQUIREMENTS	Alternative 6A: No Action	Butterfish - Negative *Loligo* - No Impact	No Impact	Neutral	No Impact	No Impact
	Alternative 6B: Increase minimum codend mesh size to $2^{1/8}$ inches	Butterfish - Low Positive *Loligo* – Very Low Negative	Low Positive	Very Low Negative	Very Low Negative	*Loligo* fishery – Very Low Negative
	Alternative 6C: Increase minimum codend mesh size to $2^{1/2}$ inches	Butterfish - Low Positive *Loligo* – Low Negative	Low Positive	Low Negative	Low Negative	*Loligo* fishery - Low Negative
	Alternative 6D: Increase minimum codend mesh size to 3 inches	Butterfish – High Positive *Loligo* – Negative	Positive	Low Negative	Low Negative	*Loligo* fishery - Negative
EXEMPTIONS FROM *LOLIGO* MINIMUM MESH REQUIREMENTS FOR *ILLEX* VESSELS	**Alternative 7A: No Action (Preferred Alternative)**	Butterfish - Low Negative Other SMB - No Impact	Low Negative	Neutral	No Impact	No Impact
	Alternative 7B: Exclude month of September from current mesh exemption for *Illex* fishery	Butterfish - Low Positive Other SMB - No Impact	Low Positive	Neutral	No Impact	Potentially Low Negative
	Alternative 7C: Exclude months of August and September from current mesh exemption for *Illex* fishery	Butterfish - Low Positive *Illex* - Potentially Low Negative Other SMB - No Impact	Low Positive	Low Negative	Low Negative	Potentially Negative
	Alternative 7D: Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels	Butterfish - Low Positive *Illex* - Negative Other SMB - No Impact	Low Positive	Low Negative	Low Negative	Negative

Table E-1 (continued)

Management Measure		VECs				
		Managed resource	**Non-target species**	**Habitat including EFH**	**Protected Resources**	**Human Communities**
LOLIGO POSSESSION LIMIT FOR THE DIRECTED *ILLEX* FISHERY DURING CLOSURE OF THE DIRECTED *LOLIGO* FISHERY	Alternative 8A: No Action	*Loligo* - Negative Other SMB - No Impact	No Impact	No Impact	No Impact	No Impact
	Alternative 8B: For *Illex* vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of retained squid catch onboard, with a maximum limit of up to 30,000 pounds of *Loligo*	*Loligo* - Potentially Low Positive Other SMB - No Impact	Potentially Low Positive	Potentially Low Positive	Potentially Low Positive	*Illex* Fishery – Positive *Loligo* Fishery – Negative
	Alternative 8C: For *Illex* vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 5% of the total weight of retained catch onboard, with a maximum limit of up to 20,000 pounds of *Loligo*	*Loligo* - Potentially Low Positive Other SMB - No Impact	Potentially Low Positive	Potentially Low Positive	Potentially Low Positive –	*Illex* Fishery – Positive *Loligo* Fishery – Negative
	Alternative 8D: For *Illex* vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of retained catch onboard, with a maximum limit of up to 10,000 pounds of *Loligo*	*Loligo* - Low Positive Other SMB - No Impact	Potentially Low Positive	Potentially Low Positive	Potentially Low Positive	*Illex* Fishery - Low Positive *Loligo* Fishery - Low Negative

Table E-1 (continued)

Management Measure		Managed resource	Non-target species	Habitat including EFH	Protected Resources	Human Communities
		VECs				
REQUIREMENT FOR ELECTRONIC DAILY REPORTING IN THE DIRECTED *ILLEX* FISHERY	Alternative 9A: No Action	No Impact	No Impact	No Impact	No Impact	No Impact
	Alternative 9B: Require electronic daily reporting in the directed *Illex* fishery	No Impact	Unknown	No Impact	No Impact	Potentially Low Negative
SEASONAL GEAR RESTRICTED AREAS (GRAS) TO REDUCE BUTTERFISH DISCARDS	**Alternative 10A: No Action (Preferred Alternative)**	Butterfish - Negative Other SMB - No Impact	No Impact	No Impact	No Impact	No Impact
	Alternative 10B: Minimum of 3 inch codend mesh size in Butterfish GRA1	Butterfish - Positive Other SMB – Unknown, Potentially Neutral	Positive	Potentially Low Negative or Positive	Potentially Low Negative or Positive	Negative
	Alternative 10C: Minimum of 3 inch codend mesh size in Butterfish GRA2	Butterfish - Positive Other SMB - Unknown, Potentially Neutral	Positive	Potentially Low Negative or Positive	Potentially Low Negative or Positive species	Negative
	Alternative 10D: Minimum of $3^{3/4}$ inch codend mesh size in Butterfish GRA1	Butterfish - Positive Other SMB – Unknown, Potentially Neutral	Positive	Potentially Low Negative or Positive	Potentially Low Negative or Positive	High Negative
	Alternative 10E: Minimum of $3^{3/4}$ inch codend mesh size in Butterfish GRA2	Butterfish - Positive Other SMB – Unknown, Potentially Neutral	Positive	Potentially Low Negative or Positive	Potentially Low Negative or Positive	High Negative

A summary comparison of the relative incremental effect contributions to the cumulative effect for each set alternatives and affected resource, or valued ecosystem component (VEC), is displayed in Table E-2. The cumulative effect baseline consists of the combined effect of the numerous "other" past, present and reasonably foreseeable future fishing and non-fishing actions that have been or would be taken by NMFS and other entities that have affects on the VECs. These are described in second row of Table E-2. Also, note the relative impact contribution of each alternative listed for each VEC in the remaining portion of Table E-2. The overall cumulative effects analysis consists of evaluating the resultant effects of the actions taken under this Amendment combined with the baseline. The impact of each alternative considered may have neutral, positive or negative impacts to each VEC. The bases for this analysis are described in more detail in Section 8.

The proposed alternatives would either increase or decrease fishing mortality of the managed resource VEC, and, in turn, have positive or negative effects, respectively, on population size or have no effect.. As such, if the total suite of actions taken under this amendment has a net result of decreasing the ability of fisheries to harvest the managed resources, then the sum cumulative effect will be positive. Decreased harvest effort would also tend to reduce fishing mortality on non-target species and protected resources and reduce disturbance of bottom habitat and thus have positive effects on these VECs. On the other hand reducing the ability of harvesters to acquire catch generally corresponds with reduced revenue, at least in the short term which translates to negative effects to human communities.

In general, it is expected that the overall long-term cumulative effects would be positive for the managed species and most VECs, as most of the preferred alternatives have neutral or positive incremental effects added to a generally positive baseline (Table E-2). The negative effects are generally shorter term, and, in most cases, would be positive over the long term. Those alternatives with neutral or no effect have no resulting cumulative effects. Thus, assuming that the generally positive baseline conditions for the long term would be achieved, it is anticipated that the preferred alternatives in this Amendment would result in positive long term effects on the managed species and other VECs. The regulatory atmosphere within which Federal fishery management operates requires that management actions be taken in a manner that will optimize the conditions of resources, habitat, and human communities. Consistent with NEPA, the SFA requires that management actions be taken only after consideration of impacts to the biological, physical, economic, and social dimensions of the human environment.

Table E-2. Summary comparison of cumulative effects for Amendment 9 alternatives.

Valued Ecosystem Components (VEC)		Managed Resources	Non-Target Species	Habitat	Protected Species	Human Communities
Baseline Effects without Amendment 9 (includes effects of past, present and reasonably foreseeable future actions)		**Negative in short term** for Butterfish; **Positive** in long term - sustainable stock sizes for all SMB species are anticipated; (Butterfish would be addressed in Amendment 10)	**Negative in short term** - Increased bycatch rates would continue until reduction measures are implemented **Positive** – Long term reduced bycatch, improved bycatch accounting, improved habitat quality	**Positive** - reduced habitat disturbance by fishing gear and non-fishing actions	**Negative or low negative in short term** -- Until Trawl TRP is implemented **Positive** – reduced gear encounters through effort reduction and Trawl TRP, Sea Turtle Strategy; improved habitat quality	**Short-term negative** lower revenues would continue until stocks are fully rebuilt **Long-term positive** sustainable resources should support viable communities and economies
Alt #	**Management Measure/Alternative**	**Relative Incremental Effect Contribution of Amendment 9 Alternatives to Overall Cumulative Effect of Baseline**				
Multi-Year Specifications for Managed Species						
1A	No Action	0	0	0	0	0
1B*	**Allow for specifications for all species up to 3 years**	0	0	0	0	+
1C	Allow for specifications for all species up to 5 years	0	0	0	0	+
Measures to Address Overcapacity of the Directed *Illex* fishery						
2A	No Action	0	--	--	--	--
2B*	**Extend entry moratorium to *Illex* fishery without sunset provision**	0	0	0	0	0
2C	Terminate entry moratorium to *Illex* Fishery	0	--	--	--	--
2D	Extend moratorium without sunset and allow entry through permit transfer	0	0	0	0	0
Revised Biological Reference Points for *Loligo*						
3A	No Action	--	0	0	0	0
3B*	**Adopt SARC 34 Recommendation**	+	0	0	0	0

Designation of EFH for *Loligo* eggs						
4A	No action	--	--	--	--	--
4B	EFH designation based on documented observations of egg mops	+	+	+	+	+/--
Area Closures to Reduce Gear Impacts to EFH						
5A	No action	0	0	0	0	0
5B	Prohibit fishing with bottom otter trawls in head of Hudson Canyon	+	+	+	+	> --
5C	Prohibit fishing with bottom otter trawls in tilefish HAPC	+	+	+	+	> --
5D*	**Prohibit fishing with bottom otter trawls in Lydonia and Oceanographer Canyons**	< +	< +	< +	< +	0
Modify *Loligo* Minimum Mesh Size						
6A	No Action	--B 0 A	0	0	0	0
6B	Increase minimum codend mesh size to $2^{1/8}$ inches	< + B 0 A	< +	< --	< --	< --
6C	Increase minimum codend mesh size to $2^{1/2}$ inches	< + B 0 A	< +	< --	< --	< --
6D	Increase minimum codend mesh size to 3 inches	>+B 0 A	+	< --	< --	--
Exemptions from *Loligo* Minimum Mesh Size Requirements for *Illex* Vessels						
7A*	**No Action**	< -- B 0 A	< --	0	0	0
7B	Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding September from current mesh exemption	< + B 0 A	< +	0	0	< --
7C	Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding August and September from current mesh exemption	< + B 0 A < -- I	< +	< --	< --	--
7D	Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels	< + B 0 A < -- I	< +	< --	< --	--

***Loligo* Possession Limit for the Directed *Illex* Fishery during Closure of Directed *Loligo* Fishery**						
8A	No Action – For *Illex* moratorium permitted vessels *Loligo* possession limit is 2500 lb = existing incidental catch allowance	-- L 0 A	0	0	0	0
8B	Possession limit is the greater of 2500 lbs or amount not to exceed 10% of total weight of retained squid to a maximum of 30,000 lbs	< + L 0 A	< +	< +	< +	+ I -- L
8C	Possession limit is the greater of 2500 lbs or amount not to exceed 5% of total weight of retained squid to a maximum of 20,000 lbs	< + L 0 A	< +	< +	< +	+ I -- L
8D	Possession limit is the greater of 2500 lbs or amount not to exceed 10% of total weight of retained squid to a maximum of 10,000 lbs	< + L 0 A	< +	< +	< +	< + I < -- L
Electronic Daily Reporting Requirement for the Directed *Illex* Fishery						
9A	No action	0	0	0	0	0
9B	Require electronic daily reporting in directed *Illex* fishery	0	0	0	0	< --
Implementation of Seasonal Gear Restricted Areas (GRA) to Reduce Butterfish Discards						
10A*	**No action**	-- B 0 A	0	0	0	0
10B	Minimum of 3 inch codend mesh size in Butterfish GRA 1	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	--
10C	Minimum of 3 inch codend mesh size in Butterfish GRA 2	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	--
10D	Minimum of $3^{3/4}$ inch codend mesh size in Butterfish GRA 1	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	> --
10E	Minimum of $3^{3/4}$ inch codend mesh size in Butterfish GRA 2	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	> --

Bolded * = Preferred Alternative
0 = No Cumulative Impact
+ = Positive Cumulative Impact
>+ = High Positive; < + = low positive
-- = Negative Cumulative Impact
> -- = High Negative; < -- = low negative

L = *Loligo* only;
B = Butterfish only
I = *Illex* only
A = All other Managed Species

Impact Definitions:
Managed Species, Non-Target species, Protected Species:
Positive: actions that increase stock size
Negative: actions that decrease stock size
Habitat:
Positive: actions that improve or reduce disturbance of habitat
Negative: actions that degrade or increase disturbance of habitat
Human Communities:
Positive: actions that increase revenue and well being of fishermen and/or associated businesses
Negative: actions that decrease revenue and well being of fishermen and/or associated businesses

Alt. #	**Management Measure/Alternative**	**Cumulative Effects by Alternative**				
		Managed Resources	**Non-Target Species**	**Habitat**	**Protected Species**	**Human Commun-ities**
Multi-Year Specifications for all Species						
1A	No Action	0	0	0	0	0
1B*	**Allow for specifications for all species up to 3 years**	0	0	0	0	+
1C	Allow for specifications for all species up to 5 years	0	0	0	0	+
Measures to Address Overcapacity of the Directed *Illex* fishery						
2A	No Action	0	--	--	--	--
2B*	**Extend entry moratorium to *Illex* fishery without sunset provision**	0	0	0	0	0
2C	Terminate entry moratorium to *Illex* Fishery	0	--	--	--	--
2D	Extend moratorium without sunset and allow entry through permit transfer	0	0	0	0	0
Revised Biological Reference Points for *Loligo*						
3A	No Action	--	0	0	0	0

3B*	**Adopt SARC 34 Recommendation**	+	0	0	0	0
Designation of EFH for *Loligo* eggs						
4A	No action	--	--	--	--	--
4B	EFH designation based on documented observations of egg mops	+	+	+	+	+/--
Area Closures to Reduce Gear Impacts to EFH						
5A	No action	0	0	0	0	0
5B	Prohibit directed fishing with bottom otter trawls in head of Hudson Canyon	+	+	+	+	> --
5C	Prohibit directed fishing with bottom otter trawls in tilefish HAPC	+	+	+	+	> --
5D*	**Prohibit directed fishing with bottom otter trawls in Lydonia and Oceanographer Canyons**	< +	< +	< +	< +	0
Modify *Loligo* Minimum Mesh Size						
6A	No Action	--B 0 A	0	0	0	0
6B	Increase minimum codend mesh size to $2^{1/8}$ inches	< + B 0 A	< +	< --	< --	< --
6C	Increase minimum codend mesh size to $2^{1/2}$ inches	< + B 0 A	< +	< --	< --	< --
6D	Increase minimum codend mesh size to 3 inches	>+B 0 A	+	< --	< --	--
Exemptions from *Loligo* Minimum Mesh Size Requirements for *Illex* Vessels						
7A*	**No Action**	< -- B 0 A	< --	0	0	0
7B	Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding September from current mesh exemption	< + B 0 A	< +	0	0	< --
7C	Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding August and September from current mesh exemption	< + B 0 A < -- I	< +	< --	< --	--
7D	Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels	< + B 0 A < -- I	< +	< --	< --	--
***Loligo* Possession Limit for the Directed *Illex* Fishery during Closure of Directed *Loligo* Fishery**						
8A	No Action – For *Illex* moratorium permitted vessels *Loligo* possession limit is 2500 lb = existing incidental catch allowance	-- L 0 A	0	0	0	0

8B	Possession limit is the greater of 2500 lbs or amount not to exceed 10% of total weight of retained squid to a maximum of 30,000 lbs	< + L 0 A	< +	< +	< +	+ I -- L
8C	Possession limit is the greater of 2500 lbs or amount not to exceed 5% of total weight of retained squid to a maximum of 20,000 lbs	< + L 0 A	< +	< +	< +	+ I -- L
8D	Possession limit is the greater of 2500 lbs or amount not to exceed 10% of total weight of retained squid to a maximum of 10,000 lbs	< + L 0 A	< +	< +	< +	< + I < -- L
Electronic Daily Reporting Requirement for the Directed *Illex* Fishery						
9A	No action	0	0	0	0	0
9B	Require electronic daily reporting in directed *Illex* fishery	0	0	0	0	< --
Implementation of Seasonal Gear Restricted Areas (GRA) to Reduce Butterfish Discards						
10A*	**No action**	-- B 0 A	0	0	0	0
10B	Minimum of 3 inch codend mesh size in Butterfish GRA 1	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	--
10C	Minimum of 3 inch codend mesh size in Butterfish GRA 2	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	--
10D	Minimum of $3^{3/4}$ inch codend mesh size in Butterfish GRA 1	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	> --
10E	Minimum of $3^{3/4}$ inch codend mesh size in Butterfish GRA 2	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	> --

Bolded * = Preferred Alternative
0 = No Cumulative Impact
+ = Positive Cumulative Impact (See Table 101 for definition for each VEC); >+ = High Positive; < + = low positive
-- = Negative Cumulative Impact (See Table 101 for definition for each VEC); > -- = High Negative; < -- = low negative
L = *Loligo* only;
B = Butterfish only

I = *Illex* only
A = All other Managed Species

Alt. #	Management Measure/Alternative	Cumulative Effects by Alternative				
		Managed Resources	**Non-Target Species**	**Habitat**	**Protected Species**	**Human Commun-ities**
Multi-Year Specifications for all Species						
1A	No Action	0	0	0	0	0
1B*	**Allow for specifications for all species up to 3 years**	0	0	0	0	+
1C	Allow for specifications for all species up to 5 years	0	0	0	0	+
Measures to Address Overcapacity of the Directed *Illex* fishery						
2A	No Action	0	--	--	--	--
2B*	**Extend entry moratorium to *Illex* fishery without sunset provision**	0	0	0	0	0
2C	Terminate entry moratorium to *Illex* Fishery	0	--	--	--	--
2D	Extend moratorium without sunset and allow entry through permit transfer	0	0	0	0	0
Revised Biological Reference Points for *Loligo*						
3A	No Action	--	0	0	0	0
3B*	**Adopt SARC 34 Recommendation**	+	0	0	0	0
Designation of EFH for *Loligo* eggs						
4A	No action	--	--	--	--	--
4B	EFH designation based on documented observations of egg mops	+	+	+	+	+/--
Area Closures to Reduce Gear Impacts to EFH						
5A	No action	0	0	0	0	0
5B	Prohibit directed fishing with bottom otter trawls in head of Hudson Canyon	+	+	+	+	> --
5C	Prohibit directed fishing with bottom otter trawls in tilefish HAPC	+	+	+	+	> --
5D*	**Prohibit directed fishing with bottom otter trawls in Lydonia and Oceanographer Canyons**	< +	< +	< +	< +	0
Modify *Loligo* Minimum Mesh Size						
6A	No Action	--B 0 A	0	0	0	0
6B	Increase minimum codend mesh size to $2^{1/8}$ inches	< + B	< +	< --	< --	< --

		0 A				
6C	Increase minimum codend mesh size to $2^{1/2}$ inches	< + B 0 A	< +	< --	< --	< --
6D	Increase minimum codend mesh size to 3 inches	>+B 0 A	+	< --	< --	--
Exemptions from *Loligo* Minimum Mesh Size Requirements for *Illex* Vessels						
7A*	**No Action**	< -- B 0 A	< --	0	0	0
7B	Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding September from current mesh exemption	< + B 0 A	< +	0	0	< --
7C	Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding August and September from current mesh exemption	< + B 0 A < -- I	< +	< --	< --	--
7D	Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels	< + B 0 A < -- I	< +	< --	< --	--
***Loligo* Possession Limit for the Directed *Illex* Fishery during Closure of Directed *Loligo* Fishery**						
8A	No Action – For *Illex* moratorium permitted vessels *Loligo* possession limit is 2500 lb = existing incidental catch allowance	-- L 0 A	0	0	0	0
8B	Possession limit is the greater of 2500 lbs or amount not to exceed 10% of total weight of retained squid to a maximum of 30,000 lbs	< + L 0 A	< +	< +	< +	+ I -- L
8C	Possession limit is the greater of 2500 lbs or amount not to exceed 5% of total weight of retained squid to a maximum of 20,000 lbs	< + L 0 A	< +	< +	< +	+ I -- L
8D	Possession limit is the greater of 2500 lbs or amount not to exceed 10% of total weight of retained squid to a maximum of 10,000 lbs	< + L 0 A	< +	< +	< +	< + I < -- L
Electronic Daily Reporting Requirement for the Directed *Illex* Fishery						
9A	No action	0	0	0	0	0
9B	Require electronic daily reporting in directed *Illex* fishery	0	0	0	0	< --
Implementation of Seasonal Gear Restricted Areas (GRA) to Reduce Butterfish Discards						
10A*	**No action**	-- B 0 A	0	0	0	0
10B	Minimum of 3 inch codend mesh size in Butterfish GRA 1	+B 0 A	+	+ inside GRA -- outside	+ inside GRA -- outside	--

				GRA	GRA	
10C	Minimum of 3 inch codend mesh size in Butterfish GRA 2	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	--
10D	Minimum of $3^{3/4}$ inch codend mesh size in Butterfish GRA 1	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	> --
10E	Minimum of $3^{3/4}$ inch codend mesh size in Butterfish GRA 2	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	> --

Bolded * = Preferred Alternative
0 = No Cumulative Impact
+ = Positive Cumulative Impact (See Table 101 for definition for each VEC); >+ = High Positive; < + = low positive
-- = Negative Cumulative Impact (See Table 101 for definition for each VEC); > -- = High Negative; < -- = low negative
L = *Loligo* only;
B = Butterfish only
I = *Illex* only
A = All other Managed Species

Table 102. Summary Comparison of Cumulative Effects by Amendment 9 Alternative.

Alt. #	**Management Measure/Alternative**	**Cumulative Effects by Alternative**				
		Managed Resources	**Non-Target Species**	**Habitat**	**Protected Species**	**Human Commun-ities**
Multi-Year Specifications for all Species						
1A	No Action	0	0	0	0	0
1B*	**Allow for specifications for all species up to 3 years**	0	0	0	0	+
1C	Allow for specifications for all species up to 5 years	0	0	0	0	+
Measures to Address Overcapacity of the Directed *Illex* fishery						
2A	No Action	0	--	--	--	--
2B*	**Extend entry moratorium to *Illex* fishery without sunset**	0	0	0	0	0

	provision					
2C	Terminate entry moratorium to *Illex* Fishery	0	--	--	--	--
2D	Extend moratorium without sunset and allow entry through permit transfer	0	0	0	0	0
Revised Biological Reference Points for *Loligo*						
3A	No Action	--	0	0	0	0
3B*	**Adopt SARC 34 Recommendation**	+	0	0	0	0
Designation of EFH for *Loligo* eggs						
4A	No action	--	--	--	--	--
4B	EFH designation based on documented observations of egg mops	+	+	+	+	+/--
Area Closures to Reduce Gear Impacts to EFH						
5A	No action	0	0	0	0	0
5B	Prohibit directed fishing with bottom otter trawls in head of Hudson Canyon	+	+	+	+	> --
5C	Prohibit directed fishing with bottom otter trawls in tilefish HAPC	+	+	+	+	> --
5D*	**Prohibit directed fishing with bottom otter trawls in Lydonia and Oceanographer Canyons**	< +	< +	< +	< +	0
Modify *Loligo* Minimum Mesh Size						
6A	No Action	--B 0 A	0	0	0	0
6B	Increase minimum codend mesh size to $2^{1/8}$ inches	< + B 0 A	< +	< --	< --	< --
6C	Increase minimum codend mesh size to $2^{1/2}$ inches	< + B 0 A	< +	< --	< --	< --
6D	Increase minimum codend mesh size to 3 inches	>+B 0 A	+	< --	< --	--
Exemptions from *Loligo* Minimum Mesh Size Requirements for *Illex* Vessels						
7A*	**No Action**	< -- B 0 A	< --	0	0	0
7B	Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding September from current mesh exemption	< + B 0 A	< +	0	0	< --
7C	Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding August and September from current mesh exemption	< + B 0 A < -- I	< +	< --	< --	--

7D	Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels	< + B 0 A < -- I	< +	< --	< --	--
***Loligo* Possession Limit for the Directed *Illex* Fishery during Closure of Directed *Loligo* Fishery**						
8A	No Action – For *Illex* moratorium permitted vessels *Loligo* possession limit is 2500 lb = existing incidental catch allowance	-- L 0 A	0	0	0	0
8B	Possession limit is the greater of 2500 lbs or amount not to exceed 10% of total weight of retained squid to a maximum of 30,000 lbs	< + L 0 A	< +	< +	< +	+ I -- L
8C	Possession limit is the greater of 2500 lbs or amount not to exceed 5% of total weight of retained squid to a maximum of 20,000 lbs	< + L 0 A	< +	< +	< +	+ I -- L
8D	Possession limit is the greater of 2500 lbs or amount not to exceed 10% of total weight of retained squid to a maximum of 10,000 lbs	< + L 0 A	< +	< +	< +	< + I < -- L
Electronic Daily Reporting Requirement for the Directed *Illex* Fishery						
9A	No action	0	0	0	0	0
9B	Require electronic daily reporting in directed *Illex* fishery	0	0	0	0	< --
Implementation of Seasonal Gear Restricted Areas (GRA) to Reduce Butterfish Discards						
10A*	**No action**	-- B 0 A	0	0	0	0
10B	Minimum of 3 inch codend mesh size in Butterfish GRA 1	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	--
10C	Minimum of 3 inch codend mesh size in Butterfish GRA 2	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	--
10D	Minimum of 3 3/4 inch codend mesh size in Butterfish GRA 1	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	> --
10E	Minimum of 3 3/4 inch codend mesh size in Butterfish GRA 2	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	> --

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0 = No Cumulative Impact
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L = *Loligo* only;
B = Butterfish only
I = *Illex* only
A = All other Managed Species

2.0 LIST OF ACRONYMS

ACFCMA	Atlantic Coastal Fisheries Cooperative Management Act
ASMFC	Atlantic States Marine Fisheries Commission or Commission
B	Biomass
CEQ	Council on Environmental Quality
CPUE	Catch Per Unit Effort
DPS	Distinct Population Segment
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act of 1973
F	Fishing Mortality Rate
FR	Federal Register
FMP	Fishery Management Plan
GRA	Gear Restricted Area
HPTRP	Harbor Porpoise Take Reduction Plan
IRFA	Initial Regulatory Flexibility Analysis
LTPC	Long-term Potential Catch
LWTRP	Large Whale Take Reduction Plan
M	Natural Mortality Rate
MAFMC	Mid-Atlantic Fishery Management Council
MMPA	Marine Mammal Protection Act
MRFSS	Marine Recreational Fisheries Statistical Survey
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSY	Maximum Sustainable Yield
mt	metric tons
NAO	National Oceanic and Atmospheric Administration Order
NE	New England
NEFMC	New England Fishery Management Council
NEFSC	Northeast Fisheries Science Center
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OY	Optimal Yield
PBR	Potential Biological Removal
PRA	Paperwork Reduction Act
PREE	Preliminary Regulatory Economic Evaluation
RIR	Regulatory Impact Review
RSA	Research Set-Aside
SAFMC	South Atlantic Fishery Management Council
SARC	Stock Assessment Review Committee
SAV	Submerged Aquatic Vegetation
SAW	Stock Assessment Workshop
SMA	Small Business Administration
SSB	Spawning Stock Biomass
SFA	Sustainable Fisheries Act
TAL	Total Allowable Landings
TL	Total Length
VECs	Valued Ecosystem Components
VMS	Vessel Monitoring System
VPA	Virtual Population Analysis
VTR	Vessel Trip Report

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4.0 INTRODUCTION AND BACKGROUND

4.1 Purpose and Need for Action

The need for this amendment is to address problems and issues that have arisen since, or as a result of the latest amendment to the FMP (Amendment 8). Although Amendment 8 was partially approved in 1998, NOAA Fisheries noted that the amendment inadequately addressed some important Magnuson-Stevens Act requirements for Federal FMPs. Specifically, the amendment was considered deficient with respect to its consideration of gear impacts on EFH as they relate to the management unit. In addition, this amendment is needed to address new scientific information, reduce the occurrence of bycatch and discarding, promote long-term planning for harvesters, processors and fishing communities and to minimize the potential for over-exploitation of the *Illex* resource.

The purpose of this amendment is to achieve the management objectives of the Atlantic mackerel, squid and butterfish FMP as outlined in Section 4.2 below, as well as to evaluate measures that would protect EFH and reduce bycatch and discards, incorporate new scientific advice from the *Loligo* stock assessment, consider a multi-year specification setting process and the moratorium on entry into the directed *Illex* fishery. The full range of management issues that are addressed in this amendment, which either correct existing FMP deficiencies, or help to better achieve the existing FMP management objectives, are described under the following headings and summarized at the end of this section.

Allow for multi-year specifications for all species managed under the FMP

This action is being considered as a means to streamline the administrative and regulatory processes involved in the specification of management measures, while, at the same time, maintaining consistency with the Magnuson-Stevens Act. As implemented through Framework 2, the FMP currently allows for multi-year specification of management measures (up to three years) for *Loligo* only. The Council is proposing to establish an allowance for multi-year specification of management measures for all four species managed under the FMP. Multi-year specification of management measures is closely associated with achieving FMP management objective 3 (provide the greatest degree of freedom and flexibility to all harvesters of these resources consistent with the attainment of the other objectives of this FMP). Increased freedom and flexibility are expected if fishery participants are provided with a streamlined regulatory environment that includes an expanded time horizon for planning their harvesting activities. Implementation of this action would not affect the annual stock status review procedures that were established in the FMP.

Maintain the moratorium on entry into the directed *Illex* fishery

This action is being considered as a means to protect the *Illex* stock from over-exploitation, and also avoid economic impacts on historic fishery participants that may occur if the existing constraints on harvest capacity for this fishery are removed. To the degree that this action achieves these results, it should promote the achievement of management objectives 1 (enhance the probability of successful (i.e., the historical average) recruitment to the fisheries) and 6 (minimize harvesting conflicts among US commercial, US recreational, and foreign fishermen). The directed *Illex* fishery is currently considered to be overcapitalized; that is, the size of the fishing fleet is greater than that needed to harvest at optimum yield in any given year. Control over expansion of harvest capacity is currently maintained through a moratorium on new entry into the directed fishery. That moratorium is scheduled to expire in July of 2009.

Revise the biological reference points for *Loligo pealeii*

This action is needed in order to keep the FMP in compliance with the Magnuson-Stevens Act. National Standard 2 of the Magnuson-Stevens Act requires that management measures be based on the best scientific information available. The most recent peer-reviewed *Loligo* stock assessment (SAW 34 – NEFSC 2002) included specific revisions to the biological reference points for *Loligo*. These reference points are used by fishery managers in setting harvest targets and thresholds such that optimum yield can be achieved. The analytical advice provided through peer-reviewed scientific stock assessments is generally accepted as being consistent with the best scientific information available, and is, therefore, consistent with National Standard 2. In addition to maintaining consistency with the Magnuson-Stevens Act, this action should indirectly promote the achievement of FMP management objective 1.

Designate EFH for *Loligo pealeii* eggs

This action is needed in order to keep the FMP in compliance with the Magnuson-Stevens Act. According to §600.815 (a) (1), "FMPs must describe EFH … for each life history stage of the species." The FMP currently identifies and describes EFH for all life stages of the management unit for which information is available, with the exception of *Loligo* squid eggs. Through this amendment, a description of EFH for *Loligo* squid eggs will be added to the FMP. In addition to maintaining consistency with the Magnuson-Stevens Act, this action supports the achievement of FMP management objective 5 (increase understanding of the conditions of the stocks and fisheries).

Close areas to reduce gear impacts to EFH

This action is needed in order to address deficiencies in the existing FMP relative to gear impacts on EFH as they relate to the management unit. In order to properly address this issue, a quantitative spatial analysis was conducted that identified the occurrence of overlap between Atlantic mackerel, squid, and butterfish fishery activity and EFH for all federally-managed species within the geographic scope of the management unit. Based on this analysis, a number of potential area closures are being considered in this amendment that would constitute conservation measures to reduce threats to EFH related to the activities of the Atlantic mackerel, squid, and butterfish fisheries. To the degree that these closures would protect critical life stages for federally-managed species within the geographic scope of the management unit, this action should provide indirect benefits to fisheries associated with these species. As such, this action should also indirectly promote the achievement of FMP management objective 6 (minimize harvesting conflicts among US commercial, US recreational, and foreign fishermen).

Increase the *Loligo* minimum mesh size requirements

This action is being considered as a means to reduce the incidence of discarding, especially of butterfish, in the directed *Loligo* fishery. The action would affect the minimum codend mesh size requirement specified for otter trawl vessels possessing *Loligo* harvested in or from the EEZ (current mesh size is $1^{7/8}$ inches). All other restrictions associated with the possession of *Loligo* by otter trawl vessels would remain in force. Selectivity analyses (Myer and Merriner 1976) provide evidence that escapement (and thus, survival) of butterfish would increase if codend mesh sizes above the current minimum were required. By enhancing the survival of butterfish, especially juvenile butterfish, this action should promote the achievement of FMP management objective 1. Additionally, this action addresses the Magnuson-Stevens Act requirement that management minimize bycatch and discarding to the extent practicable and should provide some increase in the biomass of the overfished butterfish stock.

Modify the existing exemptions from *Loligo* minimum mesh requirements for *Illex* vessels

This action is being considered as a means to reduce *Loligo* discarding in the directed *Illex* fishery. Under the current *Loligo* minimum codend mesh size requirement, vessels fishing for *Illex* during the months of June, July, August, and September seaward of the set of geographic coordinates that correspond to the 50 fathom depth contour are exempt from the minimum mesh requirements. This exemption was originally established based on the understanding that bycatch of *Loligo* in the *Illex* fishery is minimal. Subsequent analyses suggest spatial overlap between the distribution of *Loligo* and the *Illex* fishing grounds located beyond 50 F, especially in the late summer and early fall. This action is associated with achieving FMP management objective 6 (minimize harvesting conflicts among US commercial, US recreational, and foreign fishermen), as well as Magnuson-Stevens Act mandates related to bycatch and discarding.

Modify the *Loligo* possession limit for the directed *Illex* fishery during closure of the directed *Loligo* fishery

This action is being considered as a means to reduce the regulatory discards associated with the occurrence of occasional large bycatch of *Loligo* that occur in the directed *Illex* fishery during closure of the directed *Loligo* fishery, due primarily to the co-occurrence of the two species during late summer and fall. The modifications currently under consideration would allow for increases in the retention of incidentally captured *Loligo* by *Illex* vessels. The current possession limit during closure periods, which applies to all vessels, is 2,500 pounds of *Loligo*. This action is associated with the same FMP management objective (6) and Magnuson-Stevens Act mandates as the preceding action.

Establish a requirement for electronic daily reporting in the directed *Illex* fishery

This action is being considered as a means to monitor and control the retention of *Loligo* squid that are incidentally captured by the directed *Illex* fishery. This modification would work in combination with potential modifications to the *Loligo* closure possession limit that specify a limit on the total harvest of *Loligo* by the directed *Illex* fishery. By providing a means for real time monitoring of *Loligo* catches by *Illex* vessels, the directed *Illex* fishery could be informed as to when their harvest cap has been achieved. This action is associated with the same FMP management objective (6) and Magnuson-Stevens Act mandates as the two preceding actions, and is also associated with FMP management objective 5 (increase understanding of the conditions of the stocks and fisheries).

Implement seasonal gear restricted areas (GRAs) to reduce butterfish discards

This action is being considered as a means to reduce the amount of butterfish discards in small mesh otter trawl fisheries. Potential GRA boundaries and closure periods were identified through a quantitative, spatial analysis of fishing effort and butterfish discarding in bottom trawl fisheries using codend mesh sizes of ≤ 3.0 inches and ≤ 3.75 inches. This analysis is presented in Appendix 1. The proposed butterfish GRAs encompass areas which are associated with the greatest amount of butterfish discarding by small mesh otter trawl fishing activity. As with the proposed increase in the *Loligo* minimum mesh requirement, this action, by enhancing the survival of juvenile butterfish, should promote the achievement of FMP management objective 1 and the Magnuson-Stevens Act mandates regarding bycatch and discarding. Additionally, this action should reduce fishing mortality on the butterfish stock by the small mesh otter trawl fisheries, which is consistent with FMP management objective 6.

Establish the use of alternative gears and gear modifications in the Atlantic mackerel, squid, and butterfish fisheries

This action is being considered as a means to reduce the bycatch of juvenile butterfish and squid and to reduce impacts on EFH by bottom-tending gear. The modifications that are being considered would either require or encourage the use of modified or alternative gear in the harvest of Atlantic mackerel, squid, and butterfish. As with other proposed actions that would enhance the survival of butterfish, or other federally-managed species, either by reducing discarding or reducing impacts on EFH, this action should promote the achievement of FMP management objectives 1 and 6 as well as the bycatch/discard and EFH mandates of the Magnuson-Stevens Act.

SUMMARY OF THE PURPOSE AND NEED FOR THE ACTION	
NEED FOR ACTION	CORRESPONDING PURPOSE
This action is needed to reduce the administrative burden of the FMP and provide the fishing industry with the ability for long-range planning.	The purpose of Amendment 9 is to consider implementing a multi-year specification process that could establish specifications several years into the future.
This action is needed to consider the impacts to the environment and human communities that could result if the moratorium on limited access *Illex* squid permits was allowed to expire.	The purpose of Amendment 9 is to consider an extension or elimination of the moratorium on limited access *Illex* squid permits.
This action is needed to consider new scientific recommendations when determining biological reference points for *Loligo* squid.	The purpose of Amendment 9 is to consider a modification to the proxy used for determining F_{msy} in the *Loligo* squid overfishing definition.
This action is needed to designate EFH for any undesignated life history stage within the FMP and consider gear impacts on EFH because degraded aquatic habitat may contribute to reduced yields of a species.	The purpose of Amendment 9 is to designate EFH for *Loligo* eggs and evaluate measures that have the potential to protect EFH from gear impacts.
This action is needed to consider impacts resulting from bycatch and discards because excessive bycatch or discards may contribute to reduced yields of a species.	The purpose of Amendment 9 is to evaluate measures that have the potential to reduce bycatch and/or discards and improve monitoring of incidentally caught species.

4.2 History of FMP Development

Management of the Atlantic mackerel, *Loligo* and *Illex* squid, and butterfish fisheries began through the implementation of three separate FMPs (one each for mackerel, squid, and butterfish) in 1978. Subsequent amendments and frameworks that affected management of these fisheries are summarized below.

Date	Document	Management Action
1978, 1979	Original FMPs (3)	• Established management of Atlantic mackerel, squid, and butterfish fisheries
1983	Merged FMP	• Consolidated management of Atlantic mackerel, squid, and butterfish fisheries under a single FMP
1984	Amendment 1	• Implemented squid OY adjustment mechanism • Revise Atlantic mackerel mortality rate
1986	Amendment 2	• Equated fishing year with calendar year • Revised squid bycatch TALFF allowances • Implemented framework adjustment process • Converted expiration of fishing permits from indefinite to annual
1991	Amendment 3	• Established overfishing definitions for all four species
1991	Amendment 4	• Limited the activity of directed foreign fishing and joint venture transfers to foreign vessels • Allowed for specification of OY for Atlantic mackerel for up to three years
1996	Amendment 5	• Adjusted *Loligo* MSY • Eliminated directed foreign fisheries for *Loligo*, *Illex*, and butterfish • Instituted a dealer and vessel reporting system • Instituted an operator permitting system • Implemented a limited access system for *Loligo*, *Illex* and butterfish • Expanded the management unit to include all Atlantic mackerel, *Loligo*, *Illex*, and butterfish under U.S. jurisdiction.
1997	Amendment 6	• Revised the overfishing definitions for *Loligo*, *Illex*, and butterfish • Established directed fishery closure at 95% of DAH for *Loligo*, *Illex* and butterfish with post-closure trip limits for each species • Established a mechanism for seasonal management of the *Illex* fishery to improve the yield-per recruit
1997	Amendment 7	• Established consistency among FMPs in the NE region of the U.S. relative to vessel permitting, replacement and upgrade criteria

Date	Document	Management Action
1998	Amendment 8	• Brought the FMP into compliance with new and revised National Standards and other required provisions of the Sustainable Fisheries Act • Added a framework adjustment procedure
2001	Framework 1	• Created a quota set-aside for the purpose of conducting scientific research
2002	Framework 2	• Extended the moratorium on entry to the *Illex* fishery for an additional year • Established that previous year specifications apply when specifications for the management unit are not published prior to the start of the fishing year (excluding TALFF specifications) • Allowed for the specification of management measures for *Loligo* for a period of up to three years
2003	Framework 3	• Extended the moratorium on entry to the *Illex* fishery for an additional year
2004	Framework 4	• Extended the moratorium on entry to the *Illex* fishery for an additional five years

4.3 Management Objectives

The objectives of the FMP are:

1. Enhance the probability of successful (i.e., the historical average) recruitment to the fisheries.
2. Promote the growth of the US commercial fishery, including the fishery for export.
3. Provide the greatest degree of freedom and flexibility to all harvesters of these resources consistent with the attainment of the other objectives of this FMP.
4. Provide marine recreational fishing opportunities, recognizing the contribution of recreational fishing to the national economy.
5. Increase understanding of the conditions of the stocks and fisheries.
6. Minimize harvesting conflicts among US commercial, US recreational, and foreign fishermen.

4.4 Management Unit

The management unit is all northwest Atlantic mackerel (*Scomber scombrus*), *Loligo pealeii*, *Illex illecebrosus*, and butterfish (*Peprilus triacanthus*) under U.S. jurisdiction.

5.0 MANAGEMENT ALTERNATIVES

MEASURES AFFECTING FISHERY PROGRAM ADMINISTRATION

5.1 Multi-year specifications for all species managed under the FMP

The Council is considering establishing an allowance for multi-year specification of management measures for all four species managed under the FMP. As implemented through Framework 2, the FMP currently allows for multi-year specification of management measures (up to three years) for *Loligo* only. The options under consideration would affect the periodicity of the specification setting process only. They are intended to relieve the administrative demands on Council and NOAA Fisheries imposed by the current annual specification process, and provide greater regulatory consistency and predictability to the commercial and recreational fishing sectors. No changes to the annual stock status review procedures established in the FMP are being proposed.

5.1.A Alternative 1A: No action (Specify management measures for *Illex*, Atlantic mackerel and butterfish annually, and specify management measures for *Loligo* for up to three years)

Under this alternative, no adjustment to the periodicity of specification setting would take place. As such, specification by the Council of management measures for *Illex*, Atlantic mackerel and butterfish would occur each year, while management measures for *Loligo* could be specified for one to three years.

5.1.B Alternative 1B: Allow for specification of management measures (including quota specifications) for all four species in the management unit for a period of up to three years (Preferred Alternative)

Under this alternative, the Council could, in a given year, specify management measures (including quota specifications) for the following one to three years for any or all of the four species managed under the FMP. Implementation of this alternative would provide the option, not the requirement for Council to specify multi-year management measures. All of the environmental and regulatory review procedures currently required under the Magnuson-Stevens Act and NEPA would be conducted and documented during the year in which specifications are set. These analyses would consider impacts throughout the time span for which specifications are to be set (one to three years). Multi-year quotas and other management measures would not have to be constant from year to year, but would instead be based upon expectations of future stock conditions as indicated by the best scientific information available at the time the multi-year specifications are set. Annual review of updated information on the fishery by the Monitoring Committee would continue as required under the current FMP. Additionally, the Monitoring Committee would annually provide management recommendations for all four species to the Council's Squid, Mackerel, and Butterfish Committee and to the Council. Within a period of multi-year specifications, the Council retains the option to maintain the measures specified for the upcoming year, or may choose to adjust the specified quota through the quota setting process established in the FMP.

The SMB Committee has recommended that the Council choose this as the preferred alternative because the Committee expected it to achieve its administrative streamlining objectives. Additionally, management based on three-year stock projections may be more appropriate for the species managed under this FMP (based on their brief life spans) as compared to the five-year time span in Alternative 1C, below.

5.1.C Alternative 1C: Allow for specification of management measures (including quota specifications) for all four species in the management unit for a period of up to five years

This action would be identical to the preferred alternative (Alternative 1B) with the exception that management measures (including quota specifications) could be specified in a given year for each of the following one to five years for any or all of the four species managed under the FMP.

MEASURES TO ADDRESS OVERCAPACITY IN THE DIRECTED *ILLEX* FISHERY

Overcapacity exists when the harvest potential of the fishing fleet exceeds the actual catch in a given period. The failure of the fleet to harvest at capacity can indicate that a fishery is overcapitalized, a condition in which the size of the fleet is greater than that required to harvest at optimum yield. The Council is considering alternatives that could limit the potential for increases in the harvest capacity of the large scale, directed *Illex* fishery. The alternatives under consideration that would limit the harvest capacity of this fishery are based upon the understanding that it is currently overcapitalized.

5.2 Expiration of the moratorium on entry to the directed *Illex* fishery

In order to prevent excess harvest capacity from developing in the large-scale directed *Illex* fishery, a moratorium on new entry into this fishery was established in 1997. In the directed fishery, moratorium-permitted vessels are not subject to any daily *Illex* possession limit. As such, the maximum potential *Illex* landings for moratorium-permitted vessels are unlimited until 95% of the annual harvest quota has been achieved in any given year. Once 95% of the annual quota has been landed, the possession limit for vessels with *Illex* moratorium permits becomes 10,000 pounds. The moratorium on new entry was initially scheduled to expire in 2002, but has been extended several times through framework actions. Currently, the moratorium is scheduled to expire in July of 2009.

Throughout the year, a small-scale (incidental catch) fishery for *Illex* is currently provided for through an open access Federal permit that allows possession of up to 10,000 pounds of *Illex* in a single trip. In addition to the 10,000 pound trip allowance for *Illex*, vessels in possession of this permit are also allowed to land 2,500 pounds of *Loligo* squid <u>or</u> butterfish in a single trip. The Council is not considering any modifications to the FMP through this Amendment that would affect access to that permit.

5.2.A Alternative 2A: No action (The moratorium on the issuance of *Illex* permits expires July 1, 2009)

Under this alternative, the large-scale directed fishery for *Illex* would revert to open access conditions upon expiration of the moratorium in July 2009, and expansion of the *Illex* fleet would be unconstrained.

5.2.B Alternative 2B: Extend the moratorium on entry to the *Illex* fishery without sunset provision (Preferred Alternative)

Under this alternative, the scheduled expiration of the moratorium would be eliminated. As such, new entry into the directed commercial fishery for *Illex* would be prohibited indefinitely. Since its implementation in 1997, there has been a slight decline in the number of vessels in possession of the *Illex* moratorium permit in any given year, from a maximum number of 77 in 1998 to 72 in 2003. Under this alternative, the size of the directed *Illex* fleet could not expand beyond the number of permitted vessels in the year in which Amendment 9 is implemented.

The SMB Committee has recommended that the Council choose this as the preferred alternative because they agreed that the directed *Illex* fishery is overcapitalized. Furthermore, the Committee felt that compared to the other alternatives, this alternative offered the greatest degree of protection to historic participants in the directed *Illex* fishery.

5.2.C Alternative 2C: Terminate the moratorium on entry to the *Illex* fishery

Under this option, the moratorium on entry to the large-scale commercial fishery for *Illex* would be terminated and the fishery would revert to open access conditions upon the effective date for implementation of this Amendment, and expansion of the *Illex* fleet would be uncontrolled.

5.2.D Alternative 2D: Extend the moratorium on entry to the *Illex* fishery without sunset provision and allow new entry into fishery through permit transfer system

Under this alternative, vessels could transfer their permits to other vessels, either permanently or temporarily through a permit transfer system. As such, the total number of vessels in the fishery could not increase beyond the number of permitted vessels in the year in which Amendment 9 is implemented; however, different participants could enter and exit the fishery as permits are exchanged. Under the current permit system, the transfer of moratorium permits from one participant to another is allowed for only through the transfer of ownership of the permitted vessel.

5.3 Revised biological reference points for *Loligo pealeii*

The Council is considering modifying the quantitative criteria by which the target and threshold fishing mortality rates (F_{target} and $F_{threshold}$, respectively) are defined for the *Loligo* resource. If these modifications are made, they would reflect analytical advice provided by the most recent *Loligo* stock assessment (SAW 34 – NEFSC 2002). Whether or not the recommended changes are implemented, the function of these fishing mortality reference points, as they apply to the management of the resource, would remain unchanged. Accordingly, in a given year, OY would to be calculated using the F_{target} and the biomass estimate for the *Loligo* stock. Additionally, whenever the fishing mortality rate exceeds $F_{threshold}$, then, by definition, overfishing would be considered to be occurring. The Council is not considering any changes to the target and threshold biomass definitions, and no changes to these biological reference points were recommended by SAW 34. The status quo target and threshold biomass reference points for *Loligo pealeii* are B_{msy} and ½ of B_{msy}, respectively.

5.3.A Alternative 3A: No action (Maintain the status quo definitions for the F_{target} and $F_{threshold}$ biological reference points for *Loligo pealeii*)

Under this alternative, no changes to the status quo definitions for the F_{target} and $F_{threshold}$ biological reference points for *Loligo* would occur. The status quo definition for F_{target} is 75% of the F_{max} proxy for F_{msy} whenever estimated *Loligo* biomass is equal to or greater than the biomass target (B_{msy}). However, when estimated *Loligo* biomass is less than B_{msy}, then F_{target} decreases linearly such that, at the biomass threshold (½ of B_{msy}), the F_{target} is zero. The status quo definition for $F_{threshold}$ is defined as the F_{max} proxy for F_{msy}.

5.3.B Alternative 3B: Adopt SARC 34 Recommendation for the F_{target} and $F_{threshold}$ biological reference points for *Loligo pealeii* (Preferred Alternative)

Under this alternative the definitions for F_{target} and $F_{threshold}$ would be modified as recommended by SAW 34. Accordingly, the quarterly F_{target} would be defined as the mean of quarterly F values during 1987-2000 (F=0.24). Additionally, the quarterly $F_{threshold}$ would be defined as the 75th percentile of quarterly F values during the period 1987-2000 (F=0.31). The biomass target (B_{msy}) and threshold (½ of B_{msy}) would remain unchanged.

The SMB Committee has recommended that the Council choose this as the preferred alternative because the Committee accepted this alternative as being consistent with the best scientific information available. National Standard 2 of the Magnuson-Stevens Act requires that management measures be based on the best scientific information available.

MEASURES TO MINIMIZE, TO THE EXTENT PRACTICABLE, ADVERSE EFFECTS OF FISHING ON EFH (INCLUDING EFH DESIGNATION)

5.4 Designation of EFH for *Loligo* eggs

The Magnuson-Stevens Act requires that EFH be identified for all federally managed species. EFH is defined as "…those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" which implies designation throughout the entire life cycle. EFH is currently designated for adult and juvenile *Loligo* life stages, but not for *Loligo* eggs. The Council is considering modifications to the FMP that would designate EFH for *Loligo* eggs. Under this issue, the SMB Committee has not recommended any preferred alternative to the Council.

5.4.A Alternative 4A: No action (No designation of *Loligo* EFH)

Under this alternative, EFH for *Loligo* eggs would remain undesignated.

5.4.B Alternative 4B: EFH designation based on documented observations of egg mops

Loligo egg masses are found attached to rocks and boulders on sand or mud bottom, as well as attached to aquatic vegetation on primarily coastal bottom substrates from Georges Bank southward to Cape Hatteras as depicted in Figure 1. Generally, the following conditions exist where *Loligo* egg masses are found: sea surface temperatures between 10° C and 23° C, a salinity of 30 to 32 ppt, and water less than 50m in depth, although they can also be found offshore.

Under this alternative, EFH for *Loligo* eggs would be designated as benthic habitat in coastal waters based on observations of incidental catches of *Loligo* eggs in commercial trawls. These areas, indicated in Figure 1, and further described in Hatfield and Cadrin (2002), are found between Cape Cod, Massachusetts and Cape Hatteras, North Carolina on the continental shelf from the coastline to the shelf break.

5.4.C Considered but rejected for further analysis - Alternative 4C: EFH designated using juvenile *Loligo* distribution as a proxy

Under this alternative, the distribution of pre-recruited (juvenile) *Loligo* would be used as a proxy for the egg stage. The EFH for *Loligo* eggs would be designated as benthic habitat in the coastal waters along the Continental Shelf that comprise the highest 75% of the catch of pre-recruited juvenile *Loligo* from the NEFSC trawl surveys. These areas extend from the Gulf of Maine through Cape Hatteras, North Carolina on the continental shelf.

This alternative was rejected because growth is rapid between the egg stage and that of juveniles, and juveniles are highly mobile, whereas *Loligo* eggs are sessile. Advice from the NEFSC suggests that the distribution of juveniles should not be used as a proxy for EFH of *Loligo* eggs.

5.4.D Considered but rejected for further analysis - Alternative 4D: EFH designated using adult *Loligo* distribution as a proxy

Under this alternative, the distribution of adult *Loligo* would be used as a proxy for the egg stage. The EFH for *Loligo* eggs would be designated as benthic habitat in the coastal waters along the Continental Shelf that comprise the highest 75% of the catch of recruited adult *Loligo* from the NEFSC trawl surveys. These areas extend from the Gulf of Maine through Cape Hatteras, North Carolina on the continental shelf.

This alternative was rejected because mature females store spermatophores for extended periods of time and are highly mobile. Advice from the NEFSC suggests that the distribution of mature females should not be used to indicate spawning areas or to serve as proxies for EFH of *Loligo* eggs.

5.5 Area closures to reduce gear impacts on EFH

The Magnuson-Stevens Act requires that Councils evaluate potential adverse effects of fishing activities on EFH and include in FMPs management measures necessary to minimize adverse effects to the extent practicable. Potential adverse effects of fishing activities relevant to the Atlantic mackerel, squid, and butterfish FMP are described in Section 6.3 of this document. In this amendment to the FMP, the Council is considering alternatives that could close several areas to the use of bottom otter trawl gear for the harvest of Atlantic mackerel, squid, and butterfish. These potential area closures were identified through analyses of the spatial overlap between designated EFH for federally-managed species that is likely be affected by bottom trawling and bottom otter trawl fishing activities for Atlantic mackerel, squid, and butterfish. Bottom tending mobile gear such as the bottom otter trawl is frequently implicated as having a high potential for adverse impacts on bottom habitats (See Section 6.3).

5.5.A Alternative 5A: No Action (No new areas closed to fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls)

Under this alternative, no additional management measures to minimize the effects of fishing on EFH would be implemented through Amendment 9 to the FMP.

5.5.B Alternative 5B: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in the area surrounding the head of the Hudson Canyon

Under this alternative, fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls would be prohibited in statistical area 616 in the area surrounding the head of the Hudson Canyon, between the 200-foot and 500-foot isobaths as indicated in Figure 2. EFH occurs in this area that has been designated for several federally-managed species (Table 1). In addition, fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls are known to occur in this region. The latitude and longitude for the corner points of this proposed gear-restricted area are as follows:

Head of Hudson Canyon

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
39	10	73	0
39	10	72	30
39	40	72	30
39	40	72	10
39	50	72	10
39	50	73	0
39	10	73	0

5.5.C Alternative 5C: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in tilefish HAPC

Under this alternative, fishing for Atlantic mackerel, squid and butterfish with bottom otter trawls would be prohibited within the area that has been identified as tilefish HAPC. In addition, this area includes EFH designated for federally-managed species listed in Table 1. This region is in statistical areas 616 and 537, between the 300-foot and 850-foot isobaths and is indicated in Figure 3. The latitude and longitude for the corner points of this proposed gear restricted area are as follows:

Tilefish HAPC

Latitude		Longitude	
Degrees	Minutes	Degrees	Minutes
39	0	73	10
39	0	72	40
39	50	71	30
39	50	70	0
40	30	70	0
40	30	71	50
39	0	73	10

5.5.D Alternative 5D: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in Lydonia and Oceanographer Canyon (Preferred Alternative)

Under this alternative, fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls would be prohibited in Lydonia and Oceanographer Canyons as indicated in Figure 4. These canyons encompass EFH designated for several federally managed species (Table 1), as well as deep sea coral that are believed to provide structured habitat for some demersal fishes. Although fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls is limited to the areas surrounding Lydonia and Oceanographer Canyons, closing these areas would prevent expansion of these fisheries into the deeper areas of these canyons. In addition the implementation of this management measure would make the FMP consistent with the New England Fishery Management Council's monkfish FMP which closed Lydonia and Oceanographer Canyons to bottom trawl activity. Agreement between these FMPs may provide regulatory and enforcement advantages. The latitude and longitude for the corner points of each proposed gear restricted area are as follows:

Oceanographer Canyon

Latitude		Longitude	
Degrees	Minutes	Degrees	Minutes
40	10	68	12
40	24	68	9
40	24	68	8
40	10	67	59
40	10	68	12

Lydonia Canyon

Latitude		Longitude	
Degrees	Minutes	Degrees	Minutes
40	16	67	34
40	16	67	42
40	20	67	43
40	27	67	40
40	27	67	38
40	16	67	34

5.5.E Considered but rejected for further analysis - Alternative 5E: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in the EEZ

Under this alternative, fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls would be prohibited in the EEZ throughout the management unit. The management unit, under this FMP is all northwest Atlantic mackerel, *Loligo*, *Illex*, and butterfish under US jurisdiction.

This alternative was rejected because of the extraordinary economic losses which the Council expected to result from its implementation.

5.5.F Considered but rejected for further analysis -Alternative 5F: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in certain inshore areas

Under this alternative, fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls would be prohibited in the inshore areas adjacent to Long Island Sound and inshore areas off Massachusetts (Figure 5). EFH designated for federally-managed species that occurs in these areas are indicated in Table 1. The latitude and longitude for the corner points of each proposed gear restricted area are as follows:

Long Island Sound

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
40	37	73	40
39	50	73	40
40	10	72	30
40	50	72	30
40	37	73	40

Inshore Massachusetts

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
41	40	70	0
41	0	70	0
41	0	70	50
41	30	70	50
41	40	70	0

This alternative was rejected because the bottom habitat in the potential area closures have a high recovery rate from disturbance and are already regulated under the jurisdiction of the states. Compared to the effects of natural forces, this habitat is considered to be minimally affected by disturbance from bottom otter trawl activity.

MEASURES TO REDUCE, TO THE EXTENT PRACTICABLE, BYCATCH AND DISCARDING BY THE ATLANTIC MACKEREL, SQUID, AND BUTTERFISH FISHERIES

The Council is considering measures that would serve to reduce the incidence of bycatch and discarding associated with the fisheries managed under the FMP. These modifications address four general discarding issues that have been identified through analyses of observed discarding patterns and fishery activity. The issues and corresponding management responses are listed below:

1) Issue: Discarding of finfish (red hake, silver hake, and scup), especially of butterfish, in the directed *Loligo* fishery and discarding, to a lesser extent, of butterfish in the *Illex* fishery
Potential management response: i) Modifications to the *Loligo* minimum mesh size requirements, ii) Modifications to the exemption from the *Loligo* minimum mesh size requirements that apply to *Illex* vessels

2) Issue: *Loligo* regulatory discarding in the directed *Illex* fishery during *Loligo* fishery closures
Potential management response: i) Increase the *Loligo* possession limit for the directed *Illex* fishery during closures of the directed *Loligo* fishery, and ii) Requirement for daily electronic reporting by the directed *Illex* fishery

3) Issue: Butterfish discarding in small-mesh (< 3.0 inches or < 3.75 inches) otter trawl fisheries during Jan-April; in addition discarding of red hake, silver hake and spiny dogfish occur in the small-mesh fisheries and their distributions overlap with the GRA boundaries in time and space
Potential management response: Implementation of seasonal (Jan-April) small-mesh gear restricted areas (Butterfish GRAs) to fisheries using codend mesh sizes of < 3.0 inches or < 3.75 inches

4) Issue: Discarding in SMB bottom otter trawl fisheries, in general
Potential management response: gear modifications and alternative gear types

5.6 *Loligo* minimum mesh size requirements

The Council is considering modifications to the FMP that would affect the minimum codend mesh size requirement specified for otter trawl vessels possessing *Loligo* harvested in or from the EEZ. Each of the alternatives described in this section would affect the specified minimum codend mesh size only. All other restrictions associated with the possession of *Loligo* by otter trawl vessels would remain in force. As stated above, these modifications are intended to reduce the incidence of discarding, especially for butterfish, in the directed *Loligo* fishery. Selectivity analyses by Meyer and Merriner (1976) provide evidence for increased escapement of juvenile butterfish (<12 cm in length) at codend mesh sizes above the current minimum. Additionally, their analyses suggest that the probability of escapement is 50% for reproductively mature fish (>12 cm in length) at a codend mesh size of 2 $^{5/8}$ inches.

Current *Loligo* minimum mesh requirements: Owners or operators of otter trawl vessels possessing *Loligo* harvested in or from the EEZ may only fish with nets having a minimum mesh size of 1 $^{7/8}$ inches (48 mm) diamond mesh, inside stretch measure, applied throughout the codend for at least 150 continuous meshes forward of the terminus of the net, or for codends with less than 150 meshes, the minimum codend mesh size shall be a minimum of one-third of the net measured from the terminus of the codend to the head rope, unless they are fishing during the months of June, July, August, and September for *Illex* seaward of a set of geographic coordinates that correspond to the 50 fathom depth contour.

Vessels fishing under this exemption may *not have available for immediate use*, as defined above, any net, or any piece of net, with a mesh size less than 1 $^{7/8}$ inches (48 mm) diamond mesh or any net, or any piece of net, with mesh that is rigged in a manner that is inconsistent with such minimum mesh size, when the vessel is landward of the specified geographic coordinates. Gear that is shown not to have been in recent use and that is stowed in conformance with methods described in 50 CFR Part 648.23 is considered to be *not available for immediate use*. A detailed description of these methods can be viewed online at: http://www.nero.noaa.gov/nero/regs/the6481.htm through the link under Subpart B: § 648.23 Gear restrictions.

Additionally, the owner or operator of a fishing vessel shall not use any mesh construction, mesh configuration or other means that effectively decreases the mesh size below the minimum mesh size, except that a liner may be used to close the opening created by the rings in the aftermost portion of the net, provided the liner extends no more than 10 meshes forward of the aftermost portion of the net. The inside webbing of the codend shall be the same circumference or less than the outside webbing (strengthener). In addition, the inside webbing shall not be more than 2 ft (61 cm) longer than the outside webbing.

Finally, the owner or operator of a fishing vessel shall not use any device, gear, or material, including, but not limited to, nets, net strengtheners, ropes, lines, or chafing gear, on the top of the regulated portion of a trawl net that results in an effective mesh opening of less than $1^{7/8}$ inches (48 mm) diamond mesh, inside stretch measure. Net strengtheners (covers), splitting straps and/or bull ropes or wire may be used, provided they do not constrict the top of the regulated portion of the net to less than an effective mesh opening of $1^{7/8}$ inches (48 mm), diamond mesh, inside stretch measure. Net strengtheners (covers) may not have an effective mesh opening of less than $4^{1/2}$ inches (11.43 cm), diamond mesh, inside stretch measure. "Top of the regulated portion of the net" means the 50% of the entire regulated portion of the net that (in a hypothetical situation) would not be in contact with the ocean bottom during a tow if the regulated portion of the net were laid flat on the ocean floor (under these restrictions, head ropes are not considered part of the top of the regulated portion of a trawl net).

5.6.A Alternative 6A: No Action (Maintain 1 $^{7/8}$ inch minimum codend mesh requirement)

Under this option, no changes to the *Loligo* minimum mesh requirements described above would be implemented.

5.6.B Alternative 6B: Increase minimum codend mesh size to $2^{1/8}$ inches

Under this option, the *Loligo* minimum mesh requirements would remain unchanged with the exception that wherever a mesh size of $1^{7/8}$ inches (48 mm), diamond mesh, inside stretch measure is specified under those requirements, that mesh size would be increased to $2^{1/8}$ inches (54 mm) diamond, inside stretch measure.

5.6.C Alternative 6C: Increase minimum codend mesh size to $2^{1/2}$ inches

Under this option, the *Loligo* minimum mesh requirements (described above) would remain unchanged with the exception that wherever a mesh size of $1^{7/8}$ inches (48 mm), diamond mesh, inside stretch measure is specified under those requirements, that mesh size would be increased to $2^{1/2}$ inches (64 mm) diamond, inside stretch measure.

5.6.D Alternative 6D: Increase minimum codend mesh size to 3 inches

Under this option, the *Loligo* minimum mesh requirements (described above) would remain unchanged with the exception that wherever a mesh size of $1^{7/8}$ inches (48 mm), diamond mesh, inside stretch measure is specified under those requirements, that mesh size would be increased to 3 inches (76 mm) diamond, inside stretch measure. This mesh size, when compared to the other alternative mesh sizes is associated with the greatest escapement probability for butterfish, and hence the greatest potential benefit to the butterfish stock.

5.7 Exemptions from *Loligo* minimum mesh requirements for *Illex* vessels

The Council is considering modifications to the FMP that would affect the exemptions from the *Loligo* minimum mesh requirements that currently apply to federally-permitted *Illex* vessels. Under the current *Loligo* minimum mesh requirements vessels fishing for *Illex* during the months of June, July, August, and September seaward of the set of geographic coordinates that correspond to the 50 fathom depth contour are exempt from the minimum mesh requirements. When landward of these geographic coordinates, however, these vessels are not exempt from the *Loligo* minimum mesh requirements (see Section 5.6 above). As stated above, these modifications are being considered as a means of reducing discarding, especially of butterfish by the directed *Illex* fishery. The potential for occasional large butterfish discard events has been identified through analysis of vessels trip reports and fishery observer program data.

5.7.A Alternative 7A: No Action (*Illex* vessels are exempt from *Loligo* minimum mesh requirements in the months of June through September - Preferred Alternative)

Under this alternative, the exemptions from the *Loligo* minimum mesh requirements that currently apply to federally permitted *Illex* vessels would remain unchanged.

The Council choose this as the preferred alternative because it felt that the *Illex* fishery is a generally clean fishery with few discarding issues.

5.7.B Alternative 7B: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding month of September from current mesh exemption for *Illex* fishery

Under this alternative, the exemptions from the *Loligo* minimum mesh requirements that currently apply to federally permitted *Illex* vessels would be changed such that the timeframe during which these vessels would be exempt from these restrictions would include the months of June, July, and August, only. Among the months in which the *Illex* fishery is currently exempt from the *Loligo* minimum mesh exemption, harvest patterns suggest that September is associated with the greatest degree of distributional overlap between the two species.

5.7.C Alternative 7C: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding months of August and September from current mesh exemption for *Illex* fishery

Under this alternative, the exemptions from the *Loligo* minimum mesh requirements that currently apply to federally permitted *Illex* vessels would be changed such that the timeframe during which these vessels would be exempt from these restrictions would include the months of June, and July, only. Compared to June and July, harvest patterns suggest that August and September are associated with a greater degree of distributional overlap between *Loligo* and *Illex*.

5.7.D Alternative 7D: Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels

Under this alternative, the exemptions from the *Loligo* minimum mesh requirements that currently apply to federally permitted *Illex* vessels would be rescinded. As such, these vessels would no longer be exempt from the *Loligo* minimum mesh requirements during any part of the year.

5.8 *Loligo* possession limit for the directed *Illex* fishery during closure of the directed *Loligo* fishery

The Council is considering modifications to the *Loligo* possession limit that is in effect during closure of the directed *Loligo* fishery. The modifications under consideration would apply only to the directed *Illex* fishery (i.e., *Illex* moratorium-permitted vessels in possession of *Illex*). The current possession limit during closure periods that applies to all vessels is 2,500 pounds of *Loligo*. The modifications would allow for increases in the possession limit of incidentally captured *Loligo*. These modifications are intended to reduce regulatory discards and allow for the greater accountability of occasional large *Loligo* catches that may occur in the directed *Illex* fishery due to co-occurrence during late summer and fall. The modifications were not intended to provide an incentive to the *Illex* fishery to direct fishing effort on *Loligo* during closure periods.

5.8.A Alternative 8A: No Action (For *Illex* moratorium permitted vessels, the *Loligo* possession limit during closures of the directed *Loligo* fishery is consistent with the incidental catch allowance for all vessels – currently 2,500 pounds)

Under this alternative, no modifications would be made to the current possession limit for *Loligo* during closure periods for the directed *Illex* fishery.

5.8.B Alternative 8B: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of retained squid catch onboard, with a maximum limit of up to 30,000 pounds of *Loligo*

Under this alternative, *Illex* moratorium permitted vessels could possess up to 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of squid catch onboard, with a maximum limit of up to 30,000 pounds of *Loligo*. In either case, no vessel may land more than the operative possession limit in one calendar day.

5.8.C Alternative 8C: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 5% of the total weight of retained squid catch onboard, with a maximum limit of up to 20,000 pounds of *Loligo*

Under this alternative, the *Loligo* possession limit for the directed *Illex* fishery during closures of the directed *Loligo* fishery would be the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 5% of the total weight of squid catch onboard, with a maximum limit of up to 20,000 pounds of *Loligo*. The total *Loligo* landings allowed for *Illex* moratorium vessels would be capped at 5% of the 4th quarter *Loligo* quota – this cap would be established at the beginning of the year when the quarterly quotas are specified, and would not change if additions/reductions to the 4th quarter quota are made due to underages/overages in quarters 1-3. Additionally, the retention of incidentally captured *Loligo* in excess of 2,500 pounds could only occur as a result of fishing in the area seaward of the boundary line that approximates the 50 fathom depth contour as specified in the *Loligo* mesh exemption rule. Furthermore, *Illex* moratorium vessels would be required to use VMS in order to ensure compliance with the restrictions in this alternative.

5.8.D Alternative 8D: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of retained squid catch onboard, with a maximum limit of up to 10,000 pounds of *Loligo*

Under this alternative, the *Loligo* possession for the directed *Illex* fishery during closures of the directed *Loligo* fishery would be the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of squid (*Illex* and *Loligo* combined) catch onboard, with a maximum limit of up to 10,000 pounds of *Loligo*. The total *Loligo* landings allowed for *Illex* moratorium vessels would be capped at 5% of the 4th quarter *Loligo* quota. This cap would be established at the beginning of the year when the quarterly quotas are specified, and would not change if additions/reductions to the 4th quarter quota are made due to underages/overages in quarters 1-3. Additionally, the retention of incidentally captured *Loligo* in excess of 2,500 pounds could only occur as a result of fishing in the area seaward of the boundary line that approximates the 50 fathom depth contour as specified in the *Loligo* mesh exemption rule. Furthermore, *Illex* moratorium vessels would be required to use VMS in order to ensure compliance with the restrictions in this alternative.

5.9 Requirement for electronic daily reporting in the directed *Illex* fishery

The Council is considering a modification to the FMP that would require electronic daily reporting by the directed *Illex* fishery. This modification is intended to provide a means for monitoring and controlling the retention of *Loligo* catches that are incidentally taken by the directed *Illex* fishery.

5.9.A Alternative 9A: No Action (No requirement for electronic daily reporting in the directed *Illex* fishery)

Under this alternative, electronic daily reporting would not be required for the directed *Illex* fishery.

5.9.B Alternative 9B: Require electronic daily reporting in the directed *Illex* fishery

Under this alternative, *Illex* moratorium-permitted vessels would have to have vessel monitoring system (VMS) equipment installed in order to electronically transmit harvest and other data. It has not been decided at this time whether *all* moratorium-permitted vessels would be required to have VMS - a large portion of the permitted fleet does not actively participate in the fishery. Currently, there are three vendors that have been certified by NERO to provide vessel monitoring systems that meet the technical and legal requirements of fishery management programs off the Northeastern United States:

1) Boatracs
2) SkyMate
3) Thrane & Thrane (pronounced "Tron & Tron")

Communication and information services offered by one or more of the three available VMS vendors include e-mail, weather, fax, voice messaging and emergency SOS broadcasts to the US Coast Guard and/or vessel owners. Devices may be installed on vessels that transmit location data ("pings") at specified intervals or on demand. The data are transmitted via satellite to the service providers and can be relayed on to government agencies, vessel owners, etc. No specific data reporting requirements have been identified thus far under the action alternative. Reasons for this include uncertainty as to when reporting would be required, and therefore when VMS units would have to be powered up. The range of possibilities for VMS power-on requirements includes but is not limited to:

1) At all times, whether dockside or underway,
2) Anytime the vessel is in the EEZ,
3) At all times during the *Illex* fishing season (i.e., June – September),
4) At the captain's discretion upon initiation of a directed *Illex* trip.

Specific electronic reporting elements that could be reported using onboard VMS would likely consist of those that would improve the ability of assessment scientists to make estimates of relative stock size and would inform managers and industry about fleet harvest of *Illex* and other species relative to regulatory limits. The range of reporting elements includes but is not limited to:

1) Beginning and end-of-tow identifier, time, date, lat/long,
2) Depth,
3) Surface and bottom temperatures,

4) Remarks on gear configurations and/or problems,
5) Pounds kept and pounds discarded by species.

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5.10 Seasonal gear restricted areas (GRAs) to reduce butterfish discards

The Council is considering the establishment of two alternative gear restricted areas (GRAs; Butterfish GRA1, and Butterfish GRA2) to reduce discarding of butterfish in small mesh otter trawl fisheries. The GRA boundaries and closure periods were identified through a quantitative, spatial analysis of fishing effort and butterfish discarding in the small-mesh bottom trawl fisheries. This analysis is presented in Appendix 1. Within either of these GRAs, the use of bottom otter trawl gear would be subject to minimum codend mesh size requirements during the period January through April. For any of the GRA alternatives, the minimum codend mesh size would be applied throughout the codend for at least 150 continuous meshes forward of the terminus of the net, as specified under the current *Loligo* codend mesh requirements. For codends with fewer than 150 meshes, the minimum mesh size codend would be a minimum of one-third of the net measured from the terminus of the codend to the head rope, excluding any turtle excluder device extension. The mesh sizes considered for the GRA action alternatives are based on butterfish selectivity analyses (Meyer and Merriner 1976) which suggest that diamond codend mesh sizes of at least 3 in. are necessary to allow escapement of juvenile butterfish as well as a portion of the spawners that are encountered by bottom otter trawls. In delineating the GRA boundaries, the additive effects of the existing southern scup GRA were considered (min. codend mesh size = 4 ½ inches; effective Jan 1 – Mar 15)

5.10.A Alternative 10A: No Action (No butterfish GRAs - Preferred Alternative)

Under this alternative, no seasonal GRAs would be established through Amendment 9 to the FMP.

The SMB Committee has recommended that the Council choose this as the preferred alternative. The Committee felt that the benefit to the butterfish stock provided by the GRAs was likely to be minimal while the economic cost to the industry could be significant.

5.10.B Alternative 10B: Minimum of 3 inch codend mesh size in Butterfish GRA1

Under this alternative, the use of bottom otter trawl gear with a cod end mesh size of less than 3 inches (76 mm) would be prohibited in the area that has been designated as Butterfish GRA1 (Figure 6). The delineated area is associated with an estimated 50% decrease in the amount (weight) of butterfish discarding by bottom otter trawl vessels using cod end mesh sizes of less than 3 inches (76 mm) from January through April in the region identified as contributing to the majority of butterfish discarding. Based on a butterfish selectivity analysis by Meyer and Merriner (1976), escapement of juveniles as well as a portion of reproductively mature butterfish would occur under this alternative.

5.10.C Alternative 10C: Minimum of 3 inch codend mesh size in Butterfish GRA2

Under this alternative, the use of bottom otter trawl gear in the area that has been designated as Butterfish GRA2 (Figure 7) would require the use of nets with a minimum cod end mesh size of 3 inches (76 mm). The delineated area is associated with an estimated 90% decrease in amount of butterfish discarding by bottom otter trawl vessels using cod end mesh sizes of less than 3 inches (76 mm) from January through April in the region identified as contributing to the majority of butterfish discarding. As in Alternative 5.10 B, this Alternative is associated with the escapement of juveniles and a portion of the spawners but the amount of discarding is reduced by nearly twice as much.

5.10.D Alternative 10D: Minimum of 3$^{3/4}$ inch codend mesh size in Butterfish GRA1

Under this alternative, the use of bottom otter trawl gear in the area that has been designated as Butterfish GRA1 (Figure 8) would require the use of nets with a minimum cod end mesh size of 3 $^{3/4}$ inches (95 mm). The delineated area is associated with an estimated 50% decrease in the amount of butterfish discarding by bottom otter trawl vessels using cod end mesh sizes of less than 3 $^{3/4}$ inches (76 mm) from January through April in the region identified as contributing to the majority of butterfish discarding. Compared to the 3 inch minimum mesh size considered under Alternatives 5.10 B and C, the GRA boundary associated with Alternative 5.10 D is the same, but the escapement of reproductively mature butterfish is much more likely according to a butterfish selectivity analysis by Meyer and Merriner (1976).

5.10.E Alternative 10E: Minimum of 3$^{3/4}$ inch codend mesh size in Butterfish GRA2

Under this alternative, the use of bottom otter trawl gear in the area that has been designated as Butterfish GRA2 (Figure 9) would require the use of nets with a minimum cod end mesh size of 3 $^{3/4}$ inches (95 mm). The delineated area is associated with an estimated 90% decrease in the amount of butterfish discarding by bottom otter trawl vessels using cod end mesh sizes of less than 3 $^{3/4}$ inches (76 mm) from January through April in the region identified as contributing to the majority of butterfish discarding. Compared to the 3 inch minimum mesh size considered under Alternatives 5.10 B and C, the GRA boundary associated with Alternative 5.10 E is the same, but the escapement of reproductively mature butterfish is much more likely. In addition, the amount of discarding is reduced by nearly twice as much as under Alternative 5.10 D.

5.10.F Considered but rejected for further analysis - Alternative 10F: Move Scup GRA under regulatory purview of Atlantic Mackerel, Squid and Butterfish FMP

Under this alternative, the small mesh gear restricted areas (GRAs) implemented under the annual specifications for scup would be established under the regulations implementing the Atlantic mackerel, squid, and butterfish FMP. These small mesh GRAs would keep the current GRAs for scup in place but could be modified as part of the annual quota specification process under the Atlantic Mackerel, Squid and Butterfish FMP. This alternative was rejected for further analysis because it would change the manner in which the provision, as established in the scup specifications, was intended to operate. More specifically, this alternative would convert the function of the Scup GRAs into a bycatch consideration within the *Loligo* fishery, rather than a means for preventing overfishing of the scup resource as established in the scup specifications.

5.11 Alternative gears and gear modifications

The Council considered alternatives that would have required modifications to small-mesh bottom trawl gear currently used to harvest species managed under the FMP or that would encourage the use of alternative gear types (e.g., squid jigging gear) to reduce the bycatch of juvenile butterfish and squid and to reduce impacts on EFH by bottom-tending gear. For example, *Loligo* jig fisheries currently occur on west coast of the USA (Anon. 1998) and off the coast of S. Africa (et al. 1993). In addition, commercial jigging of *Illex illecebrosus* by former distant water fleets has been successfully conducted along the continental slope of southern New England (Long and Rathjen 1980). The Council rejected this suite of alternatives for reasons described below. As such, there are no viable alternatives to the no action alternative and there is no analysis of these alternatives in the document

5.11.A Alternative 11A: No Action (Current gear types and gear configurations used for the harvest of Atlantic mackerel, squid, and butterfish are maintained - SMB Committee's Preferred Alternative)

Under this alternative, no modifications to the gear configurations or allowable gear types used to harvest species managed under the FMP would be made. Implementation of this alternative, however, would not rescind any established gear restrictions as they apply to the fisheries managed under this or any other FMP.

The Council has chosen this as the preferred alternative because they feel that changing over to completely different gear types, or greatly modifying existing gear would be too costly to fishermen in terms of initial outlay, and would constrain their ability to catch target species.

5.11.B Considered but rejected for further analysis - Alternative 11B: Modification of bottom otter trawls to function as "off-bottom" trawls

This alternative would prohibit the use of bottom otter trawls in the harvest of *Loligo*, *Illex*, Atlantic mackerel, and butterfish, and require vessels using otter trawl gear in these fisheries to configure this gear such that it operates "off-bottom". In other words, when otter trawls are used in the harvest of the species in this management unit, the gear, when towed, would not be in contact with the ocean bottom. This alternative was considered as a means to decrease fishery encounters with benthic, non-target species. In addition, this alternative was intended to decrease the gear impacts of bottom- otter trawls on EFH. Industry representatives on the Committee acknowledged that this modification would likely minimize encounters with benthic, non-target species and decrease the gear impacts on EFH; however, they also suggested that it would significantly diminish their ability to harvest *Loligo* squid, compared to methods currently under use.

According to the 1998 Massachusetts Division of Marine Fisheries and the University of Massachusetts at Dartmouth Center for Marine Science, Environment, and Technology (CMAST) Fisheries Research Strategic Plan, the cost of net modification and construction would be about $1,400 per vessel. This does not include the cost of chain or the cost of labor.

5.11.C Considered but rejected for further analysis -Alternative 11C: Allocate 10% of the first quarter *Loligo* quota to harvest through the use of squid jigging gear by moratorium-permitted vessels

Under this alternative, a subset (10%) of the quota allocated to the first quarter (Q1) would be reserved for the harvest by moratorium-permitted vessels using squid jigging gear. As such, once 70% of the Q1 allocation has been taken, harvest of *Loligo* by gear other than squid jigging gear would be limited to the closure possession limit (currently 2,500 pounds). Once 80% of the Q1 allocation has been taken, any vessel in possession of *Loligo* squid would be subject to the closure possession limit. This alternative was rejected by the Council. Industry testimony indicated that squid jigging gear is used successfully in other areas of the world; however, they considered this gear type to be ineffective for harvesting *Loligo* squid in U.S. Atlantic waters. The Council agreed with this position.

Squid jigging machines cost approximately $3,100 per machine (see http://www.ptialaska.net/~mythosdk/AFM/index.html for an example). Five to ten machines are needed per vessel for a commercial operation. Installation costs would run another $3,000 to $5,000 per vessel. Jigs and line to outfit the machines would cost another $3,000 to $5,000 per vessel.

Table 1. The presence and absence of EFH for federally managed species that are moderately and highly vulnerable to bottom otter trawling in the proposed closures (1=presence, 0=absence).

Species	**5B** Mouth of Hudson Canyon	**5C** Tilefish HAPC	**5D** Lydonia and Oceanographer Canyons
Atlantic cod	0	1	0
Atlantic sea scallops	1	1	0
Barndoor Skate	0	1	1
Black Sea Bass	1	1	0
Clearnose Skate	1	1	0
Haddock	1	1	0
Little Skate	1	1	0
Ocean pout	1	1	0
Red Hake	1	1	0
Redfish	0	1	1
Rosette Skate	1	1	0
Scup	1	1	0
Silver Hake	1	1	0
Smooth Skate	1	1	1
Summer Flounder	1	1	0
Thorny Skate	0	1	1
Tilefish	1	1	1
White Hake	1	1	0
Winter Flounder	0	1	0
Winter Skate	1	1	1
Witch Flounder	1	1	0
Yellowtail Flounder	1	1	0
Total Species	17	22	6

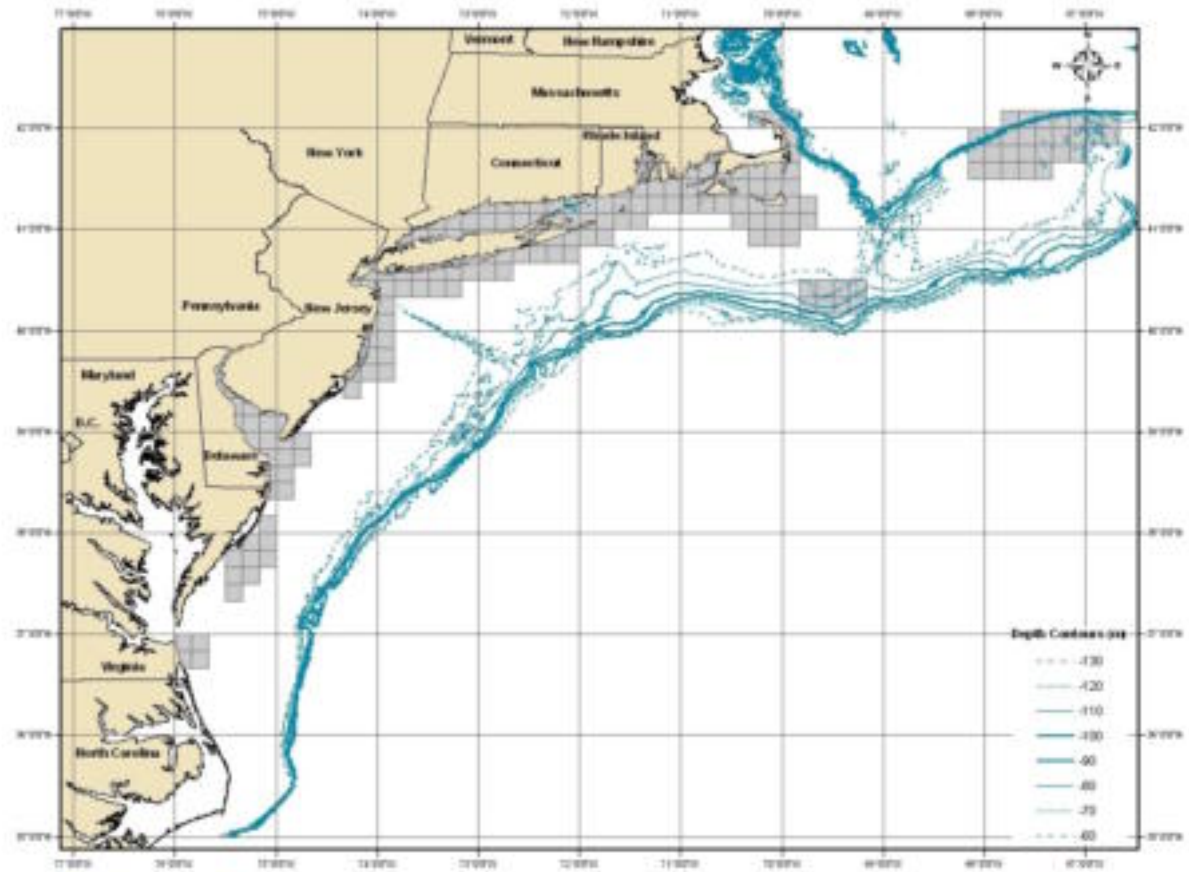


Figure 1. Ten minute squares consistent with persistent spawning areas described by Hatfield and Cadrin (2002) for *Loligo pealeii*, as indicated from incidental catches of eggs in commercial squid trawls.

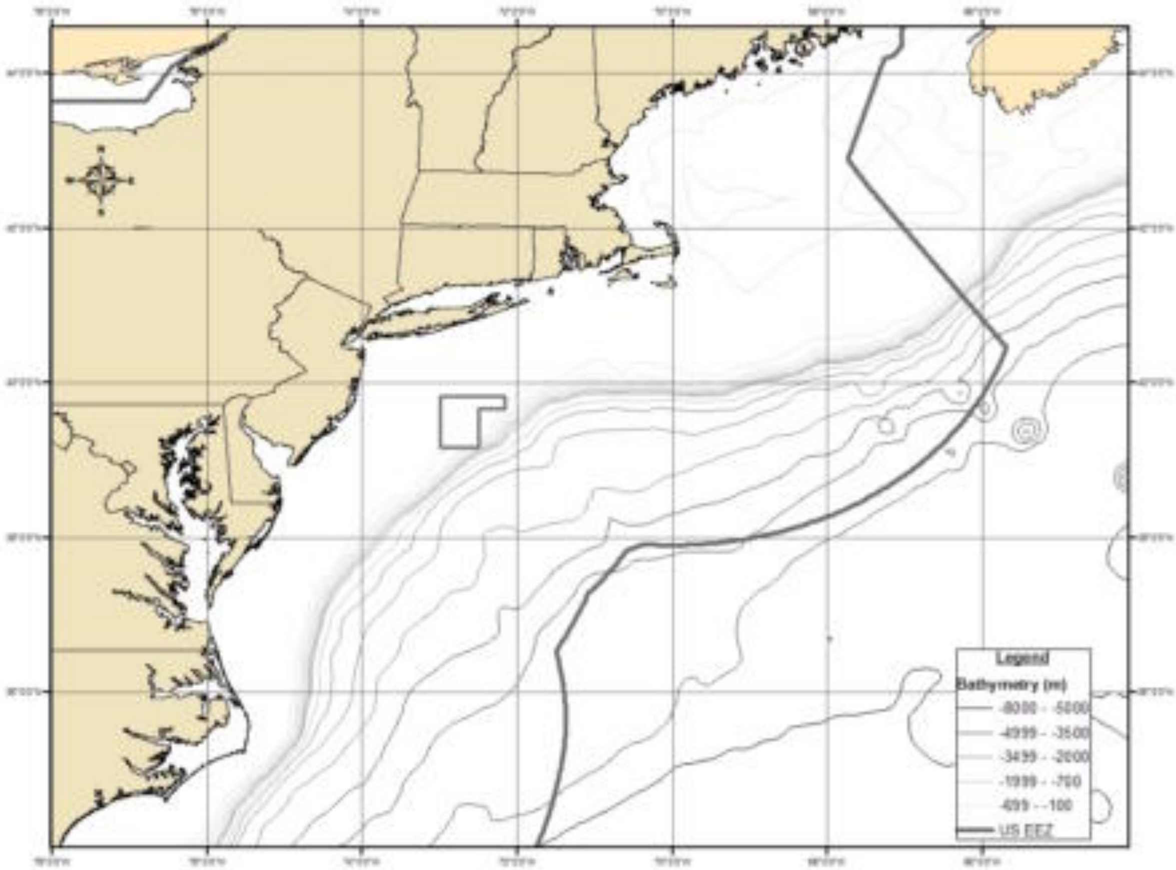


Figure 2. Proposed Head of Hudson Canyon closure (Alternative 5B).

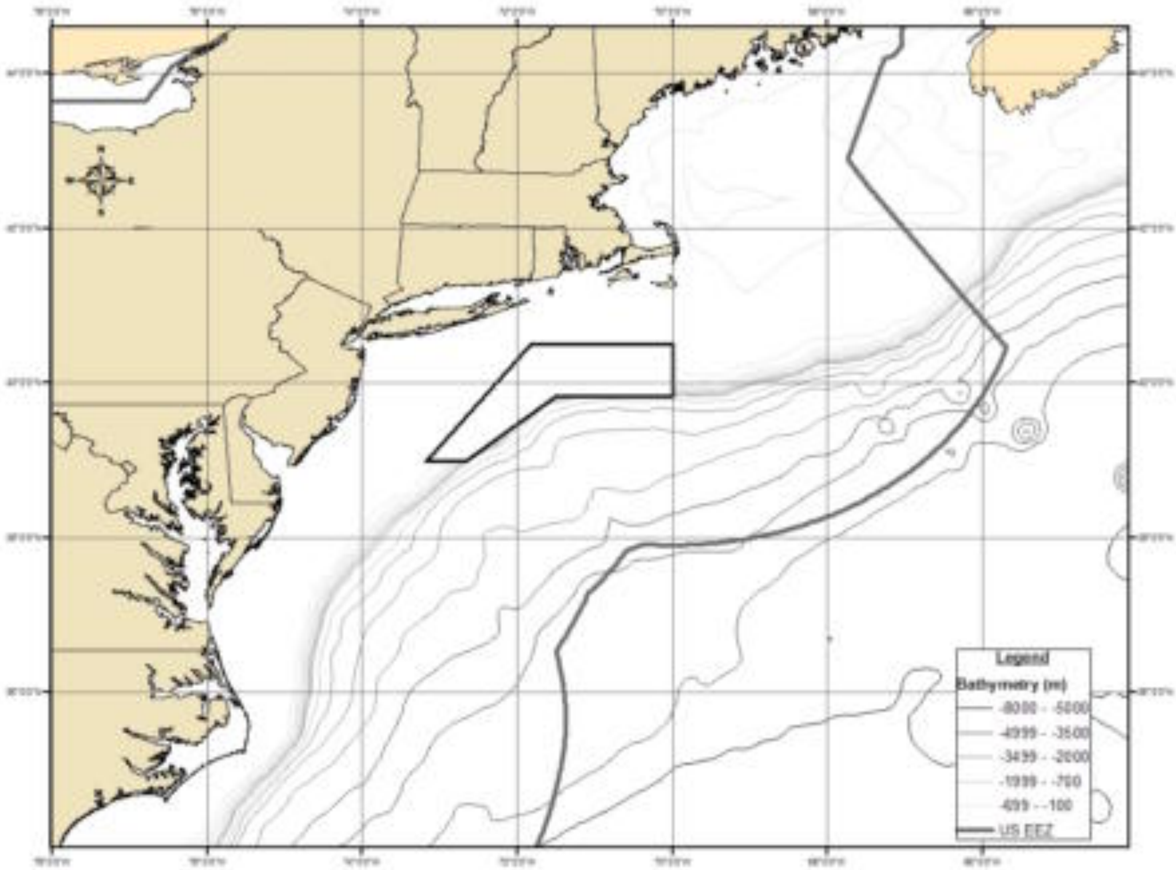


Figure 3. Proposed Tilefish HAPC closure (Alternative 5C).

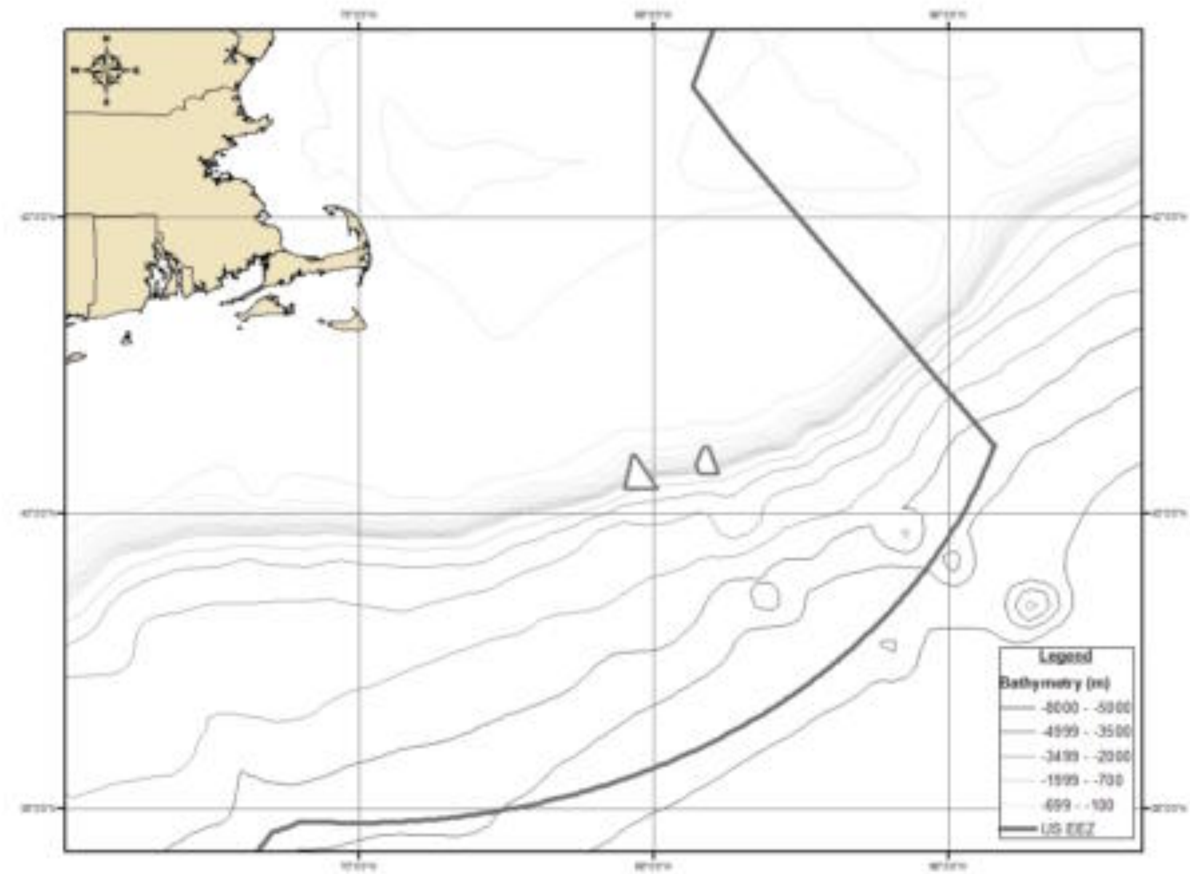


Figure 4. Proposed Lydonia and Oceanographer Canyon closures (Alternative 5D.

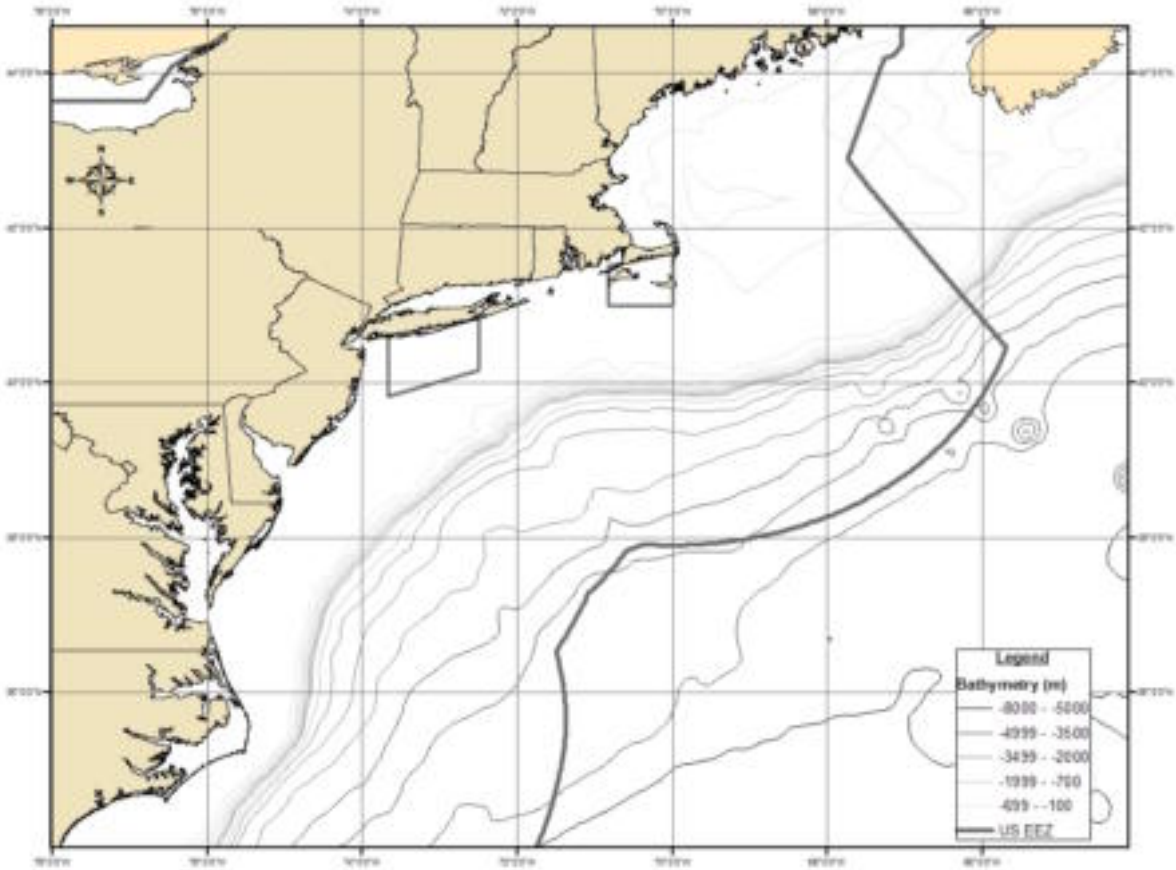


Figure 5. Proposed closures of inshore areas off Long Island and Massachusetts (Alternative 5F).

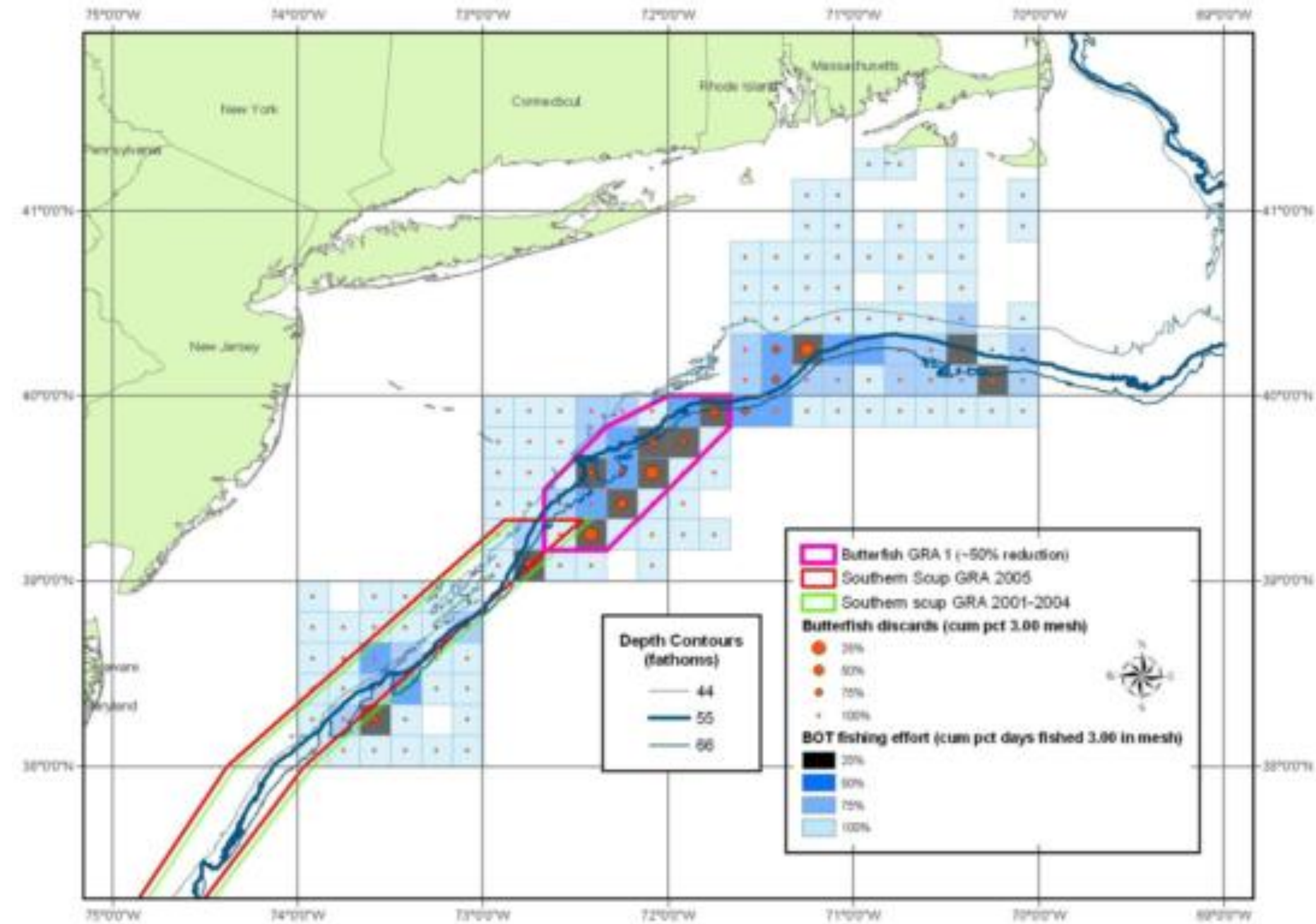


Figure 6. Location of potential gear restricted area “Butterfish GRA 1” (effective Jan-Apr).
Shading in the highlighted ten-minute squares (10 Lat min x 10 Long min) reflects fishing effort from vessels using bottom otter trawls with less than 3 inch codend mesh, while the circles indicate the distribution and intensity of butterfish discarding in these ten-minute squares.

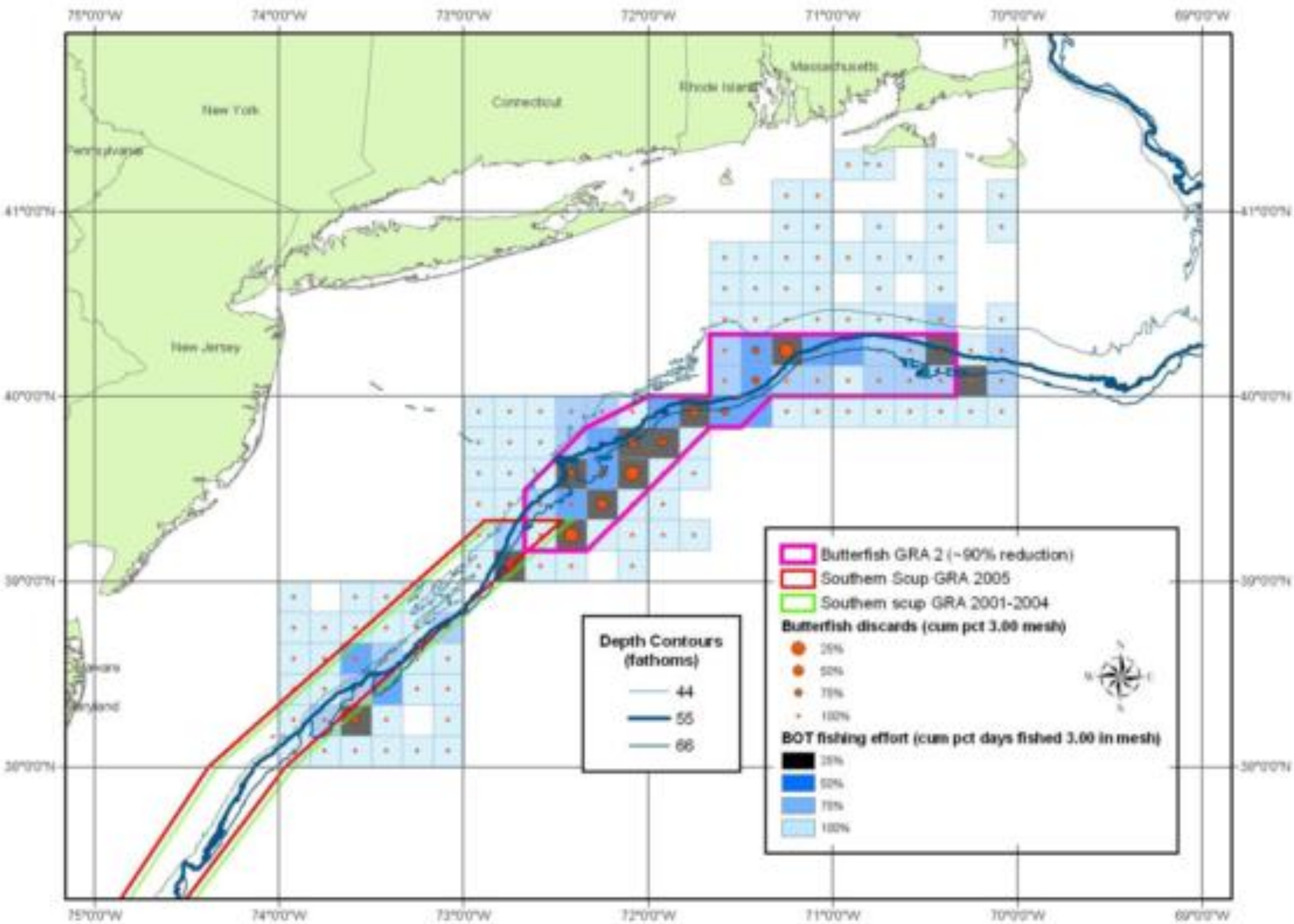


Figure 7. Location of potential gear restricted area “Butterfish GRA 2” (effective Jan-Apr).
Shading in the highlighted ten-minute squares (10 Lat min x 10 Long min) reflects fishing effort from vessels using bottom otter trawls with less than 3 inch codend mesh, while the circles indicate the distribution and intensity of butterfish discarding in these ten-minute squares.

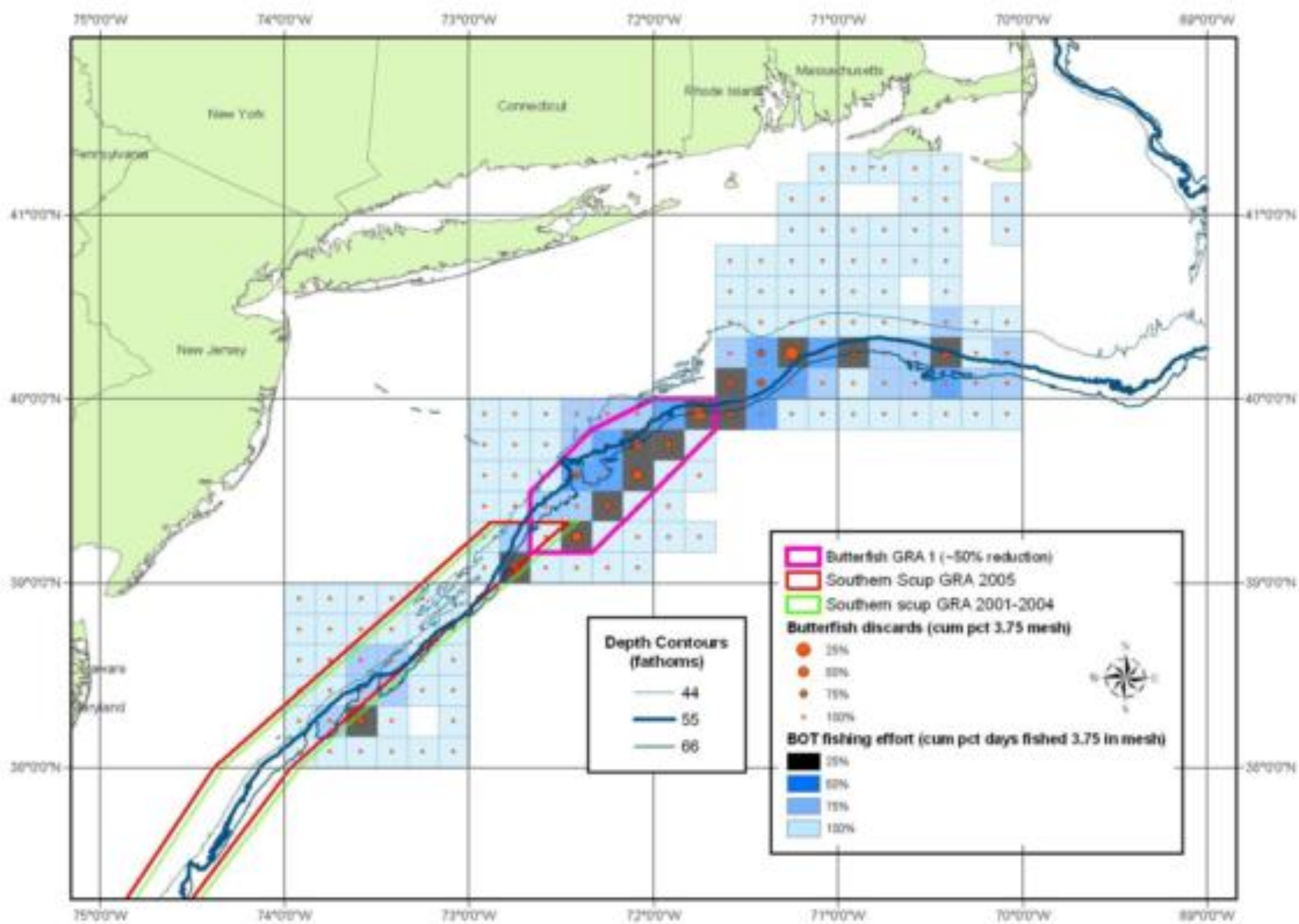


Figure 8. Location of potential gear restricted area "Butterfish GRA 1" (effective Jan-Apr).
Shading in the highlighted ten-minute squares (10 Lat min x 10 Long min) reflects fishing effort from vessels using bottom otter trawls with less than 3 ¾ inch codend mesh, while the circles indicate the distribution and intensity of butterfish discarding in these ten-minute squares.

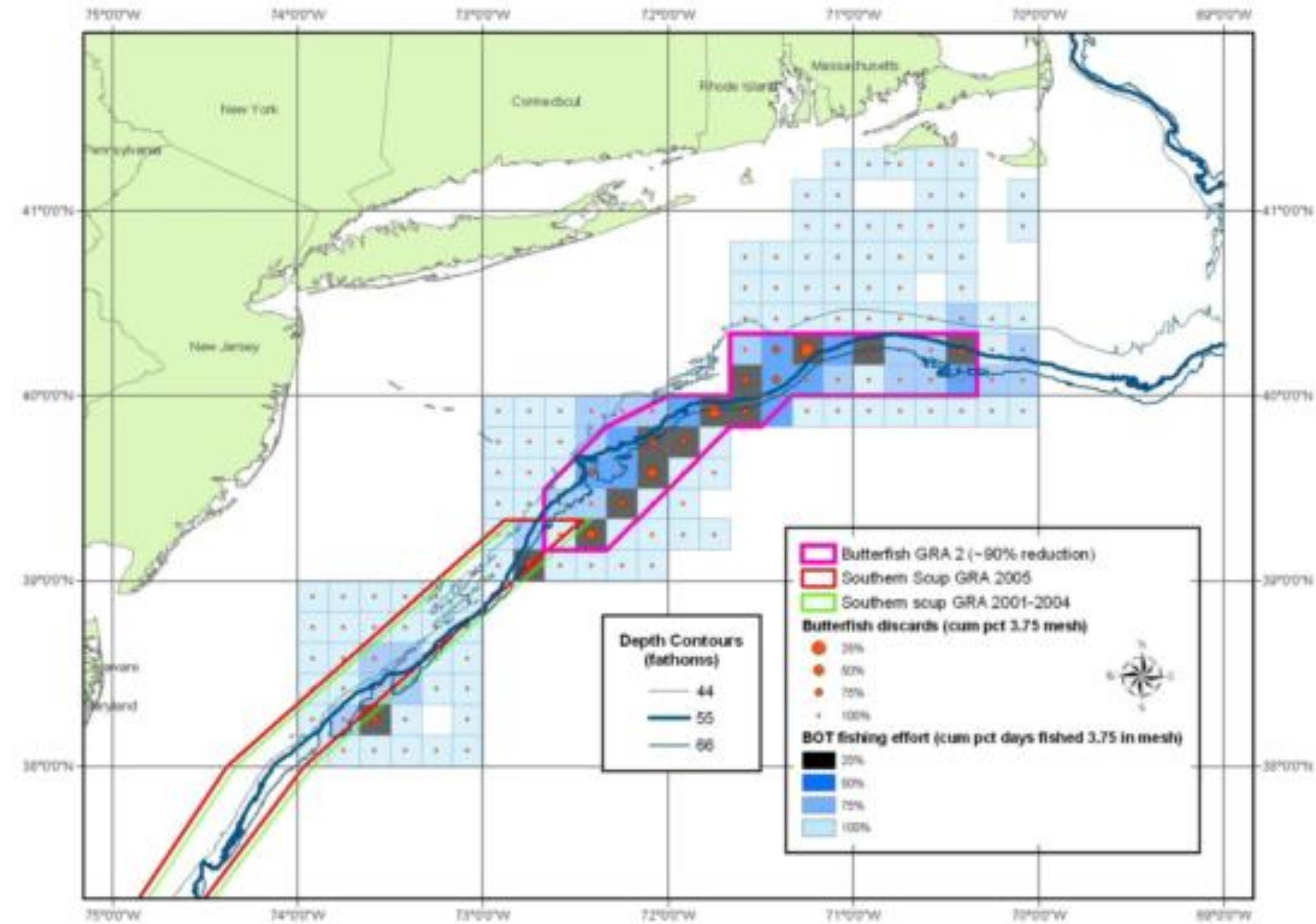


Figure 9. Location of potential gear restricted area "Butterfish GRA 2" (effective Jan-Apr).
Shading in the highlighted ten-minute squares (10 Lat min x 10 Long min) reflects fishing effort from vessels using bottom otter trawls with less than 3 ¾ inch codend mesh, while the circles indicate the distribution and intensity of butterfish discarding in these ten-minute squares.

6.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT

This section serves to identify and describe the *valued ecosystem components* (VECs; Beanlands and Duinker 1984) that are likely to be directly or indirectly affected by the actions proposed in this document. These VECs comprise the affected environment within which the proposed actions will take place. Following the guidance provided by the Council on Environmental Quality (CEQ 1997), the VECs are identified and described here as a means of establishing a baseline for the impact analysis that will be presented in the subsequent document section (Section 7.0 Analysis of Impacts). The significance of the various impacts of the proposed actions on the VECs will ultimately be determined from a cumulative effects perspective, that is, in the context of other past, present, and reasonably foreseeable future actions and their additive impacts on these VECs.

<u>Identification of the Selected Valued Ecosystem Components</u>

As indicated in CEQ (1997), one of the fundamental principles of cumulative effects analysis, is that "… the list of environmental effects must focus on those that are truly meaningful." As such, the range of VECs is described in this section is limited to those for which a reasonable likelihood of meaningful impacts is expected. These VECs are listed below.

1. Managed Resources
   - Atlantic mackerel stock
   - *Illex* stock
   - *Loligo* stock
   - Atlantic butterfish stock
2. Non-target species
3. Habitat including EFH for the managed resources and non-target species
4. Endangered and other protected resources
5. Human Communities

The species listed under the managed resources VEC comprise all of the species managed under the Atlantic mackerel, Squid, and Butterfish FMP. Changes to the FMP, such as those proposed in this amendment have the potential to directly affect the condition of one or more of these stocks. These impacts would come about when management actions either reduce or expand the directed harvest or bycatch of these species.

Similarly, management actions that would change the distribution and/or magnitude of fishing effort for the managed resources could indirectly affect the *non-target species* VEC (species incidentally captured as a result of fishing activities for the managed resources), the *habitat* VEC (especially types vulnerable to activities related to directed fishing for the managed resources), and the *protected resources* VEC (especially those species with a history of encounters with the managed fisheries).

The *human communities* VEC could be affected directly or indirectly through a variety of complex economic and social relationships associated with the either the managed species or any of the other VECs.

Temporal Scope of the Selected VECs

The Atlantic mackerel, squid and butterfish fisheries have a long history, which was dominated by distant water fleets (DWFs) prior to the implementation of the individual FMPs in 1978 and 1979. There is substantial uncertainty in estimates of foreign landings and historical domestic landings of *Loligo and Illex*. Landings of these two species are more accurate beginning in 1987 due to better reporting of landings by species and prohibitions on foreign fishing (Cadrin and Hatfield 1999; NEFSC 2003). Similar uncertainties are likely to apply to the pre-1987 landings of butterfish and mackerel. There was no observer coverage of foreign fleets before 1978, and observer coverage was low in the early 1980s (Cadrin and Hatfield 1999).

While the effects of the historical fisheries are considered, the temporal scope of past and present actions for *managed resources*, *non-target species*, *habitat and human communities* is primarily focused on actions that have occurred after FMP implementation. An assessment using this timeframe demonstrates changes to the resources and human community that have resulted through management under the Council process and through U.S. prosecution of the fisheries rather than foreign fleets. Further, landings and discard data collected prior to implementation of the FMP is often insufficient for the purposes of detailed analysis.

For *endangered and other protected species*, the scope of past and present actions is on a species-by-species basis (Section 6.2) and is largely focused on the 1980s and 1990s through the present, when NMFS began generating stock assessments for marine mammals and turtles that inhabit waters of the U.S. EEZ.

The temporal scope of future actions for all five VECs, which includes the measures proposed by this amendment, extends five years into the future. This period was chosen because the dynamic nature of resource management and lack of information on projects that may occur in the future makes it difficult to predict impacts beyond this timeframe with any certainty.

Geographic Scope of the Selected VECs

The overall geographic scope for the *managed resources*, *non-target species*, *habitat*, and *endangered and protected species* can be considered as the total range of these VECs in the Western Atlantic Ocean. The Atlantic mackerel and *Illex* resources are subject to exploitation by foreign fisheries in areas beyond U.S. jurisdictional waters and historically, within U.S. waters. Reference to foreign fishery activities is made in relation to North Atlantic Fisheries Organization (NAFO) Subareas, which are indicated in Figure 10. The management unit identified in the FMP (Section 4.3) covers a subset of the overall geographic scope, and is defined as all northwest Atlantic mackerel, *Loligo*, *Illex*, and butterfish under U.S. jurisdiction. The analyses of impacts presented in this amendment focuses primarily on actions related to the harvest of the managed resources. Therefore, a more limited geographic area is used to define the core geographic scope within which the majority of harvest effort for the managed resources occurs. The shaded areas in Figure 11 illustrate the extent of these various geographic areas.

Because the potential exists for far-reaching sociological or economic impacts on U.S. citizens who may not be directly involved in fishing for the managed resources, the overall geographic scope for *human communities* is defined as all U.S. human communities. Limitations on the availability of information needed to measure sociological and economic impacts at such a broad level necessitate the delineation of core boundaries for the human communities. These are defined as those U.S. fishing communities directly involved in the harvest of the managed resources. These communities were found to occur in coastal states from Maine to North Carolina. Communities heavily involved in the managed fisheries are identified in the port and community description (Section 6.5) and are indicated in Figure 12. The directionality and magnitude of impacts on human communities directly involved in SMB fisheries will be a function of their level of involvement and dependence on these fisheries.

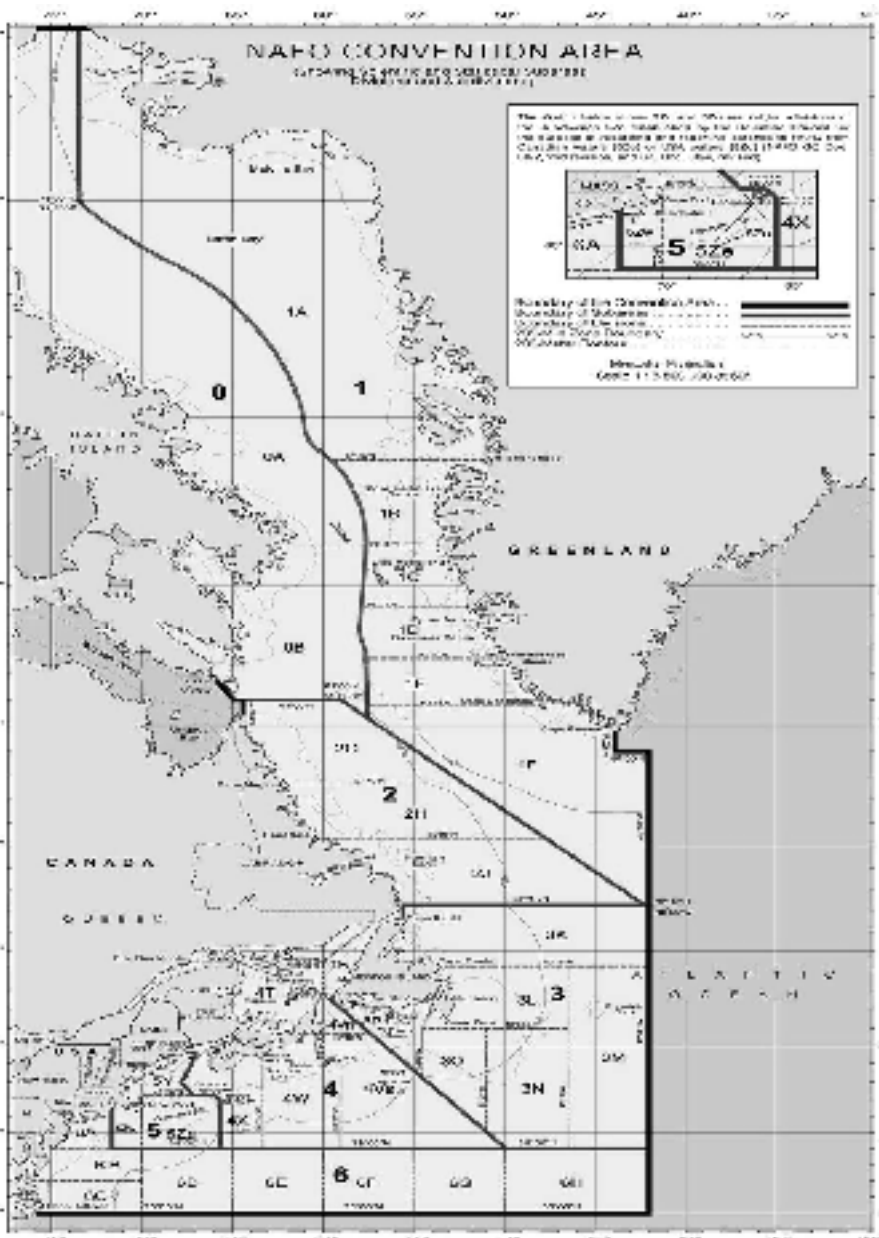


Figure 10. NAFO Convention Area. Indicates scientific and statistical subareas.

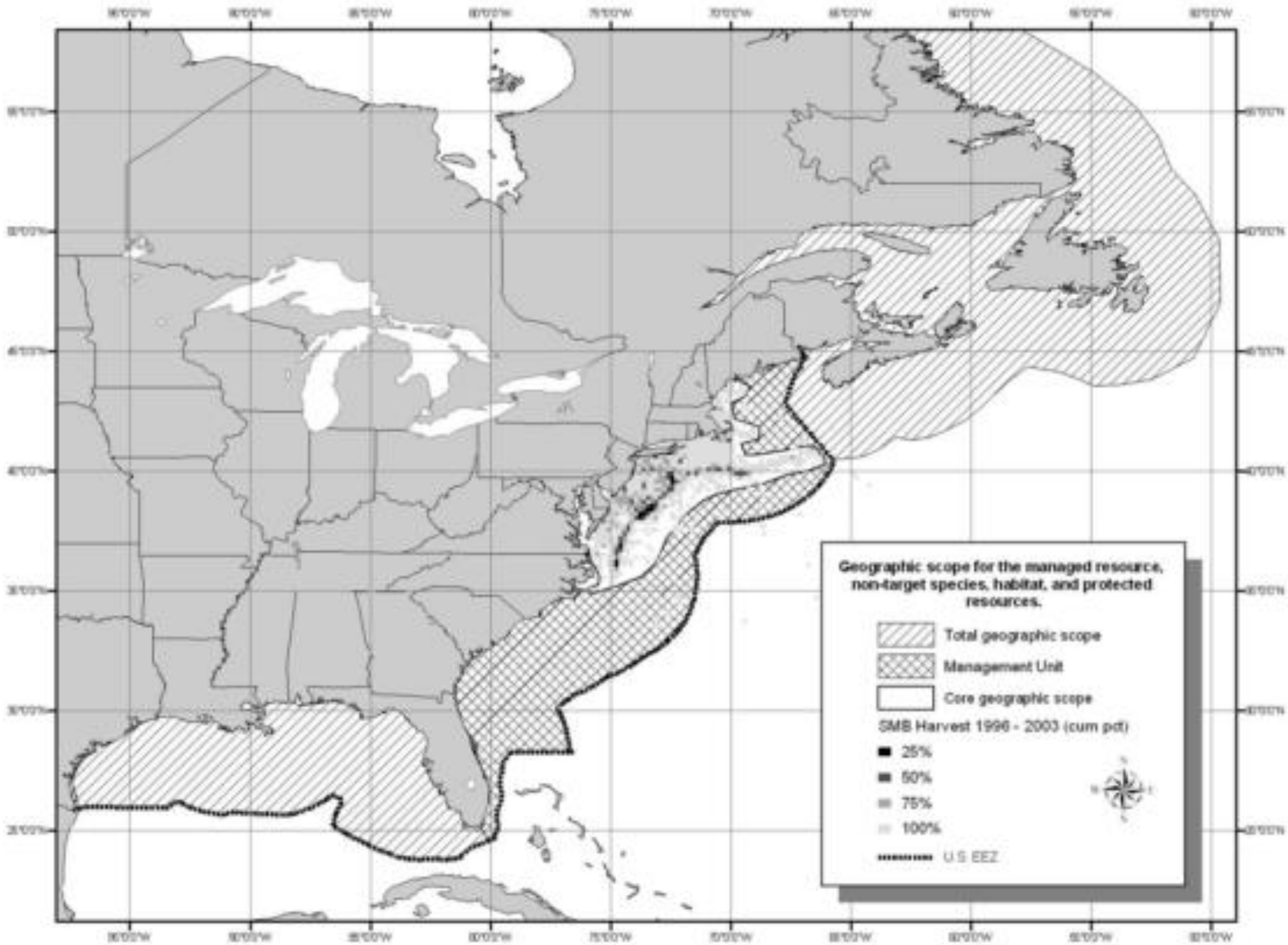


Figure 11. Geographic scope of the VECs, not including human communities.

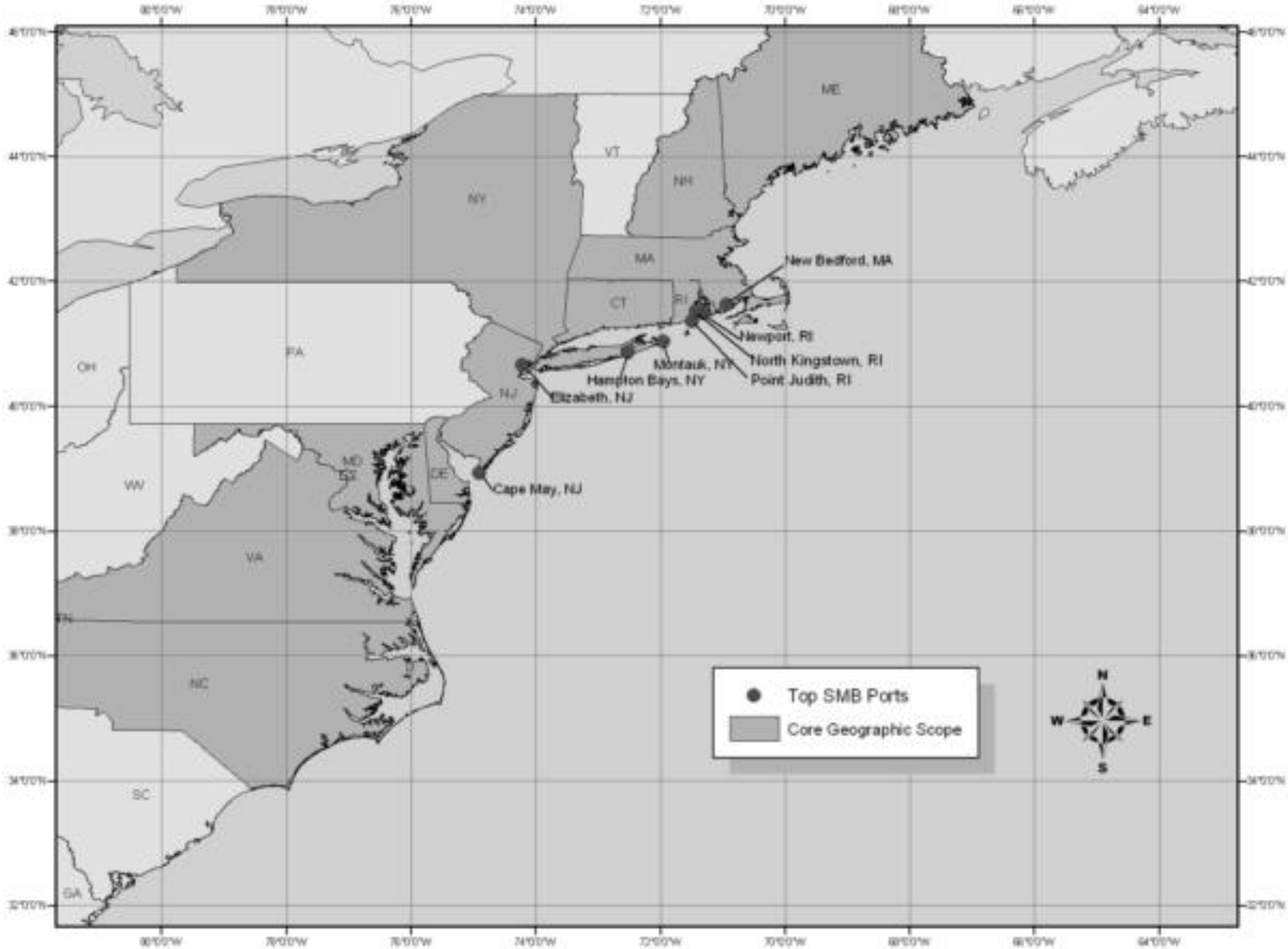


Figure 12. Core geographic scope of the human communities VEC.

6.1 Description of the Managed Resources

In the description of the managed resources VEC presented here, the focus is on stock status and those fishery activities that *directly* affect stock status. These include the harvest of a given species, as well as discarding. The life histories and ecological relationships of Atlantic mackerel, *Illex*, *Loligo*, and butterfish are addressed in detail in Appendices 5-8, respectively. Additionally, specific life stage habitat requirements are presented in Section 6.3 (Description of Habitat, Including Essential Fish Habitat Analysis). Fishery activities and non-fishing activities that may affect habitat quality are considered to indirectly affect the managed resources. These are also considered in Section 6.3.

The Magnuson-Stevens Act's National Standard 1 Guidelines establish specific stock status determination criteria for measuring the condition of a managed fishery resource. In the description of the managed resources VEC presented here, the conditions of the stocks, past, present or future, are described in comparison to the stock status determination criteria.

<u>Specification of status determination criteria (Magnuson-Stevens National Standard 1):</u>

Each FMP must specify, to the extent possible, objective and measurable status determination criteria for each stock or stock complex covered by that FMP and provide an analysis of how the status determination criteria were chosen and how they relate to reproductive potential. Status determination criteria must be expressed in a way that enables the Council and the Secretary to monitor the stock or stock complex and determine annually whether overfishing is occurring and whether the stock or stock complex is overfished. In all cases, status determination criteria must specify both of the following:

1) a maximum fishing mortality threshold or reasonable proxy thereof, and

2) a minimum stock size threshold or reasonable proxy thereof.

Two categories of mortality (natural mortality: M, and fishing mortality: F) contribute to total mortality (Z), the overall rate at which fish are removed from a given population (M + F = Z). Influences on natural mortality include disease, predation, senescence and any other non-human components of the ecosystem. Many of the ecological relationships for the managed resources have been identified, however, because of the complexity of these relationships, M is generally not directly estimated on an annual basis, and in most stock assessments the analyses focuses on fishing mortality and its relationship with stock size. This approach is consistent with providing information necessary to determine the status of a stock with regard to Magnuson-Stevens Act criteria (1) and (2) above. When an assessment indicates that fishing mortality has exceeded threshold levels, overfishing is said to be occurring. When an assessment indicates that stock size has fallen below the established threshold, then the stock is considered to be overfished. In either case, the Magnuson-Stevens Act requires that management measures be put in place to mitigate these outcomes. Several of the management actions proposed in this amendment were developed as a means of improving the conditions of some of the managed stocks by mitigating the impacts of past and/or present fishing activities on these stocks.

6.1.1 Atlantic mackerel stock

Status of the Stock

Fishing mortality threshold: F_{MSY} = 0.16 when the spawning stock biomass (SSB) is greater than 644,000 mt. F_{MSY} decreases linearly from 0.16 to zero at 161,000 mt SSB (¼ B_{MSY}).

Fishing mortality target: F_{TARGET} = 0.12 at 644,000 mt SSB, and F_{TARGET} decreases linearly from 0.12 to zero at 322,000 mt (½ B_{MSY}).

Stock size threshold: 161,000 mt (¼ of B_{MSY}).

Stock size target: 644,000 mt of SSB.

The status of the Atlantic mackerel stock was most recently assessed at SARC 42. Biological reference points (BRP) for Atlantic mackerel adopted in Amendment 8 to the Atlantic Mackerel, Squid and Butterfish FMP (implemented in 1998) are Fmsy = 0.45 and SSBmsy = 890,000 mt. These reference points were re-estimated in SARC 42 to be F_{msy} = 0.16 and SSB_{msy} = 644,000 mt. Fishing mortality on Atlantic mackerel in 2004 was estimated to be F = 0.05 and spawning stock biomass was 2.3 million mt. Relative to the updated biological reference points, SARC 42 concluded that the northwest Atlantic mackerel stock is not overfished and overfishing is not occurring.

SARC 42 also noted that fishing mortality on mackerel has remained low for the last decade, but increased slightly from 0.01 in 2000 to 0.05 in 2004 concomitant with a recent increase in fishing activities. The confidence interval (± 2 SD) for F in 2004 ranged from 0.035 to 0.063. Retrospective analysis shows that F may be underestimated in recent years. Mackerel spawning stock biomass increased from 663,000 mt in 1976 to 2.3 million mt in 2004. The confidence interval on the 2004 SSB estimate (± 2 SD) ranged from 1.49 to 3.14 million mt; based on retrospective analysis, SSB has sometimes been overestimated in recent years.

Recruitment was variable during 1962-2004, with three very large year-classes observed in 1967, 1982, and 1999. Recruitment during 2000-2004 averaged 2.3 billion fish, and ranged from 0.8-5.0 billion age-1 fish. Recruitment from the 2002 (1.8 billion fish) and 2003 (2.8 billion fish) cohorts appears promising.

Deterministic projections for 2006-2008 were conducted by assuming an estimated catch of 95,000 mt (209 million lbs) in 2005, a target fishing mortality of 0.12 (assuming F_{target}=0.75 x F_{msy}) in 2006-2008, and annual recruitment values based on the fitted S/R curve. If 95,000 mt (209 million lbs) were landed in 2005, SSB in 2006 would increase to 2,640,210 mt (5.8 billion lbs). If the F_{target} F=0.12 is attained in 2006-2008, SSB will decline to 2,304,020 mt (5.1 billion lbs) in 2007 and to 2,043,440 mt (4.5 billion lbs) in 2008. Landings during 2006-2008 would be 273,290 mt (603 million lbs), 238,790 mt (527 million lbs), and 211,990 mt (467 million lbs), respectively if fishing mortality was maintained at F_{target}. These landings are the result of an unusually large year-class (1999) present in 2005, and will not be sustainable in the long term. It is expected that these projected landings will decline to MSY (89,000 mt (196 million lbs)) in the future when more average recruitment conditions exist in the stock.

The projections for SSB (000 mt), landings (000 mt), and recruits (millions of individuals) during 2006-2008 for the northwest Atlantic stock of mackerel given in SARC 42 are as follows:

Year	SSB	F	Landings	Recruits
2005	2450	0.04	95	942
2006	2640	0.12	273	951
2007	2304	0.12	238	963
2008	2043	0.12	211	941

Fishery Activities that Directly Affect Stock Status

<u>Commercial Atlantic Mackerel Fishery.</u>

The modern northwest Atlantic mackerel trawl fishery was established by the European DWF in the early 1960's. While the first DWF landings reported in 1961 were not large (11,000 mt), they increased substantially to over 114,000 mt by 1969. Total international commercial landings (NAFO Subareas 2-6; Figure 10) peaked at 437,000 mt in 1973 and then declined sharply to 77,000 by 1977 (Overholtz 1989).

The decline in DWF landings was due in large part to the implementation of the Magnuson-Stevens Act in 1976, which expanded the EEZ and established U.S. control of the portion of the Atlantic mackerel fishery occurring in NAFO Subareas 5 and 6 (Figure 10). Within U.S. waters, the foreign Atlantic mackerel fishery was restricted by NOAA to certain areas or "windows". DWF landings in U.S. waters declined from an unregulated level of 385,000 mt in 1972 to less than 400 mt from 1978-1980. Following implementation of the Atlantic mackerel FMP in 1978, foreign Atlantic mackerel catches were permitted to increase gradually to 15,000 mt in 1984 reaching a peak of about 43,000 mt in 1988.

U.S. commercial landings of Atlantic mackerel from 1982 to 2006 and annual quotas (1994-2006) are summarized in Table 2 and Figure 13. U.S. commercial landings of Atlantic mackerel increased gradually from less than 3,000 mt in the early 1980’s to around 10,000 mt in 1990. In the 1990s, U.S. management policy eliminated the directed foreign Atlantic mackerel fishery in the EEZ. Atlantic mackerel landings by U.S. vessels in the 1990s ranged from 4,700 mt in 1993 to 15,500 mt in 1996 and 1997. U.S. landings were approximately 12,500 mt in 1999 and declined to 5,600 mt in 2000. After 2000, Atlantic mackerel landings increased markedly from 12,300 mt in 2001 to 59,000 mt in 2006.

Based on data from the Dealer database, the vast majority of commercial Atlantic mackerel landings are taken by trawl gear (Table 2). Among trawl types, paired midwater otter trawls have become increasingly more important in recent years. From 2002-2006, paired midwater trawls comprised 38% of commercial Atlantic mackerel landings, while unspecified midwater trawls also accounted for 38% of the landings, and bottom otter trawls comprised only 14% of the landings. By comparison, from 1996-2000, paired midwater trawls landings comprised only 2% of the total commercial Atlantic mackerel landings, while unspecified midwater trawls accounted for 5% of the landings, and bottom otter trawls accounted for 87% of the landings.

Table 2. U.S. commercial Atlantic mackerel landings (mt) from 1982 - 2006 , by major gear type, and recent quotas (1994-2006).

YEAR	TRAWL, OTTER, BOTTOM, FISH	TRAWL, OTTER, MIDWATER	TRAWL, OTTER, MIDWATER PAIRED	ALL OTHERS	TOTAL	QUOTA (mt)
1982	1,908	-	19	744	2,671	
1983	890	-	410	1,342	2,642	
1984	1,235	118	396	1,045	2,795	
1985	1,481	-	249	905	2,635	
1986	3,436	-	2	514	3,951	
1987	3,690	-	0	649	4,339	
1988	5,770	-	0	562	6,332	
1989	7,655	-	0	589	8,245	
1990	8,847	-	0	1,031	9,878	
1991	15,514	564	223	285	16,586	
1992	11,302	-	1	458	11,761	
1993	3,762	479	-	412	4,653	
1994	8,366	1	-	551	8,918	120,000
1995	7,920	50	-	499	8,469	100,000
1996	13,345	1,295	-	1,088	15,728	105,500
1997	13,927	628	-	847	15,403	90,000
1998	12,095	571	1,363	495	14,525	80,000
1999	11,181	99	-	752	12,031	75,000
2000	4,551	736	-	362	5,649	75,000
2001	584	11,396	-	360	12,340	85,000
2002	4,008	11,670	10,477	376	26,530	85,000
2003	5,139	13,729	11,644	226	30,738	175,000
2004	5,885	23,170	20,499	5,439	54,993	170,000
2005	5,437	8,410	18,894	9,468	42,209	115,000
[a]2006	10,362	24,413	19,938	4,346	59,059	115,000

[a] Data are preliminary.

Source: Unpublished NMFS dealer weighout data.

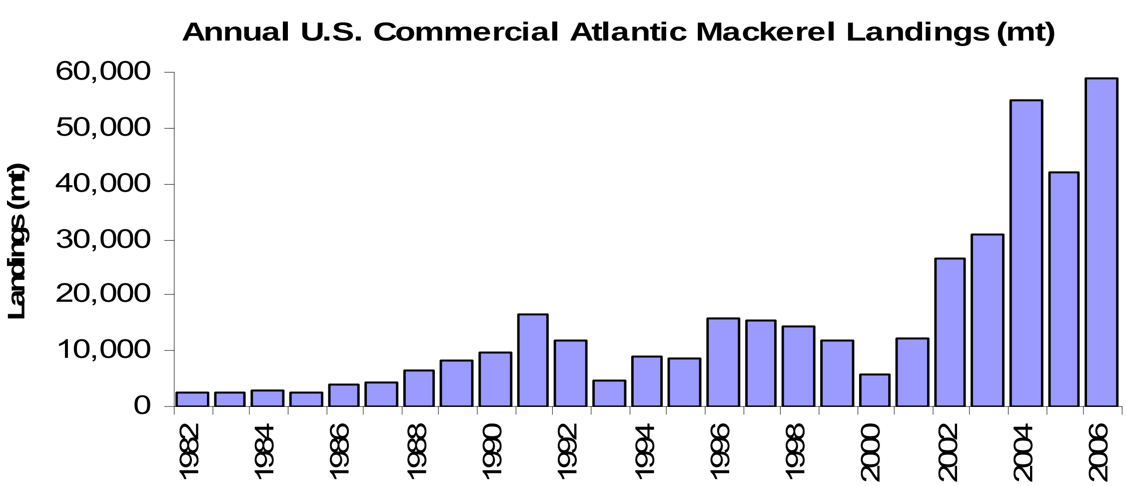


Figure 13. Annual U.S. commercial Atlantic mackerel landings (mt).
Source: Unpublished NMFS dealer weighout data.

Temporal and Geographic Patterns of Commercial Atlantic Mackerel Harvest

The bulk of commercial Atlantic mackerel landings occur in the early part of the year (Jan – Apr; Table 3; Figure 14). During these months the stock tends to be in shallower water and is more accessible to commercial harvest.

Geographically, Atlantic mackerel harvest is widely distributed between Maine and North Carolina. Concentrations of catch occur on the continental shelf southeast of Long Island, NY and east of the Delmarva peninsula (Figure 15).

Table 3. U.S. commercial landings (mt) of Atlantic mackerel by month from 1994 - 2004.

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1994	224	1,505	2,878	3,305	815	70	8	6	3	5	10	51
1995	484	909	2,534	3,644	536	103	7	3	24	5	4	215
1996	2,363	2,459	4,782	4,015	1,630	39	4	3	2	42	17	368
1997	3,186	3,361	3,296	3,858	1,462	20	2	3	2	4	13	196
1998	1,364	1,120	4,298	6,015	625	8	28	23	3	4	22	1,016
1999	2,706	2,803	2,099	3,845	399	33	7	11	8	7	30	85
2000	67	747	1,889	1,763	358	11	6	6	3	6	23	771
2001	3,640	2,757	2,880	2,772	179	5	6	7	10	4	16	65
2002	2,714	8,494	10,566	3,114	474	20	3	10	9	3	15	796
2003	6,029	8,279	12,769	2,970	312	12	1	3	2	9	27	327
2004	14,142	16,200	18,551	3,671	655	16	8	0	0	0	2	536
Total	36,917	48,634	66,541	38,970	7,445	337	79	74	66	90	179	4,425

Source: Unpublished dealer weighout data

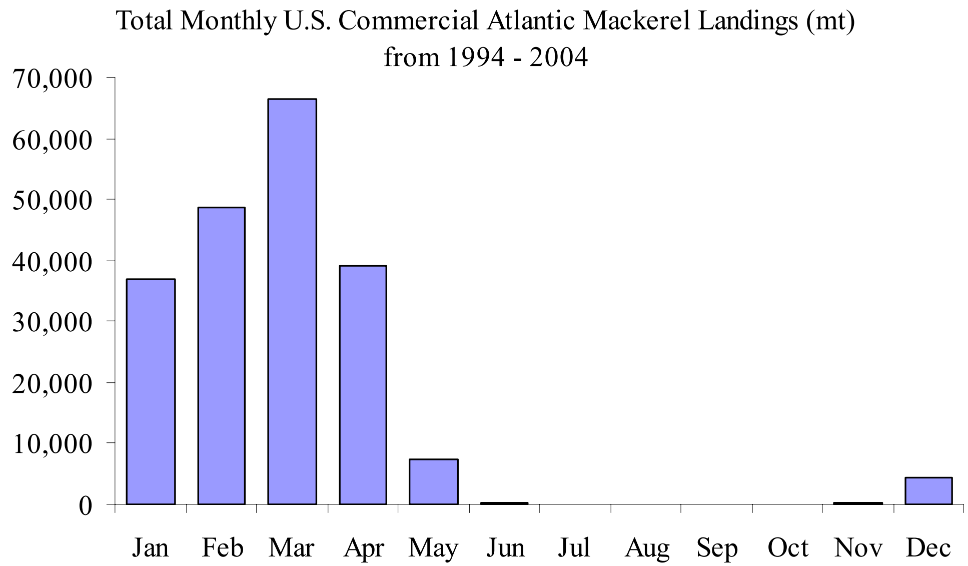


Figure 14. Total monthly U.S. commercial Atlantic mackerel landings (mt) from 1994 to 2004.

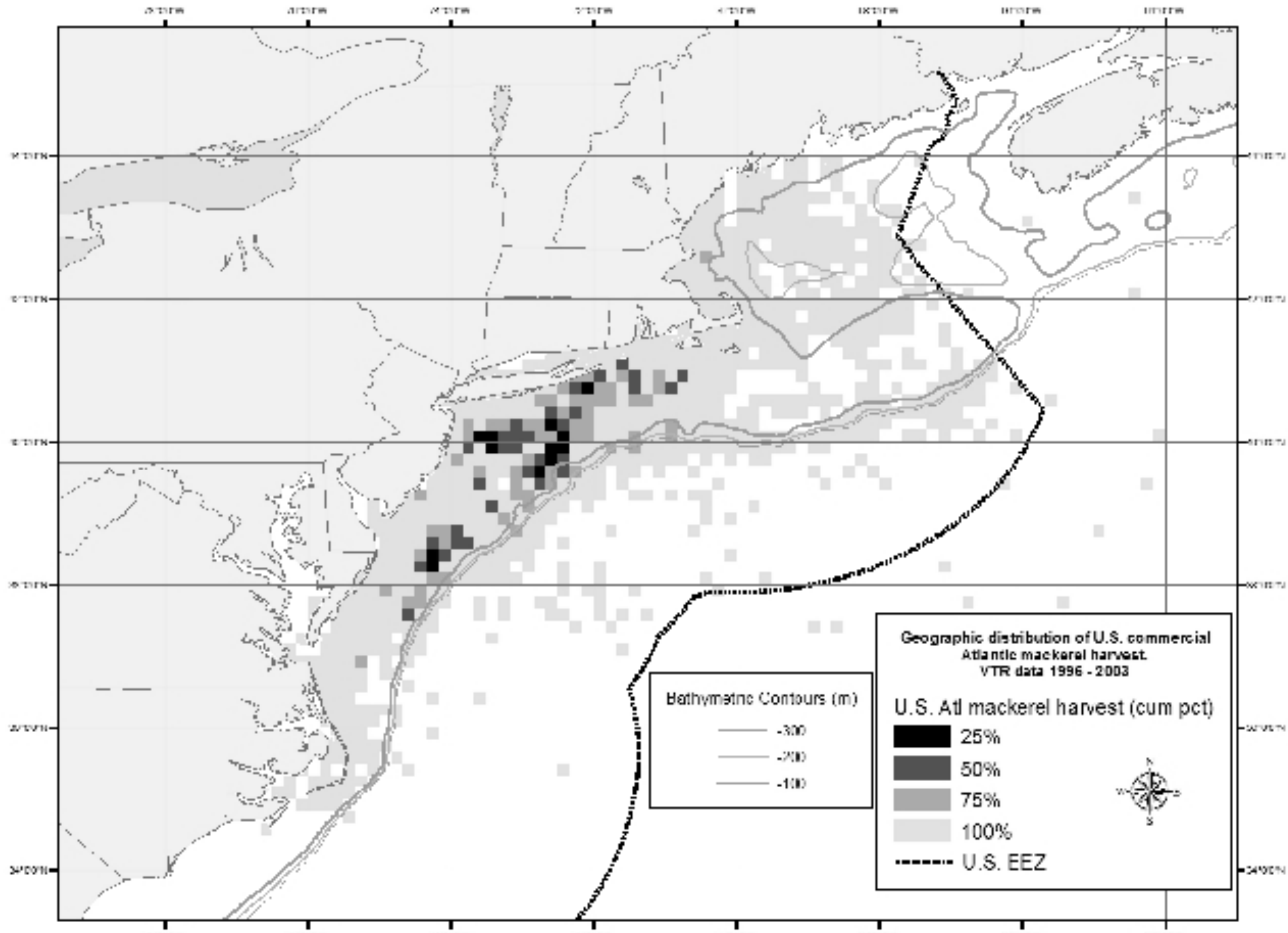


Figure 15. Geographic distribution of Atlantic mackerel harvest according to VTR data (1996 – 2003)

Commercial Discarding. Commercial fisheries that use gear types for which Atlantic mackerel are particularly vulnerable (e.g., mid-water and bottom otter trawls) are the most likely to contribute to the bycatch mortality of Atlantic mackerel. Based on NMFS observer data from 1996 – 2003, the vast majority of observed Atlantic mackerel discards appear to have occurred when bottom otter trawls were used. However, during this period, only 7 out of 720 observed trawl tows were recorded as mid-water trawl tows. Given the prevalence of mid-water trawl gear in Atlantic mackerel landings, it is likely that the observer bottom trawl data are an unreliable source of information for characterizing Atlantic mackerel discards in the commercial fishery.

Self-reported discarding from the VTR data show roughly 95% of Atlantic mackerel discards coming from bottom otter trawls and mid-water trawls from 1996 to 2004. The prevalence of discards from either gear type fluctuate from year to year with no particular trend apparent (Figure 16).

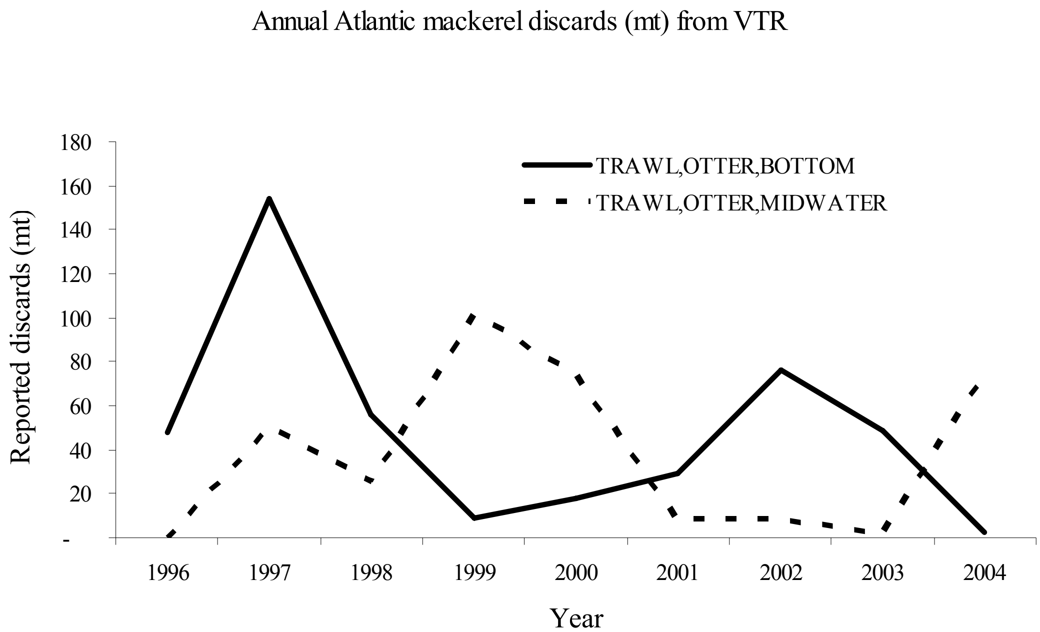


Figure 16. Self-reported Atlantic mackerel discards for bottom otter trawls and mid-water trawls from 1996-2004.
Source: Unpublished VTR data.

SARC 30 (NEFSC 1999) concluded that discards of Atlantic mackerel are not likely to be significant. This conclusion is supported by the limited amount of NEFSC at sea observation data relative to the discard of Atlantic mackerel on otter trawl trips collected from 1989-2003. Based on this information and discussion in the most recent stock assessment, discarding of Atlantic mackerel is not believed to be a significant source of mortality for this species.

Recreational Atlantic Mackerel Fishery.

The magnitude of recreational landings has been minimal in comparison with commercial fishery landings, and is therefore unlikely to significantly affect stock status. Recreational landings of Atlantic mackerel have been estimated through the NMFS Marine Recreational Fishery Statistics Survey since 1981. Annual recreational landings have ranged from 284 mt in 1992 to 4,223 mt in 1986, and have exceeded 1,200 mt in most years since 1994. Annual recreational Atlantic mackerel landings by state indicate that, in most years, the majority of recreational Atlantic mackerel landings occur from Virginia to Maine, with highest catches occurring between New Jersey and Massachusetts.

6.1.2 *Illex* stock

Status of the Stock

<u>Fishing mortality threshold:</u> F_{MSY} = 1.22.

Fishing mortality target: F_{TARGET} = 75% of F_{MSY}

<u>Stock size threshold:</u> ½ of B_{MSY} =19,650 mt

Stock size target: 39,300 mt.

The *Illex illecebrosus* population is assumed to constitute a unit stock throughout its range of exploitation from Cape Hatteras to Newfoundland (Dawe and Hendrickson 1998; Hendrickson and Holmes 2004). Spawning occurs throughout the year (Dawe and Beck 1997; Hendrickson 2004) and stock structure is complicated by the overlap of seasonal cohorts. This highly migratory, oceanic species tends to school by size and sex and, based on age validation studies (Dawe et al. 1985: Hurley et al. 1985), is a sub-annual species. A statolith-based aging study of squid caught in a research survey conducted in U.S. waters indicated that the oldest individual was about seven months (215 days) of age (Hendrickson 2004). Spawning occurs on various places on the US shelf, including on the fishing grounds during the fishing season.

Observer data for 1995-2004 indicate that discarding of *Illex* occurs primarily in the *Illex* and offshore *Loligo* fisheries and is higher in the latter. During this time period, annual discards from both fisheries combined ranged between 53 and 1,565 mt, 0.5% - 6.0% of the annual *Illex* landings by weight. Annual discards were highest during 1998 (453 mt) and 2004 (1,565 mt), when USA *Illex* landings were highest.

The most recent stock assessment occurred in 2005 at SAW 42. It was not possible to evaluate current stock status because there are no reliable current estimates of stock biomass or fishing mortality rate. In addition, no projections were made in SAW 42. In addition, at SAW 37 (previous assessment) it was not possible to evaluate current stock status because there were no reliable estimates of absolute stock biomass or fishing mortality to compare with existing reference points. However, based on a number of qualitative analyses, overfishing was not likely to have occurred during 1999-2002. Relative exploitation indices for the domestic U.S. fishery have declined since reaching a peak in 1999 and were below the 1982-2002 mean during 2000-2002.

As noted above, current absolute stock size is unknown and no stock projections were done in SAW 42. Although new models show promise, the results could not be accepted because required seasonal maturity and age data are lacking. Cooperative research projects with the

Illex fishing industry such as the collection of tow-based fisheries and biological data and electronic logbook reporting (Hendrickson et al. 2003) should continue because these high resolution data are needed to improve the assessment models. Based on promising new models, the collection of in-season maturity and age data are essential for improvement of the assessment.

Fishery Activities that Directly Affect Stock Status

Commercial *Illex* Fishery

Foreign fishing fleets became interested in the exploitation of Northwest Atlantic squid stocks when the USSR first reported large bycatch of squid from that region in the mid-1960s. By 1972, foreign fishing fleets reported landing 17,200 thousand mt of *Illex* from Cape Hatteras to the Gulf of Maine. During the period 1973-1982, foreign landings of *Illex* in U.S. waters averaged about 18,000 mt, while U.S. fisheries averaged slightly more than 1,100 mt per year. Foreign landings from 1983-1986 were part of the U.S. joint venture fishery which ended in 1987 (NEFSC 2003). The domestic fishery for *Illex* increased steadily during the 1980's as foreign fishing was eliminated in the U.S. EEZ.

Because their geographical range extends well beyond the US EEZ, *Illex* are subject to exploitation in waters outside of US jurisdiction. During the mid-1970's, a large directed fishery for *Illex* developed in NAFO subareas 2-4 (see Figure 1 above). Reported landings of *Illex* increased dramatically from 17,700 mt in 1975 to 162,000 mt in 1979. *Illex* landings in NAFO subareas 2-4 subsequently plummeted to slightly less than 13,000 mt by 1982. Hence, within the total stock of *Illex* (NAFO Subareas 2-6) landings peaked in 1979 at 180,000 mt but have since declined sharply, ranging from 2,800 to 22,200 mt during the period 1983-1991 (NEFSC 2003).

U.S. commercial landings of *Illex* between 1982 and 2006 have fluctuated from 1,428 mt in 1983 to 26,097 mt in 2004 (Table 4; Figure 17). Over that time period there was a relatively steady increase in landings which peaked in the mid-1990s and more or less steadily declined. Two exceptional years since the mid-1990s peak were 1998 (23,568 mt) and 2004 (26,097 mt; Figure 8), resulting in closures of the directed fishery because the domestic quota was exceeded by 24.0 % and 8.7 %, respectively. The vast majority of U.S. commercial *Illex* landings is taken by bottom otter trawls (Table 4).

Table 4. U.S. commercial *Illex* landings (mt) from 1982 – 2006, by major gear type, and recent quotas (1994-2006)..

Year	TRAWL, OTTER, BOTTOM, FISH	ALL OTHERS	TOTAL	Quota (mt)	Percent Overage
1982	3,530	3	3,533		
1983	1,413	16	1,428		
1984	3,287	3	3,290		
1985	2,447	0	2,447		
1986	4,408	1	4,409		
1987	6,468	494	6,962		
1988	1,953	4	1,957		
1989	6,802	-	6,802		
1990	11,315	0	11,316		
1991	11,906	2	11,908		
1992	17,822	5	17,827		
1993	18,012	0	18,012		
1994	17,687	657	18,344	30,000	
1995	13,906	6	13,912	30,000	
1996	15,672	1,279	16,951	21,000	
1997	13,004	352	13,356	19,000	
1998	23,219	349	23,568	19,000	24.0
1999	7,309	80	7,389	19,000	

[a] Data are preliminary.
Source Unpublished NMFS dealer weighout data

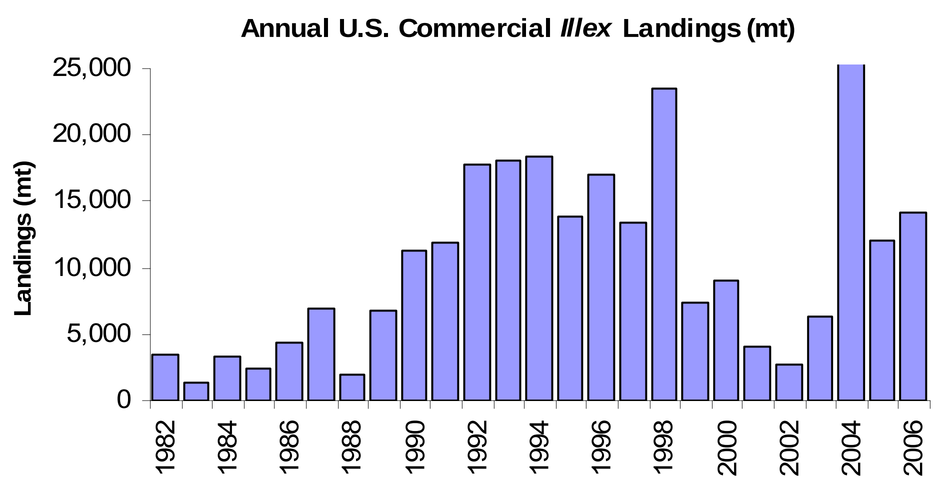


Figure 17. Annual U.S. commercial *Illex* landings (mt).
Source: Unpublished NMFS dealer weighout data.

<u>Temporal and Geographic Patterns of Commercial *Illex* Harvest</u>

The bulk of commercial *Illex* landings occur in May - Oct (Table 5; Figure 18). The temporal patterns of the *Illex* fisheries in both U.S. and Canadian waters are determined primarily by the timing of the species' feeding migration onto and spawning migration off of the continental shelf, although worldwide squid market conditions also influence the timing of the fishing season in the U.S. EEZ (NEFSC 2003). According to NEFSC (2003), the largest contribution to total *Illex* landings tends to occur along the continental shelf break in depths between 128 and 366 m (70 – 200 fathoms; Figure 19).

Table 5. U.S. commercial landings (mt) of *Illex* by month from 1994 - 2004.

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1994	28	7	43	130	825	5,219	6,313	4,428	1,197	66	69	18
1995	20	22	65	152	123	4,046	4,621	2,597	1,276	940	36	13
1996	34	16	17	1	338	3,928	2,810	3,832	2,550	2,614	770	40
1997	48	52	27	30	15	732	5,265	3,708	2,225	1,165	69	17
1998	21	8	21	135	2,260	6,516	7,718	6,536	301	13	10	30
1999	59	7	36	32	19	1,591	2,275	2,604	606	152	6	3
2000	7	3	2	0	44	1,410	2,056	2,122	2,098	562	6	1
2001	28	83	4	15	2	671	1,632	706	469	70	317	12
2002	3	0	5	1	10	608	223	835	553	320	153	37
2003	0	0	0	0	1	1,139	1,295	1,218	553	1,969	212	1
2004	1	0	0	12	1,529	5,647	6,627	7,734	3,496	0	0	13
Total	250	199	220	508	5,166	31,507	40,836	36,320	15,325	7,873	1,650	184

Source: Unpublished dealer weighout data

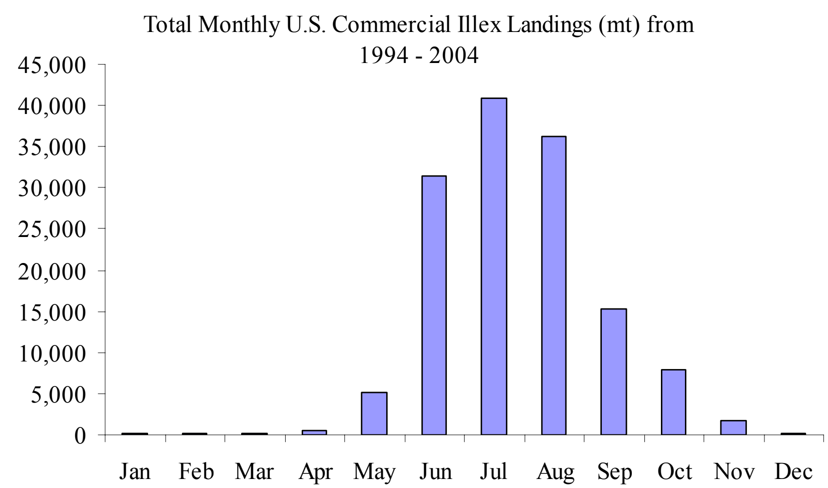


Figure 18. Total monthly U.S. Commercial *Illex* landings (mt) 1994-2004.
Source: Unpublished NMFS dealer weighout data.

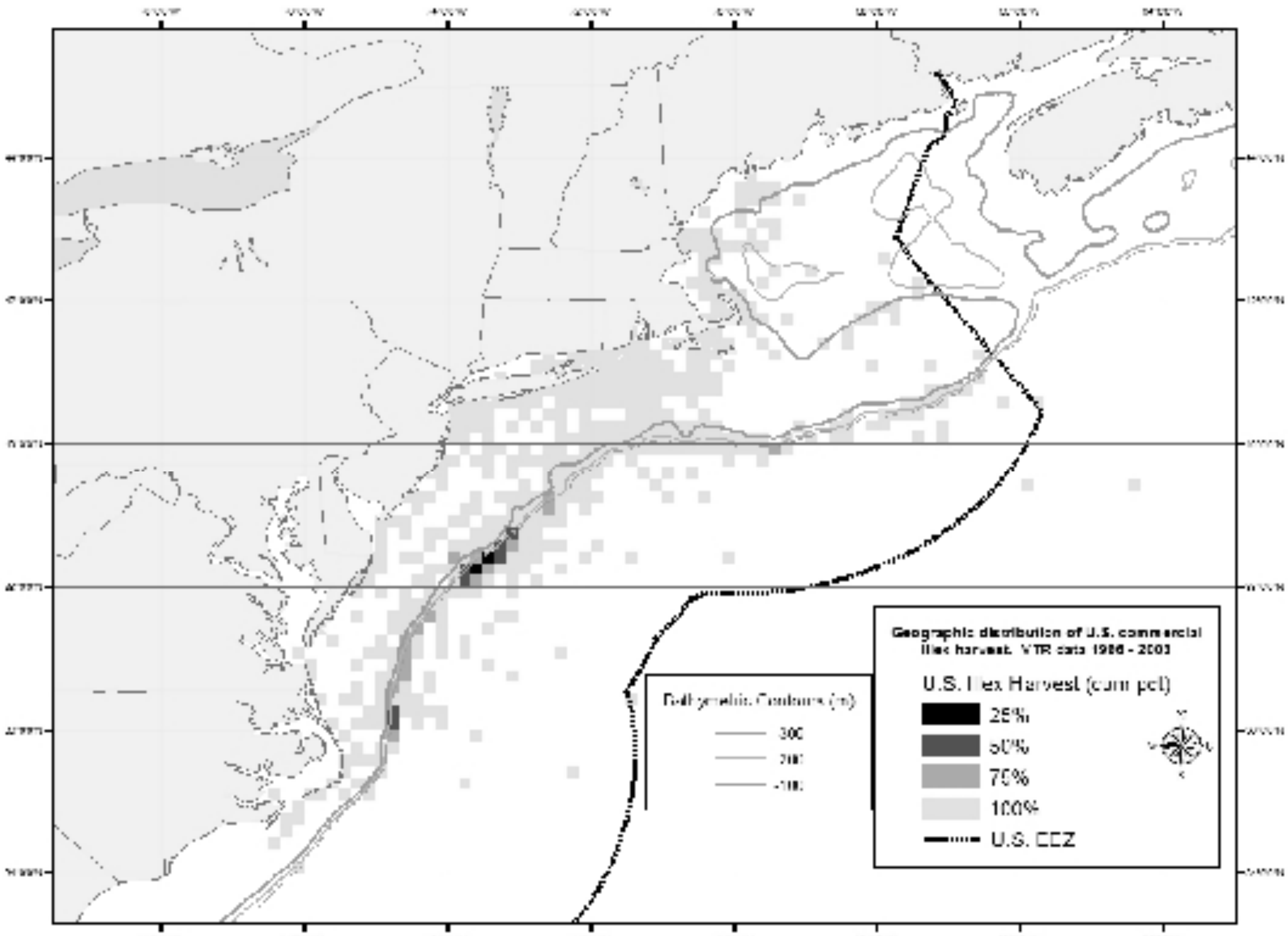


Figure 19. Geographic distribution of *Illex* harvest according to VTR data (1996 – 2003).

Commercial Discarding

Estimates of commercial discarding between 1995 and 2002 were included in the 2003 stock assessment for *Illex* (NEFSC 2003). In the report for that assessment, it was suggested that other fisheries likely to incur *Illex* bycatch would be those that utilize bottom trawls rigged with mesh sizes similar to that used by the directed fishery. Additionally, *Illex* bycatch is most likely to occur in fisheries that are active during May-November when *Illex* is present on the U.S. continental shelf. The offshore *Loligo* fishery meets both of these criteria and catch data from observed trips from the NEFSC Observer Program database indicate that a majority of the *Illex* bycatch, during 1995-2002, occurred in the offshore *Loligo* fishery. The levels of observer coverage necessary to characterize spatial and temporal patterns of *Illex* discarding at an acceptable level of precision, however, were insufficient. Nevertheless, annual discards of *Illex* during 1995-2002 ranged from 0.1 to 4.5% (NEFSC 2003).

Recreational Fishing

Although *Illex* are a ubiquitous bait item used in recreational fishing activities, these bait squid are a product of the commercial fishery and are, therefore, already accounted for. There is no directed recreational fishery for *Illex* of any significance.

6.1.3 *Loligo* stock

Fishing mortality threshold: F_{max} proxy

Fishing mortality target: F_{TARGET} = 75% of F_{max} whenever estimated *Loligo* biomass is equal to or greater than the biomass (stock size) target. When estimated *Loligo* biomass is less than B_{msy}, then F_{target} decreases linearly such that, at the biomass threshold, the F_{target} is zero

Stock size threshold: ½ of B_{MSY} = 40,000 mt

Stock size target: B_{MSY} = 80,000 mt

The latest stock assessment for *Loligo* was conducted at SAW 34 (NEFSC 2002). The assessment indicated that stock biomass fluctuated around an average of around 20,000 mt from 1987 to 2000, with biomass in 2000 approximately 24,000 mt (95% confidence interval of 17,000 to 34,000 mt). The (quarterly) fishing mortality rate had fluctuated widely about a mean value of 0.2 over the same period. Relative to a new proposed fishing mortality rate threshold, and current estimates of fishing mortality, overfishing was not occurring. Biomass increased since 1994 but recruitment was below average. NEFSC (2002) suggested that the existing biomass reference points are inadequate, although no alternative reference points have been proposed.

In conclusion, the current status of the *Loligo* stock is unknown with regard to the stock size threshold. Overfishing was determined not to have been occurring at the time of the assessment, however given the short life span of the species (< 1 year), one cannot assume that current conditions are consistent with those reported in that assessment.

Fishery Activities that Directly Affect Stock Status

Commercial *Loligo* Fishery

Reported foreign landings of *Loligo* increased from 2,000 mt in 1964 to a peak of 36,500 mt in 1973. Foreign *Loligo* landings averaged 29,000 mt for the period 1972-1975. Foreign fishing for *Loligo* began to be regulated with the advent of extended fishery jurisdiction in the US in 1977. The result of these restrictions was an immediate reduction in the foreign catch of *Loligo* from 21,000 mt in 1976 to 9,355 mt in 1978; however foreign *Loligo* catches had again risen above 20,000 mt by 1982 (NMFS 2002).

In the 1980s, U.S. management of squid resources focused on the development of domestic fisheries. U.S. domestic harvest of *Loligo* peaked in 1989 (23,650 mt) and averaged 17,186 mt during 1987-2006 (Table 6; Figure 20). During 2000, the first year the annual quota (15,000 mt) was divided into trimester periods, the annual quota was exceeded by 16.5%. During 2001-2006, quarterly quotas were in effect. Trimester quotas are proposed for 2007 (MAFMC 2007).

Table 6. Commercial *Loligo* landings (mt) from 1982 - 2006, by major gear type, and recent quotas (1994-2006)..

YEAR	TRAWL, OTTER, BOTTOM, FISH	POUND NET, FISH	FLOATING TRAP	POUND NET, OTHER	OTHER / UNKNOWN	TOTAL	QUOTA (mt)	Overage (%)
1982	2,445	2	1	73	4	2,524		
1983	8,266	2	23	0	441	8,731		
1984	6,649	438	67	0	5	7,158		
1985	6,217	281	359	0	7	6,864		
1986	10,867	522	77	0	46	11,513		
1987	9,699	552	96	0	7	10,354		
1988	16,811	1,007	649	0	95	18,562		
1989	22,416	33	450	692	59	23,650		
1990	14,354	114	306	166	13	14,954		
1991	18,849	52	317	109	81	19,409		
1992	17,914	24	44	95	100	18,177		
1993	21,885	8	84	196	99	22,272		
1994	22,404	25	37	75	22	22,563	44,000	
1995	17,623	22	13	144	547	18,348	36,000	
1996	11,720	22	74	113	484	12,414	25,000	
1997	15,649	14	231	182	36	16,113	21,000	
1998	18,962	12	34	62	53	19,123	21,000	
1999	19,148	49	45	59	18	19,319	21,000	
2000	17,200	27	61	139	53	17,480	[a]15,000	16.5
2001	14,021	8	89	57	62	14,238	17,000	
2002	16,509	7	31	101	60	16,707	17,000	
2003	11,840	2	58	27	8	11,935	17,000	
2004	12,763	1	0	86	2,597	15,447	17,000	
2005	11,652	6	1	37	5,287	16,983	17,000	
[b]2006	11,050	0	39	34	4,544	15,667	17,000	

[a] Increased from 13,000 mt to 15,000 mt by an in-season adjustment.
[b] Data are preliminary.
Source: Unpublished NMFS dealer weighout data

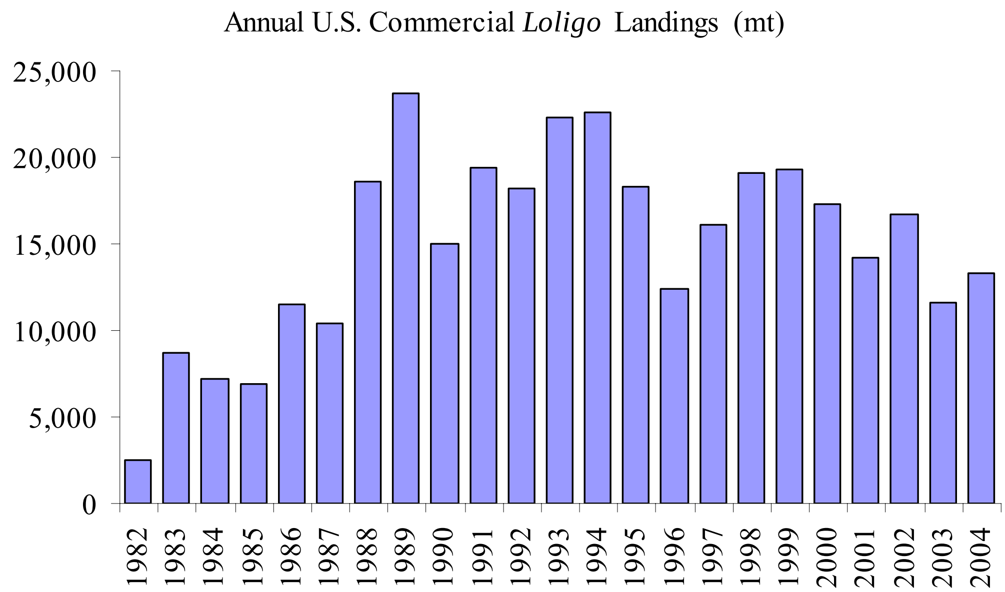


Figure 20. Annual U.S. commercial *Loligo* landings (mt).
Source: Unpublished NMFS dealer weighout data.

Temporal and Geographic Patterns of Commercial *Loligo* Harvest

Patterns of commercial harvest of *Loligo* are linked to patterns of availability to the commercial fishery. *Loligo* have complicated seasonal and annual distribution patterns (Brodziak and Macy 2001, Hatfield and Cadrin 2002). Depending on season and water temperatures, this species is distributed from relatively shallow near shore areas, across the continental shelf and on the upper continental slope with the largest individuals in relatively deep water (Cadrin and Hatfield 1999). Commercial *Loligo* landings generally peak in the spring and fall (Table 7; Figure 21). Landings of *Loligo* early in the year occur near the continental shelf break (102 – 183 m [56-100 fathoms]; Hendrickson 2005), while summer and fall landings are harvested predominately nearshore (Figure 23).

Since 2000, allocation of the annual quota has been divided up into smaller periods (trimesters in 2000, quarters in 2001 and thereafter) such that whenever 80% of the sub-annual quota has been landed, the fishery is “closed”, and a daily possession limit of 2,500 pounds is in effect for the remainder of that period. During the first year of the sub-annual quota monitoring, 2000, annual *Loligo* landings exceeded the annual quota by 16.5% (Table 6).

Loligo Closure Dates 2000 – 2006.

<u>2000</u>
Mar 25 – Apr 30; Jul 1- Aug 31; Sep 7 – Oct 6; Oct 26 - Dec 31

<u>2001</u>
May 29 – Jun 30

<u>2002</u>
May 28 – Jun 30; Aug 16 – Sep 30; Nov 2 - Dec 11; Dec 24 – Dec 31

<u>2003</u>
Mar 25 - Mar 31

<u>2004</u>
Mar 5 - Mar 31

<u>2005</u>
Feb 20 - Mar 31; Apr 25 - Jun 30; Dec 18 - Dec 31

2006
Feb 13 - Mar 31; Apr 21 - Apr 27; May 23 - Jun 30; Sep 2 - Sep 30

Table 7. U.S. commercial landings (mt) of *Loligo* by month from 1994 - 2004.

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1994	1,152	1,806	1,623	631	1,085	470	654	1,458	4,239	4,010	2,888	2,546
1995	1,372	1,846	2,412	1,404	1,106	1,098	2,487	491	833	2,685	1,675	940
1996	2,633	2,545	2,222	1,619	736	285	401	326	106	496	555	490
1997	719	1,526	1,075	1,391	1,135	314	690	775	1,265	3,312	1,950	1,959
1998	1,710	4,390	4,575	1,557	365	203	452	284	391	1,536	1,744	1,916
1999	1,630	1,452	1,810	1,950	650	549	1,365	1,738	1,887	2,470	2,189	1,628
2000	1,588	2,566	2,231	339	1,275	1,723	1,617	1,323	931	3,030	390	238
2001	856	1,035	2,026	1,461	604	461	825	622	512	1,768	2,213	1,856
2002	1,560	1,677	1,600	1,521	1,643	455	1,764	1,844	358	2,723	566	997
2003	1,187	1,985	1,808	398	276	87	49	114	1,202	860	2,038	1,618
2004	1,772	2,655	1,000	1,062	733	408	195	379	230	549	1,420	2,918
Total	16,178	23,483	22,382	13,333	9,606	6,053	10,500	9,354	11,954	23,439	17,630	17,107

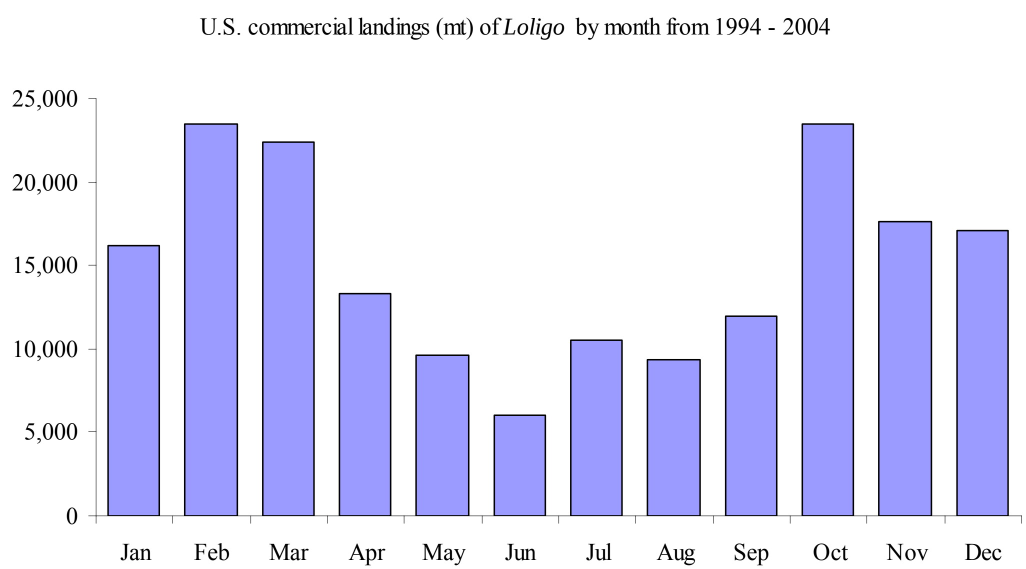


Figure 21. Total monthly U.S. Commercial *Loligo* landings (mt) 1994-2004.
Source: Unpublished NMFS dealer weighout data

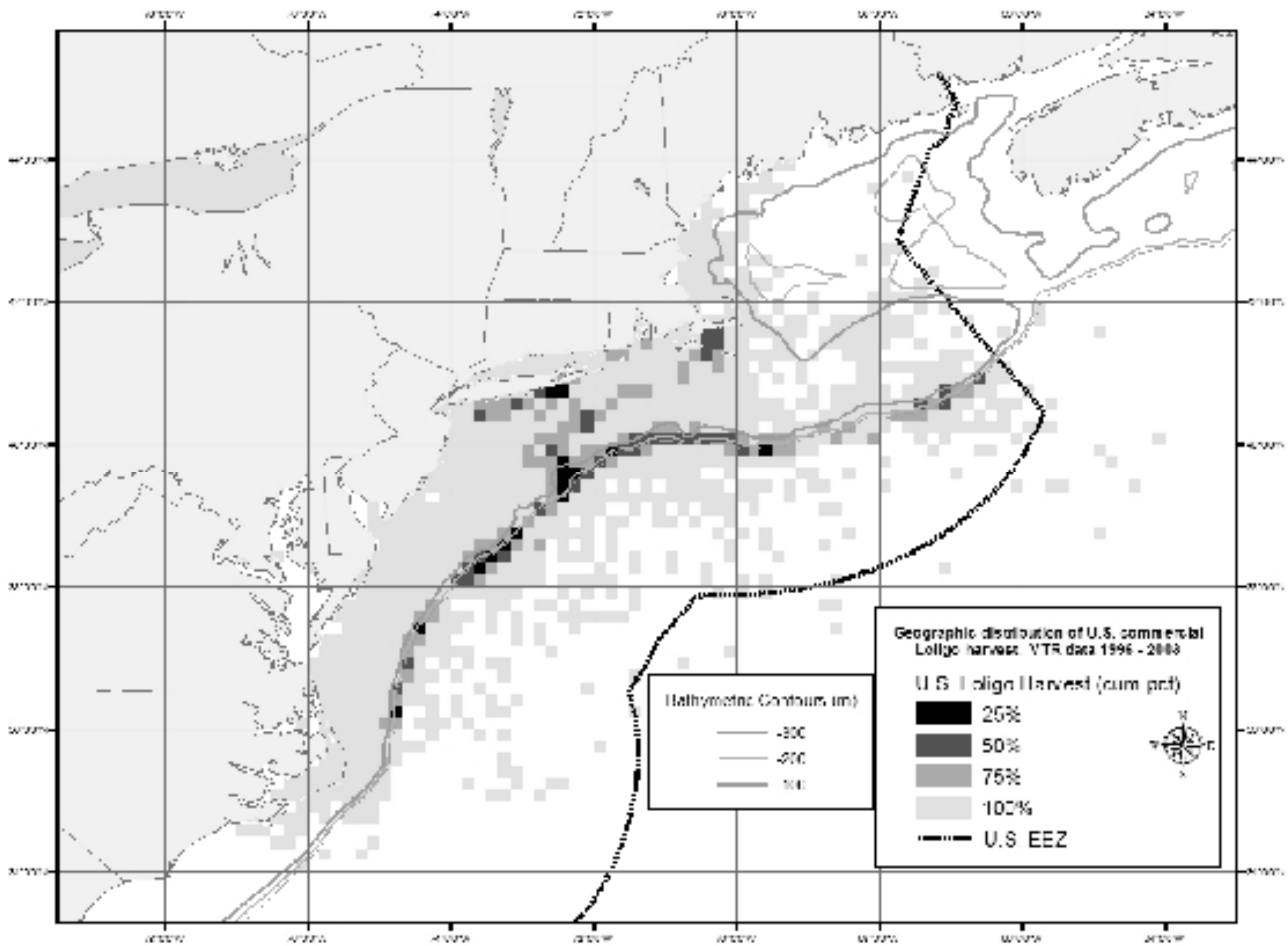


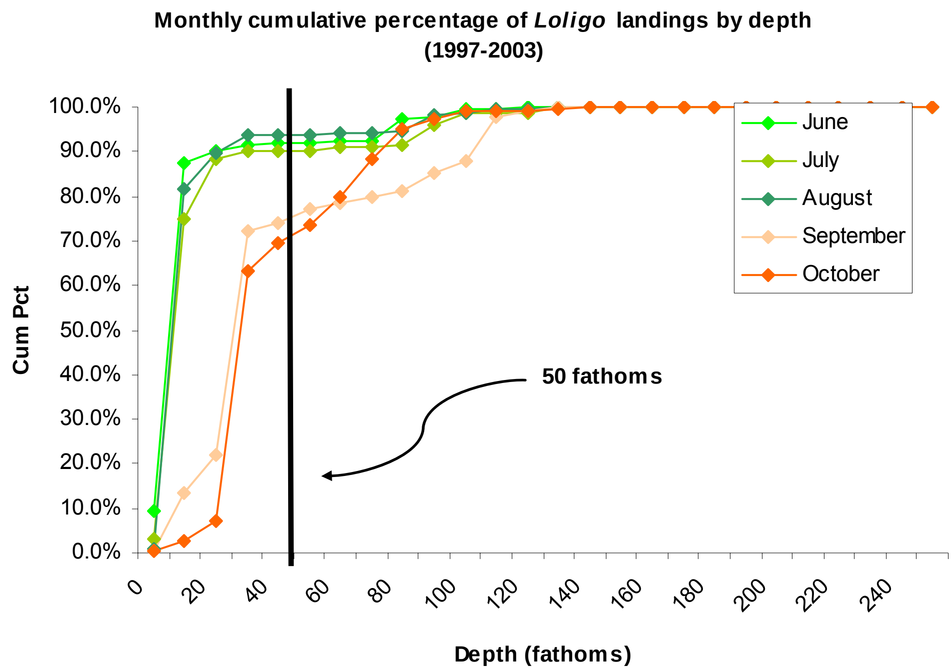
Figure 22. Geographic distribution of *Loligo* harvest according to VTR data (1996 – 2003).

Commercial Discarding

Cadrin and Hatfield (1999) estimated commercial discards of *Loligo* that occurred during the period 1989-1998. Their estimated discard to landings ratios (weight of *Loligo* discards to total weight of all species landed) ranged 1%-14% and averaged 6%. In the latest assessment (NEFSC 2002), the ratio of discards of *Loligo* to *Loligo* landings was estimated to be about 3% during 1997-2000. It was noted, however, that because *Loligo* are taken in tows targeting many species, including target species not considered in the assessment, the lower 3% discard rate compared to Cadrin and Hatfield's (1999) 6% estimate for the entire bottom trawl fishery is probably a reasonable analytical outcome. Nevertheless, it was also pointed out that in most cases, the number of trips and tows used to generate discard estimates was small and possibly non-representative. As such, the estimated discard rates in the assessment, and in Cadrin and Hatfield (1999), are likely to be imprecise and possibly biased.

Importantly, a minimum mesh size for *Loligo* was established in 1996 under Amendment 5, however, a provision was included that exempted otter trawl vessels participating in the directed fishery for *Illex* during the months of June, July, August, and September, from the *Loligo* minimum mesh requirements. The exemption provision for the *Illex* fishery was included because the bulk of *Illex* landings are taken offshore, and at a time when the *Loligo* fishery is generally active nearshore (Figure 23).

A sub-annual quota system established for *Loligo* in 2000 has resulted in closure of the directed *Loligo* fishery during a portion of each year since then. In 2000 and 2002, large amounts of *Loligo* discards were reported in vessel trip reports by vessels engaged in *Illex* fishing. Maps of NEFSC survey catches identify offshore overlap of the *Loligo* and *Illex* stocks in Sep-Nov (Figure 24). In addition, depth distributions of *Illex* and *Loligo* catches in the directed fisheries indicate overlap of the two species during September and October (Figure 23). Given the large catches that typically occur in the prosecution of the *Illex* fishery, the potential for substantial discarding of *Loligo* during *Loligo* closure periods exists. An analysis of regulatory discarding during 2000-2003 (Appendix 2) indicates that discarding of *Loligo* occurred during directed fishery closures during all three years. Discard to kept ratios of *Loligo* were higher during directed fishery closure periods than when the fishery was open. The NMFS Observer Program data indicated that regulatory discarding of *Loligo* occurred primarily in the *Illex* fishery, but also in the silver hake, summer flounder and Atlantic mackerel fisheries. Regulatory discarding of *Loligo* in these fisheries could be reduced to near zero, with the exception of the *Illex* fishery, if the *Loligo* trip limit during directed fishery closures is increased to 5,000 lbs. A 5,000-lb trip limit would also reduce the number of *Illex* trips with regulatory discards of *Loligo* by 13% (Table 8). The Vessel Trip Report data indicate that the discard to kept ratios of *Loligo* and the percentage of trips which exceeded the closure period trip limit were highest during closures which occurred in June through October, coincident with the *Illex* fishing season. Therefore, an increase in the closure period trip limit to 5,000 lbs during June through October would be beneficial to the *Loligo* stock. Regulatory discards are difficult to estimate accurately and an increased trip limit would allow potential discards to be landed, resulting in a more accurate quantification of fishery removals. Increases in the bycatch trip limit to 7,500 lbs or 10,000 lbs, during June through October, would further reduce the number of *Illex* trips with regulatory discarding of *Loligo* by another 5% and 10%, respectively (Table 8). However, increasing the trip limit to these levels may result in little gain in regulatory discard reduction and may encourage directed fishing.



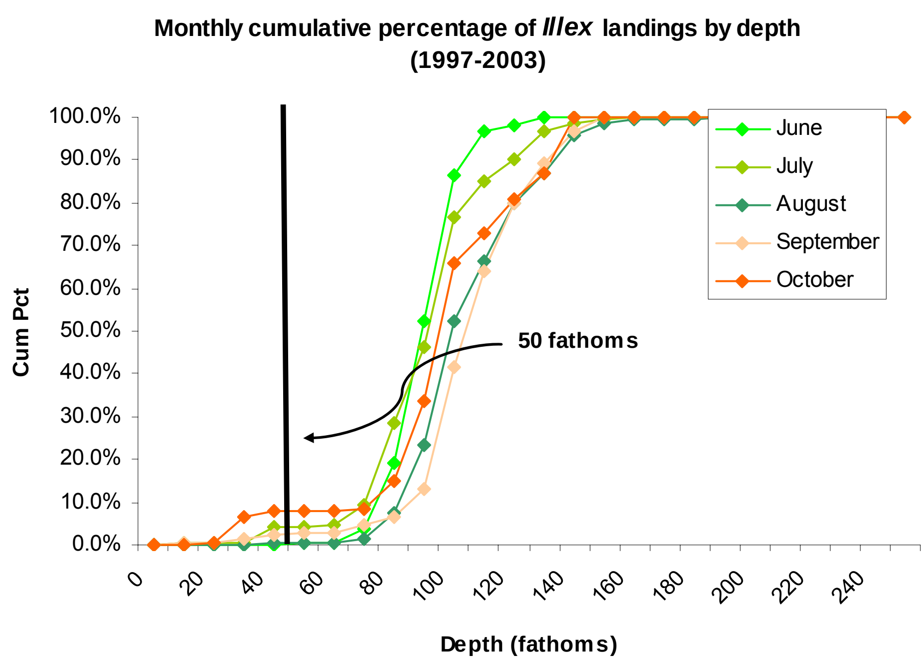


Figure 23. Distribution of *Loligo* (top) and *Illex* (bottom) landings by depth, month from 1997-2003 VTR data

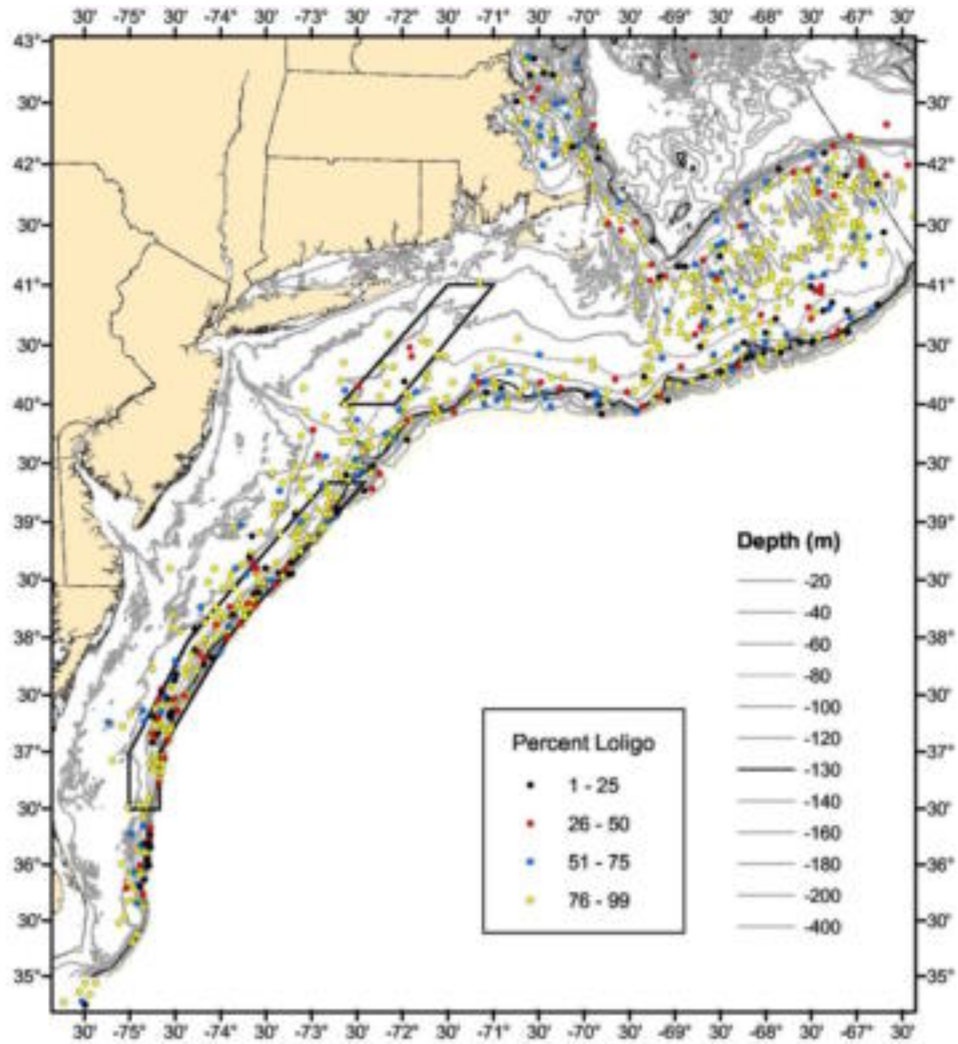


Figure 24. Co-occurrence of *Loligo* and *Illex* in NEFSC research bottom surveys during fall, 1992-2003.

Table 8. Percentage of bottom trawl trips with *Loligo pealeii* bycatch, by amount and target species, based on trips recorded in the NMFS Observer Program Database during 1998-2004.

	N trips by target species							
L. pealeii bycatch, lbs	*Illex*	%	Silver Hake	%	Summer Flounder	%	Atlantic Mackerel	%
2,500	27	69.2	86	96.6	350	99.2	18	94.7
5,000	5	12.8	3	3.4	3	0.8	1	5.3
7,500	2	5.1	0	0.0	0	0.0	0	0.0
10,000	2	5.1	0	0.0	0	0.0	0	0.0
12,500	0	0.0	0	0.0	0	0.0	0	0.0
15,000	0	0.0	0	0.0	0	0.0	0	0.0
17,500	1	2.6	0	0.0	0	0.0	0	0.0
20,000	0	0.0	0	0.0	0	0.0	0	0.0
22,500	0	0.0	0	0.0	0	0.0	0	0.0
25,000	1	2.6	0	0.0	0	0.0	0	0.0
27,500	1	2.6	0	0.0	0	0.0	0	0.0
Total	39		89		353		19	

6.1.4 Butterfish stock

Fishing mortality threshold: $F_{0.1} = 1.01$

Fishing mortality target: $F_{msy} = 0.38$

Stock size threshold: ½ of B_{MSY} = 11,399 mt

Stock size target: B_{msy} = 22,798 mt

The Atlantic butterfish stock was most recently assessed in 2003 at SAW 38 (NEFSC 2004). Compared to the fishing mortality threshold, the estimated fishing mortality during 2002 (0.34) was near the F_{msy} target, indicating that overfishing was not occurring. However, the 2002 stock biomass estimate (7,800 mt) was below the stock size threshold of 1/2 B_{msy}, indicating that the stock is overfished. These estimates of fishing mortality and biomass were, however, considered to be highly uncertain. The average F from 2000 to 2002 was 0.39 and the F estimated for 2002 was 0.34 (80% confidence interval of 0.25 to 1.02). Average biomass ranged from 7,800 to 77,200 mt from 1969 to 2002, with 2002 biomass estimated as 7,800 mt (80% confidence interval of 2,600 to 10,900).

Recruitment of butterfish has declined since 1995 and was among the lowest in the time series during 2001 and 2002. The NEFSC fall survey indices for butterfish during 2001 and 2002 were the lowest in the time series since 1968. The 2002 spawning stock biomass estimate (8,700 mt) was one of the lowest in the time series.

Discards are a significant source of mortality for this stock, and are estimated to be more than twice the landings (NEFSC 2004). Therefore, the SAW 38 assessment included the recommendation that measures be taken to reduce discarding of butterfish. Data from the NEFSC research bottom trawl survey indicated in 2005 that butterfish biomass was below the biomass threshold. As such the stock is determined to be overfished. Amendment 10 to the SMB FMP is currently in development in order to establish a recovery plan for the butterfish stock.

Fishery Activities that Directly Affect Stock Status

Commercial Butterfish Fishery

Beginning in 1963, vessels from Japan, Poland and the USSR began to exploit butterfish along the edge of the continental shelf during the late-autumn through early spring. Reported foreign catches of butterfish increased from 750 mt in 1965 to 15,000 mt in 1969, and then to about 18,000 mt in 1973. With the advent of extended jurisdiction in US waters, reported foreign landings declined sharply from 10,353 mt in 1976 to 1,326 mt in 1978. Foreign landings were slowly phased out by 1987. Since 1988, foreign butterfish landings have averaged about 1 mt .

During 1982-2006, a peak in U.S. commercial butterfish landings (11,300 mt) occurred in 1984 (Figure 25). Relatively high landings levels in the 1980s were attributed to heavy demand for butterfish in the Japanese market (NEFSC 2004). Demand from that market has since waned and landings averaged only 2,790 mt during 1990-1999. Since 2001, there has been no directed fishery so landings have been very low, ranging from 400-500 mt during 2002-2006 (Table 9; Figure 25).

The vast majority of butterfish landings come from bottom otter trawl fishing (Table 9). Unlike the other resources managed through this FMP, landings of butterfish are generally a result of bycatch in other directed fisheries. Of the 5,018 trawl trips monitored through the NMFS observer program from 1989-2004, only 16 (~ 0.3%) indicated butterfish as the target species; yet butterfish were retained on 901 (~ 18%) of the observed trips. As such, it is difficult to characterize the trips that contribute to the majority of butterfish landings. As indicated in the SAW 38 assessment, butterfish may be retained or discarded depending on the particular demand in that fishery. Fisheries with substantial butterfish bycatch include the squid, silver hake, and mixed groundfish fisheries. Of these fisheries the largest and most consistent bycatch occurs in the small-mesh squid fisheries (NEFSC 2004).

Table 9. Commercial butterfish landings (mt) from 1982 – 2006, by major gear type, and recent quotas (1994-2006)..

YEAR	TRAWL, OTTER, BOTTOM, FISH	POUND NET, FISH	FLOATING TRAP	OTHER / UNKNOWN	TOTAL	QUOTA (mt)
1982	7,479	13	57	14	7,563	
1983	3,635	14	111	38	3,798	
1984	11,132	69	65	4	11,269	
1985	4,040	12	67	22	4,140	
1986	4,352	30	37	7	4,426	
1987	4,458	19	23	8	4,508	
1988	1,904	30	64	3	2,001	
1989	3,065	86	24	28	3,203	
1990	2,218	27	25	28	2,298	
1991	2,112	12	7	58	2,189	
1992	2,682	22	4	47	2,754	
1993	4,369	23	20	63	4,475	
1994	3,448	74	11	102	3,635	10,000
1995	1,889	57	17	104	2,067	10,000
1996	3,342	63	26	124	3,555	5,900
1997	2,554	67	32	142	2,795	5,900
1998	1,832	47	28	59	1,966	5,900
1999	1,979	66	16	50	2,110	5,900
2000	1,316	49	7	78	1,449	5,900
2001	4,278	43	19	64	4,404	5,897
2002	782	28	9	52	872	5,900
2003	477	16	6	37	536	5,900
2004	366	42	0	128	537	5,900
2005	256	29	1	155	433	1,681
[a]2006	329	6	1	207	543	1,681

[a] Data are preliminary

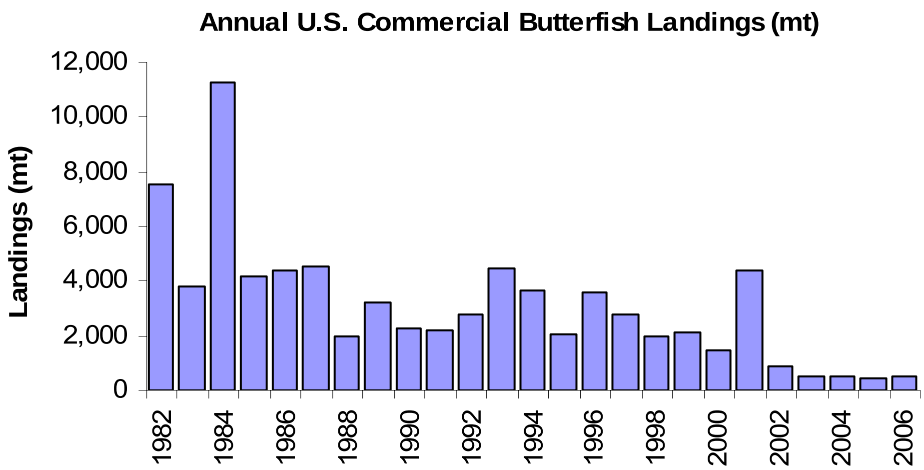


Figure 25. Annual U.S. commercial butterfish landings (mt).
Source: Unpublished NMFS dealer weighout data.

Temporal and Geographic Patterns of Commercial Butterfish Harvest

The bulk of the U.S. commercial butterfish landings occur in January-March (Table 10; Figure 26). Although low level butterfish harvest is widespread, concentrations of landings come from southern New England shelf break areas near 40º N, as well as in and near Long Island Sound (Figure 27).

Table 10. U.S. commercial landings (mt) of butterfish by month from 1994 - 2004.

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1994	872	697	202	114	196	167	71	94	119	315	211	520
1995	401	312	183	105	128	126	61	66	92	143	160	290
1996	445	636	494	270	228	496	104	116	149	177	216	225
1997	325	478	431	200	198	149	132	132	149	120	146	335
1998	621	261	123	189	116	95	63	63	157	69	93	116
1999	179	449	295	152	112	105	66	126	138	274	129	85
2000	35	50	110	75	105	54	52	121	304	269	171	102
2001	1,630	955	610	299	187	128	120	80	63	108	120	104
2002	59	106	94	82	154	71	43	39	74	49	53	47
2003	49	47	69	35	47	37	15	19	28	48	35	46
2004	60	40	34	31	51	44	30	22	36	34	26	13
Total	4,675	4,030	2,646	1,552	1,521	1,472	759	878	1,309	1,607	1,359	1,882

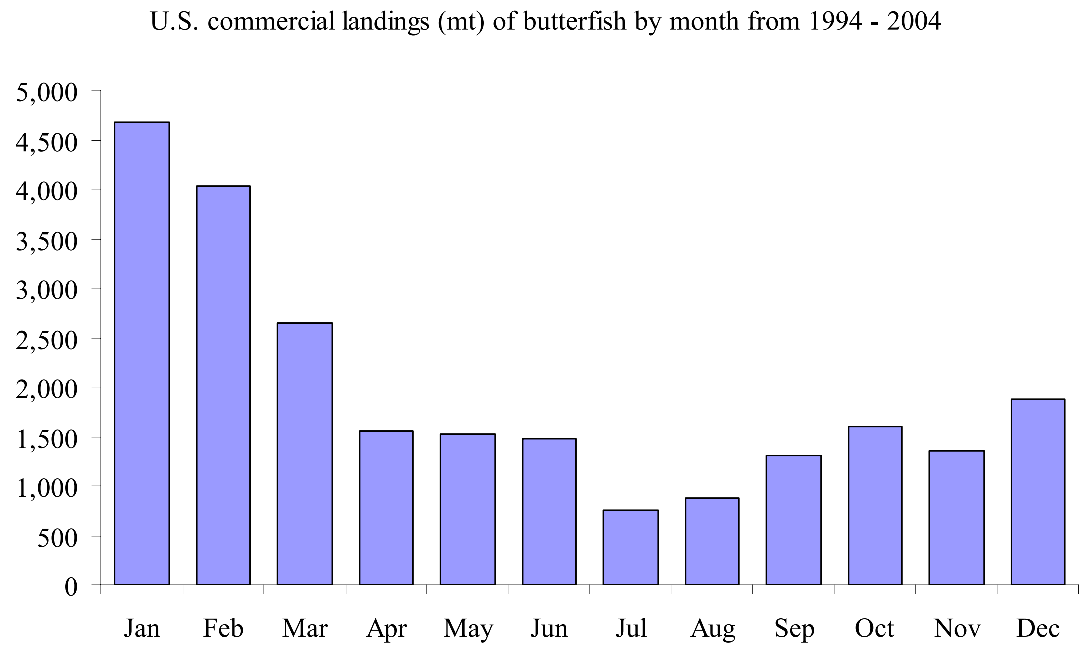


Figure 26. Total monthly U.S. commercial butterfish landings (mt) 1994-2004.
Source: Unpublished NMFS dealer weighout data

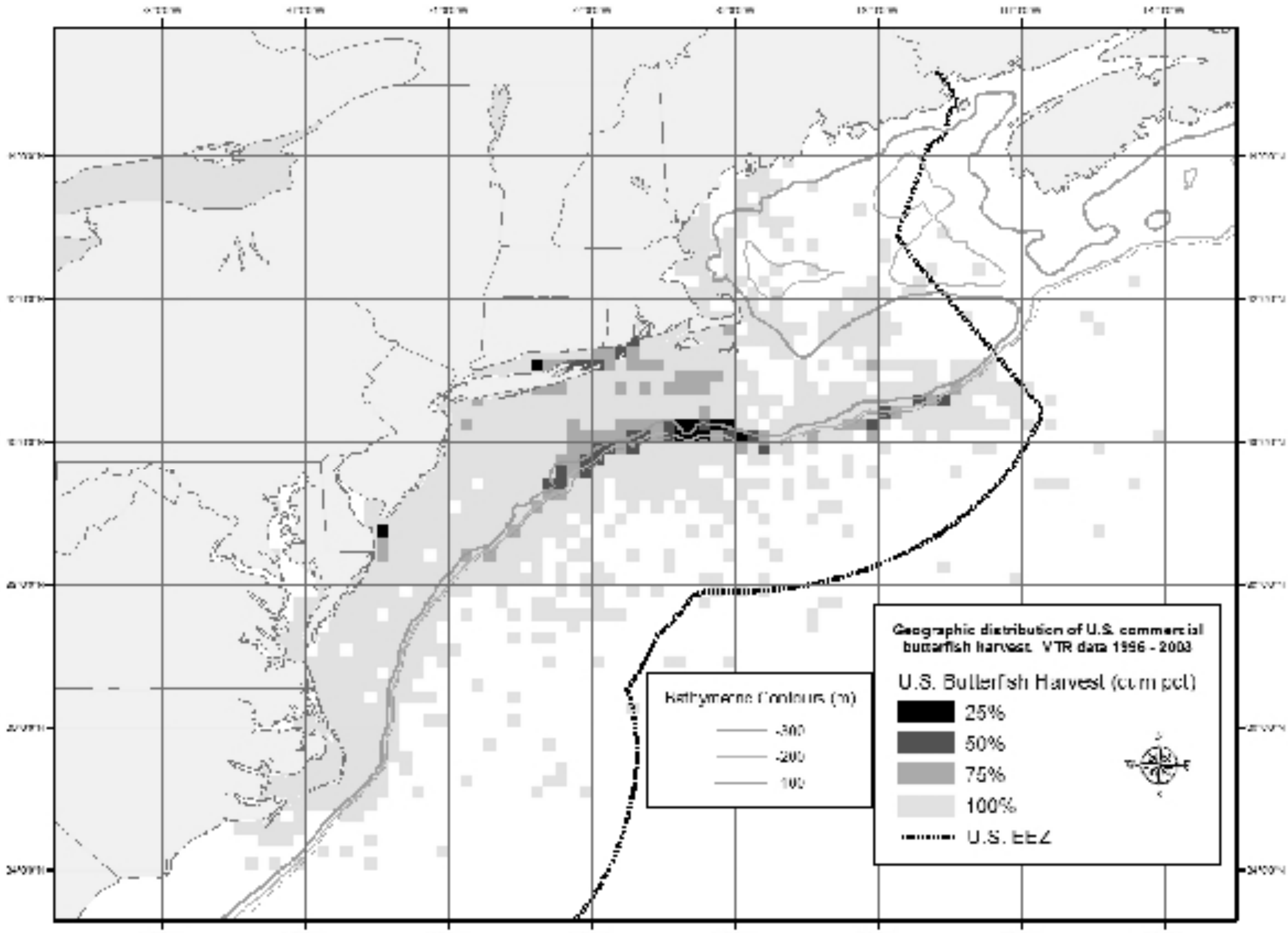


Figure 27. Geographic distribution of butterfish harvest according to VTR data (1996 – 2003).

Commercial Discarding

As noted in the SAW 38 stock assessment for butterfish (NEFSC 2004), commercial discards, though difficult to estimate are likely more than twice the commercial landings of butterfish. Butterfish discard estimates are available from SARC 38 where separate calculations of discards were made using either VTR or NMFS observer data. SARC 38 concluded that VTR data could not be used to produce valid estimates of discards for butterfish. Based on information from NMFS observer data, from 1989-2002, butterfish were caught frequently in the squid (*Loligo* and *Illex*), mixed groundfish, silver hake and fluke fisheries. Overall, the fishery for squid produced the highest level of butterfish discards over the entire period (NEFSC 2004).

According to an unpublished NEFSC report (Appendix 3a), during 1978-1982, a minimum codend mesh size of 60 mm was required in the directed squid fisheries in U.S. waters. Currently, more than one third (41%) of the U.S. *Loligo* landings and 46% of the *Illex* landings are taken with codend mesh sizes of 60 - 76 mm.

In the same NEFSC report, data from the NEFSC Observer Program (1996-2003) were used to compare the percentage of otter trawl tows with butterfish discards, by codend mesh size, to all otter trawl tows sampled and to compare the percentage of discarded butterfish weight, by codend mesh size, to all otter trawl tows sampled (Figure 28). The results indicated that 81% of the tows with butterfish discards occurred on otter trawlers with codend mesh sizes of ≤ 65 mm and 9% of the tows with codend mesh sizes of 66-80 mm (Figure 28). The highest percentage of butterfish discards (92%) also occurred with the use of codend mesh ≤ 65 mm. Butterfish discards of 7% occurred with the use of codend mesh sizes of 66-80 mm mesh (Figure 29). The target species *Loligo* and silver hake, as indicated by the captain prior to each tow, accounted for 77% and 11%, respectively, of the butterfish weight discarded in the 76-80 mm mesh range. For the ≤ 65 mm mesh range, target species and the percentages of butterfish discard weight that each represented were: *Loligo* (50%), *Illex* (30%), squid and mixed groundfish (6%), Atlantic mackerel (4%) and butterfish (2%).

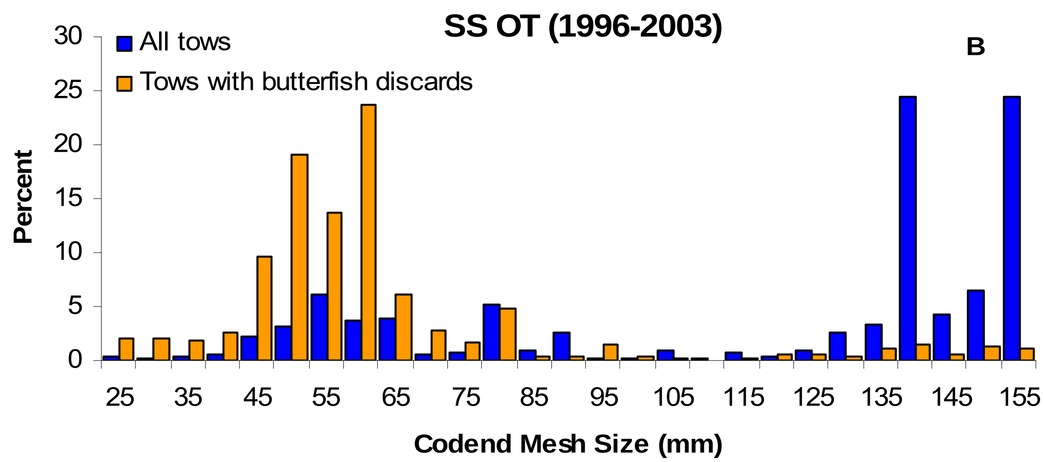


Figure 28. Otter trawl tows with butterfish discards versus all otter trawl tows, by codend mesh size, based on data from the NEFSC Observer Program Database.

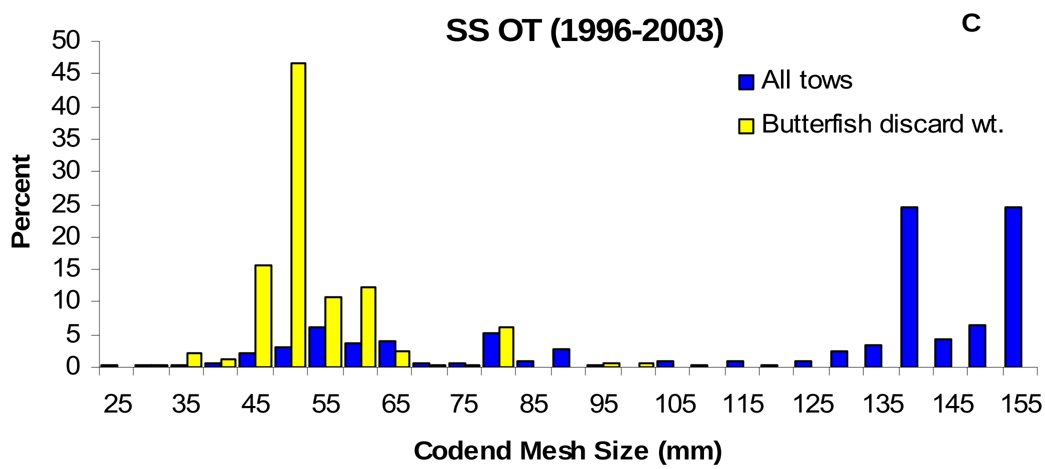


Figure 29. Discarded butterfish weight versus all otter trawl tows, by codend mesh size, based on data from the NEFSC Observer Program Database.

Given the negative effect of commercial otter trawl discarding on the condition of the butterfish stock, a number of new analyses have been conducted for this amendment in order to identify potential management solutions to the discarding problem. These analyses are presented in detail in Appendices 1 and 2; however, important results of the analyses are presented here.

In an unpublished analysis by the NEFSC staff, the distribution of butterfish discards (in weight) for all observed otter trawl tows with codend mesh sizes less than 3.0 inches and 3.75 inches were mapped for January-April,1996-2003. The maps showing the distributions of butterfish discards from the NEFSC Observer Database, by quarter-degree square, are very similar regardless of whether 3.0-inch (Figure 30) or 3.75-inch (Figure 31) codend mesh sizes were included. The quarter-degree squares associated with the highest two discard categories, which comprised 83-84% of the total butterfish discards that were mapped, are the same for both mesh size ranges.

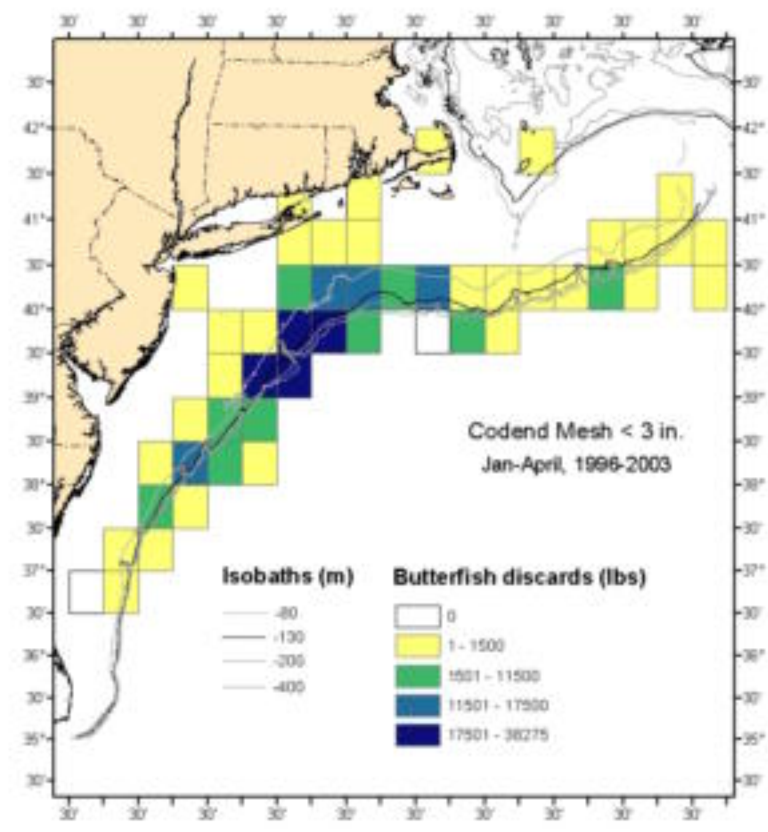


Figure 30. Observed butterfish discards, by quarter-degree square, for otter trawl fisheries using codend mesh sizes less than 3.0 inches during Jan.-April, 1996-2003

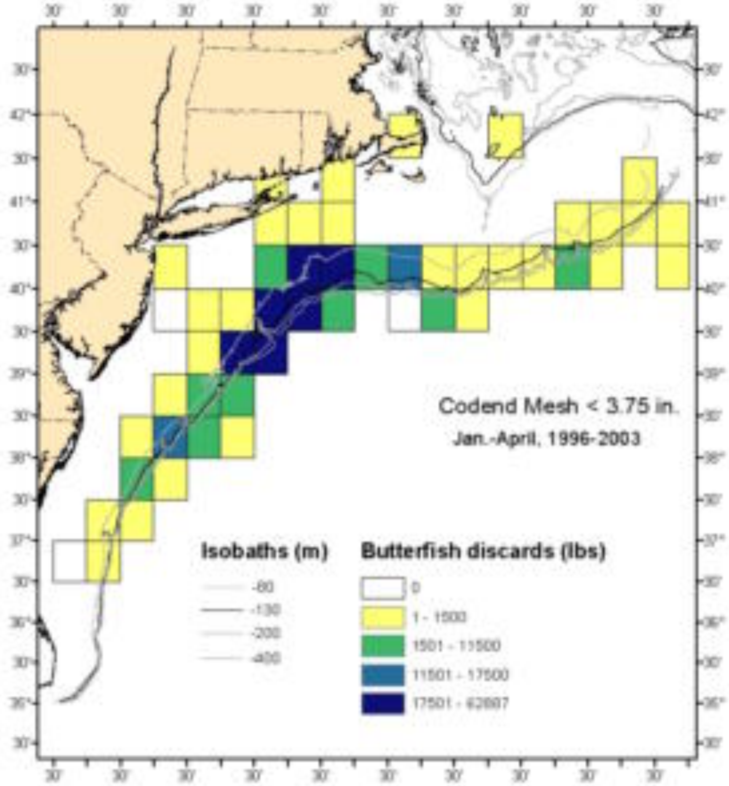


Figure 31. Observed butterfish discards, by quarter-degree square, for otter trawl fisheries using codend mesh sizes less than 3.75 inches during Jan.-April, 1996-2003.

For the purposes of this amendment, additional analyses were conducted that identified the spatial overlap of small mesh bottom otter trawl fishing effort and estimated total butterfish discards at a finer level of spatial detail. These analyses identified areas that, if closed to small mesh bottom otter trawl activity during Jan-Apr, are likely to substantially reduce the incidence of butterfish discarding. The details of this analysis are presented in Appendix 1. The boundaries of the areas resulting from this analysis which will decrease butterfish discards by 50% and 90% are illustrated in Figures 32 and 33, respectively. It should be noted that the existing southern GRA (Figure 32), designed to reduce scup discarding in small-mesh fisheries using codend mesh sizes < 4.5 inches, also offers some protection to butterfish during January - March 15 (compare Figure 32 with Figure 16 in Appendix 1); the effective GRA period. In 2005, this GRA was moved westerly by 3 minutes (Figure 32).

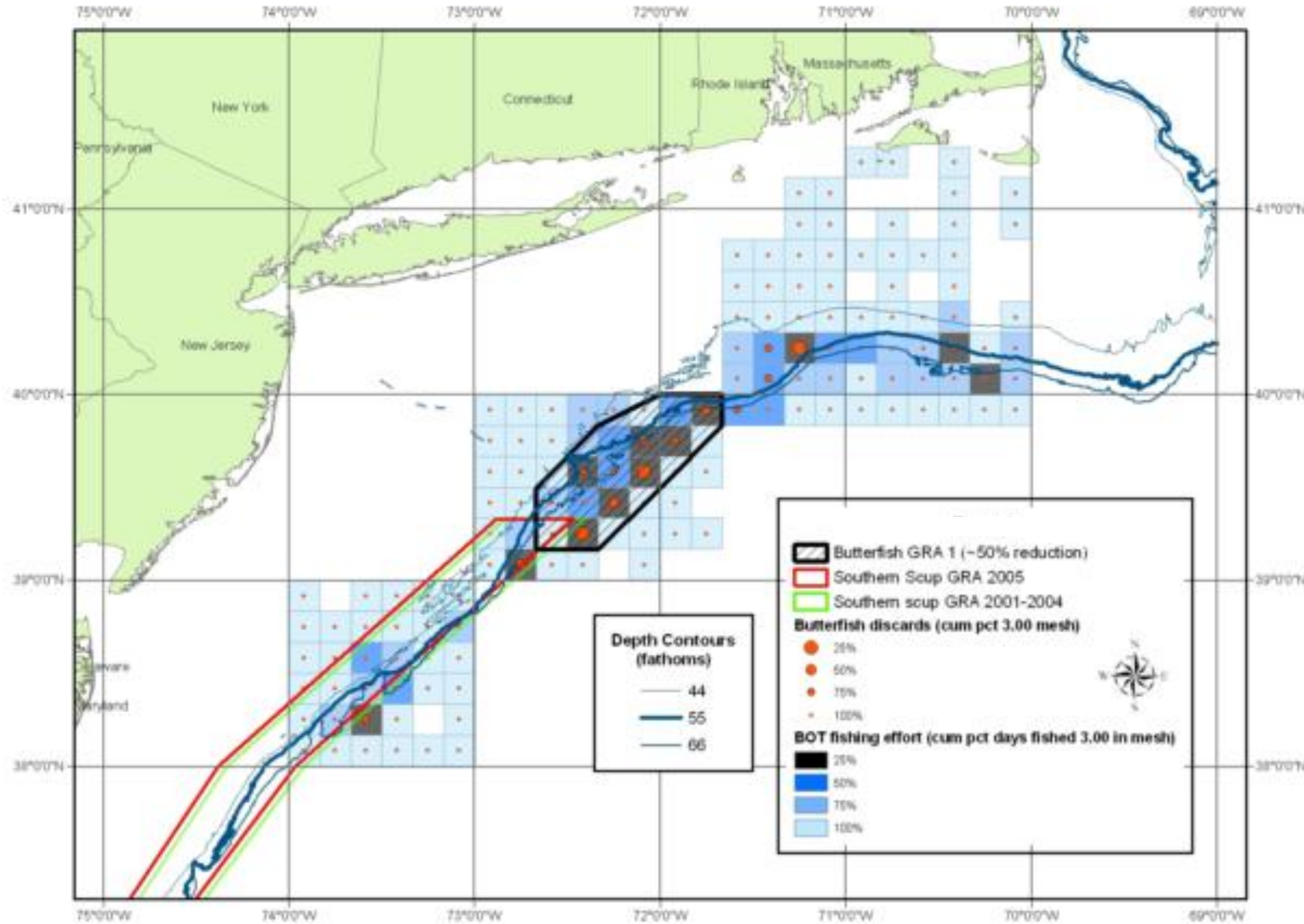


Figure 32. Area identified as decreasing butterfish discards by approximately 50% in Jan-Apr if closed to small mesh (< 3.75 in) bottom otter trawl fishing

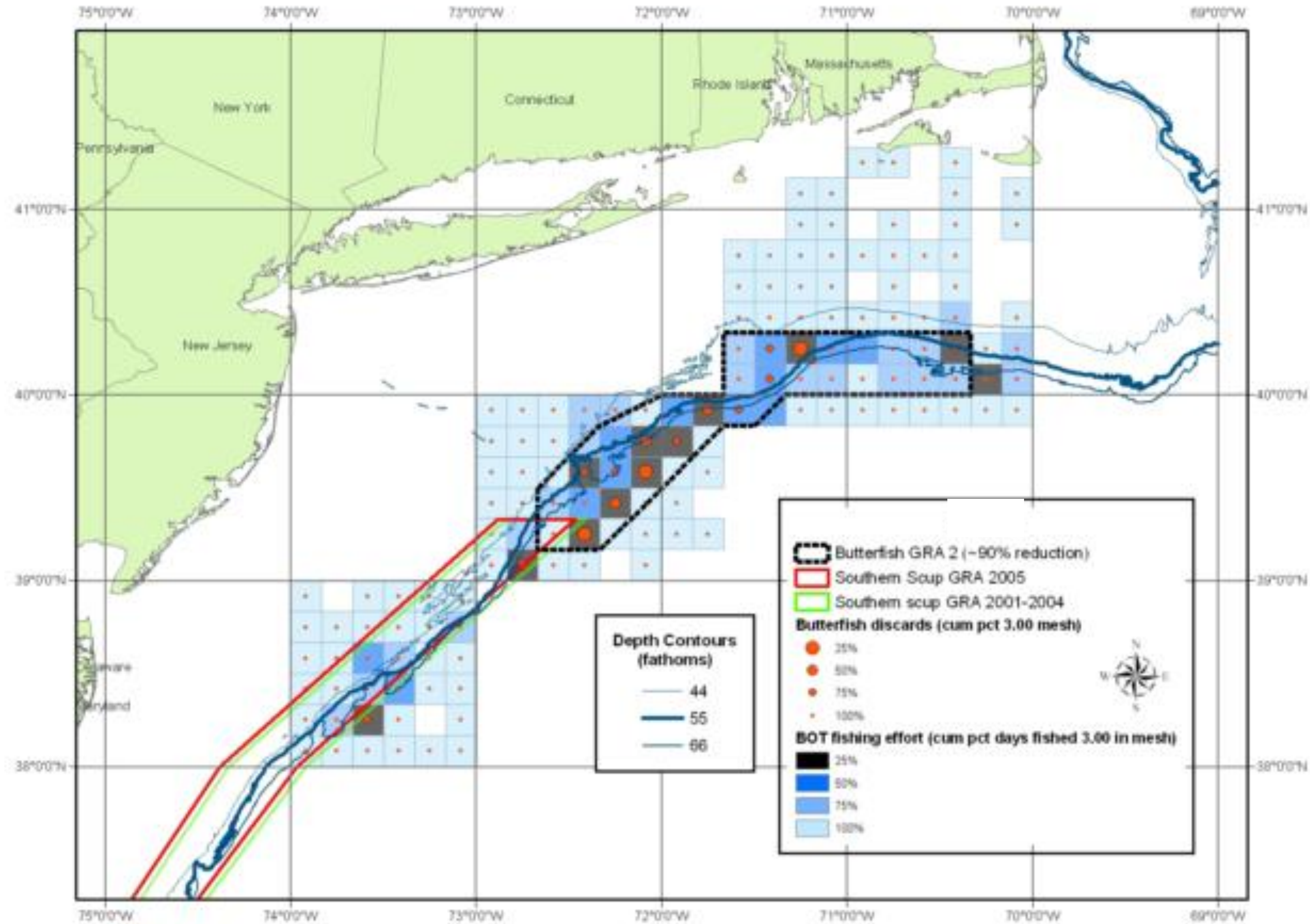


Figure 33. Area identified as decreasing butterfish discards by approximately 90% in Jan-Apr if closed to small mesh (< 3.75 in) bottom otter trawl fishing

6.2 Non-Target Species

The non-target species VEC includes the major species incidentally captured and discarded as a result of directed fishing for the managed resources. When incidental catch is retained and landed, the catch is accounted for in the landings for that species. This is consistent with the definition of bycatch used by the NEFSC's bycatch estimation methodology (Rago et al. 2005). Discarding of managed resources by SMB or other fishery activities is accounted for in the description of the managed resource VEC given above in Section 6.1.

Table 11A provides a list of the most frequently discarded species or species groups (species or species groups that comprised 2% or more of the discards from each of the "directed" SMB fisheries) during 1989-2003 based on data from the NEFSC Observer Program. This list includes: butterfish (*Peprilus triacanthus*), scup (*Stenotomus chrysops*), silver hake (*Merluccius bilinearis*), red hake (*Urophycis chuss*), spiny dogfish (*Squalus acanthias*), longfin inshore squid (*Loligo pealeii*), fourspot flounder (*Hippoglossina oblonga*), Northern shortfin squid (*Illex illecebrosus*), Atlantic mackerel (*Scomber scombrus*), unspecified sea robins (Family Triglidae), Atlantic herring (*Clupea harengus*), blueback herring (*Alosa aestivalis*), John Dory (*Zenopsis conchifera*), unspecified skates (Order Rajiformes), little skate (*Leucoraja erinacea*), black sea bass (*Centropristis striata*), and chub mackerel (*Scomber japonicus*).

Note that the managed resources are included in this list (grayed out in Table 11A). An analysis of discarding by SMB fisheries was conducted and is presented in Appendix 3b. This analysis indicated that although discarding of a number of species has been documented on observed SMB trips, the temporal and spatial resolution (i.e., sample size) needed to adequately characterize seasonal patterns in discarding was generally inadequate, with the exception of otter trawl trips where butterfish and red hake were discarded.

Table 11A. Species comprising 2% or more of the discards from each SMB fishery based on the NEFSC Observer Program database (1989 – 2003). Pct Disc (Overall) represents the discard weight of a species divided by the total discard weight of all species in the directed fishery expressed as a percentage. Pct Disc (Sp) represents the percentage of the catch, by species, which is discarded in the directed fishery. SMB species are highlighted.

Butterfish (N = 134 observed directed trips)

	Catch Disposition					
SPECIES	Disc (lbs)	Kept (lbs)	Grand Total (lbs)	Pct Disc (Overall)	Pct Disc (Sp)	D:K Ratio
BUTTERFISH	629,167	737,372	1,366,539	22%	46%	0.853
HAKE, SILVER	436,587	752,314	1,188,901	15%	37%	0.580
HAKE, RED	397,293	62,030	459,323	14%	86%	6.405
SKATES	246,261	23,740	270,001	9%	91%	10.373
DOGFISH SPINY	227,413	4,998	232,411	8%	98%	45.501
SCUP	196,752	176,834	373,585	7%	53%	1.113
SQUID (LOLIGO)	112,042	1,530,191	1,642,233	4%	7%	0.073
MACKEREL, ATLANTIC	99,637	758,201	857,838	3%	12%	0.131
FLOUNDER, FOURSPOT	98,131	569	98,700	3%	99%	172.462
SKATE, LITTLE	78,557	16,114	94,671	3%	83%	4.875
SQUID (ILLEX)	50,728	1,074,339	1,125,067	2%	5%	0.047

Illex **(N = 67 observed directed trips)**

	Catch Disposition					
SPECIES	Disc (lbs)	Kept (lbs)	Grand Total (lbs)	Pct Disc (Overall)	Pct Disc (Sp)	D:K Ratio
SQUID (ILLEX)	124,503	10,436,005	10,560,508	39%	1%	0.012
BUTTERFISH	59,447	75,335	134,782	19%	44%	0.789
MACKEREL, CHUB	53,481	10,127	63,608	17%	84%	5.281
MACKEREL, ATLANTIC	50,024	69	50,093	16%	100%	724.986
HAKE, SILVER	11,611	286	11,897	4%	98%	40.626
JOHN DORY	9,338	4,039	13,378	3%	70%	2.312

Loligo **(N = 311 observed directed trips)**

	Catch Disposition					
SPECIES	Disc (lbs)	Kept (lbs)	Grand Total (lbs)	Pct Disc (Overall)	Pct Disc (Sp)	D:K Ratio
BUTTERFISH	567,206	100,494	667,700	26%	85%	5.644
HAKE, SILVER	347,550	216,419	563,969	16%	62%	1.606
SCUP	301,608	107,397	409,005	14%	74%	2.808
SKATES	123,977	2,375	126,352	6%	98%	52.201
HAKE, RED	111,925	5,367	117,292	5%	95%	20.854
SQUID (LOLIGO)	99,365	3,563,824	3,663,189	5%	3%	0.028
SKATE, LITTLE	85,230	15,704	100,934	4%	84%	5.427
DOGFISH SPINY	82,034	4,611	86,645	4%	95%	17.791
SEA ROBINS	68,757	391	69,148	3%	99%	175.849
FLOUNDER, FOURSPOT	47,948	429	48,377	2%	99%	111.767
SQUID (ILLEX)	44,269	30,352	74,621	2%	59%	1.459
MACKEREL, ATLANTIC	40,390	25,808	66,198	2%	61%	1.565

Mackerel (N = 40 observed directed trips)

	Catch Disposition					
SPECIES	Disc (lbs)	Kept (lbs)	Grand Total (lbs)	Pct Disc (Overall)	Pct Disc (Sp)	D:K Ratio
MACKEREL, ATLANTIC	288,698	3,312,600	3,601,298	43%	8%	0.087
DOGFISH SPINY	76,560	8,885	85,445	11%	90%	8.616
HERRING, ATLANTIC	65,695	489,195	554,890	10%	12%	0.134
SCUP	62,153	27,375	89,528	9%	69%	2.270
HAKE, RED	45,131	4,771	49,902	7%	90%	9.459
HERRING, BLUE BACK	32,048	13,903	45,951	5%	70%	2.305
BUTTERFISH	31,578	41,037	72,616	5%	43%	0.769
HAKE, SILVER	29,756	58,757	88,513	4%	34%	0.506
SEA BASS, BLACK	11,409	7,854	19,263	2%	59%	1.453

The NEFSC Observer Program database was also queried to identify the sharks, rays and large pelagic finfish species discarded in the SMB fisheries, during 1995-2003, based on the captain's designation of the target species prior to conducting each tow. A large number of some species are discarded primarily in the *Loligo* and *Illex* fisheries (Table 11B). The highest numbers of commercial finfish that are discarded in both squid fisheries are swordfish (*Xiphias gladius*) with most being discarded in the *Illex* fishery. The analysis indicates that swordfish were discarded every year during 1995-2003 and that as many as 89 swordfish were taken in any single year. There is currently a low landings limit on the number of swordfish that can be taken in non-directed fisheries. The Atlantic swordfish stock is in year seven of a ten-year rebuilding plan (NMFS 2006c). In addition to swordfish, several of the tuna and shark species caught in the two squid fisheries (highlighted in Table 11B) are overfished and/or overfishing is occurring; some of these stocks are also included in rebuilding plans (NMFS 2006c).

Table 11B. Sharks, rays and large pelagic finfish species discarded and kept (numbers and weight, lbs) in the SMB fisheries based on the NEFSC Observer Program database, 1995-2003. Highlighted species are those with stocks that are overfished and/or overfishing occurring and/or the stock is subject to a rebuilding plan.

***Illex* Fishery**

Common Name	Scientific Name	Number Discarded	Weight (lbs) Discarded	Number Kept	Weight (lbs) Kept
CUTLASSFISH, ATL	*Trichiurus lepturus*	408	243	0	0
GROUPER, NK	*Mycteroperca sp*	0	0	6	247
MOLA, OCEAN SUNFISH	*Mola mola*	13	3,020	0	0
RAY, TORPEDO	*Torpedo nobiliana*	4	42	0	0
RAY,MANTA, ATLANTIC	*Manta birostris*	3	1,200	0	0
SHARK, ATL ANGEL	*Squatina dumerili*	3	49	0	0
SHARK, BASKING	*Cetorhinus maximus*	4	19,500	0	0
SHARK, BIGEYE SAND TIGER	*Odontaspis noronhai*	1	150	0	0
SHARK, BIGNOSE	*Carcharhinus altima*	16	186	0	0
SHARK, BLACK TIP	*Carcharhinus limbatus*	2	24	0	0
SHARK, BLUE (BLUE DOG)	*Prionace glauca*	1	300	0	0
SHARK, CARCHARHIN,NK	*Carcharhinus sp*	5	118	0	0
SHARK, DUSKY	*Carcharhinus obscurus*	18	596	0	0
SHARK, FINETOOTH	*Aprionodon isodon*	1	19	0	0
SHARK, HAMMERHEAD, GREAT	*Sphyrna mokarran*	6	1,450	0	0
SHARK, HAMMERHEAD, SCALLOPED	*Sphyrna lewin*	29	6,865	0	0
SHARK, HAMMERHEAD,NK	*Sphyrnidae*	6	785	0	0
SHARK, MAKO, NK	*Isurus sp*	0	0	1	300
SHARK, NK	*Squaliformes*	3	103	0	0
SHARK, SILKY	*Carcharhinus falciformis*	2	91	0	0
SHARK, THRESHER	*Alopias vulpinus*	2	425	0	0
SHARK, THRESHER, BIGEYE	*Alopias superciliosus*	1	300	0	0
SKATE, LITTLE	*Raja eriancea*	1	250	0	0
SWORDFISH	*Xiphias gladius*	164	6,779	85	7,919
TUNA, BIG EYE	*Thunnus obesus*	0	0	2	400
TUNA, BLUEFIN	*Thunnus thynnus*	1	57	1	100
TUNA, YELLOWFIN	*Thunnus albacares*	2	70	5	275

Table 11B. (continued)

Common Name	Scientific Name	Number Discarded	Weight (lbs) Discarded	Number Kept	Weight (lbs) Kept
	***Loligo* Fishery**				
AMBERJACK, NK	*Seriola sp*	1	1	0	0
BONITO, ATLANTIC	*Sarda sarda*	3	6	4	32
CUTLASSFISH, ATL	*Trichiurus lepturus*	3	21	0	0
GROUPER, NK	*Mycteroperca sp*	0	0	6	247
MOLA, OCEAN SUNFISH	*Mola mola*	4	1,100	0	0
RAY, NK	*Rajiformes*	1	9	0	0
RAY, TORPEDO	*Torpedo nobiliana*	23	540	0	0
SHARK, ATL ANGEL	*Squatina dumerili*	4	53	0	0
SHARK, BASKING	*Cetorhinus maximus*	12	52,000	0	0
SHARK, BLUE (BLUE DOG)	*Prionace glauca*	2	165	0	0
SHARK, BULL	*Carcharhinus leucas*	0	0	4	34
SHARK, DUSKY	*Carcharhinus obscurus*	3	56	0	0
SHARK, HAMMERHEAD, SCALLOPED	*Sphyrna lewin*	5	1,600	0	0
SHARK, HAMMERHEAD,NK	*Sphyrnidae*	5	1,390	0	0
SHARK, MAKO, NK	*Isurus sp*	1	3	0	0
SHARK, NIGHT	*Carcharhinus signatus*	1	10	0	0
SHARK, PORBEAGLE (MACKEREL SHARK)	*Lamna nasus*	2	300	0	0
SHARK, SAND TIGER	*Odontaspis taurus*	1	45	1	50
SHARK, SANDBAR (BROWN SHARK)	*Carcharhinus plumbeus*	2	10	0	0
SHARK, THRESHER	*Alopias vulpinus*	3	115	0	0
SHARK, THRESHER, BIGEYE	*Alopias superciliosus*	1	80	0	0
SHARK, TIGER	*Galeocerdo cuvier*	1	15	0	0
STINGRAY, ATLANTIC	*Dasyatis sabina*	1	5	0	0
STINGRAY, ROUGHTAIL	*Dasyatis centroura*	4	845	0	0
STURGEON, ATLANTIC	*Acipenser oxyrhynchus*	7	300	0	0
SWORDFISH	*Xiphias gladius*	26	922	4	138
TAUTOG (BLACKFISH)	*Tautoga onitis*	1	5	0	0
TUNA, BIG EYE	*Thunnus obesus*	1	1	0	0
TUNA, LITTLE (FALSE ALBACORE)	*Euthynnus alletteratus*	11	74	2	16
TUNA, NK	*Euthynnus thunnus sp*	1	1	0	0
TUNA, SKIPJACK	*Katsuwonus pelamis*	1	3	0	0
	Butterfish Fishery				
STURGEON, ATLANTIC	*Acipenser oxyrhynchus*	1	250	0	0
STURGEON, NK	*Acipenseridae*	1	15	0	0
SHARK, BASKING	*Cetorhinus maximus*	1	275	0	0
SHARK, TIGER	*Galeocerdo cuvier*	2	153	0	0
SHARK, SANDBAR (BROWN SHARK)	*Carcharhinus plumbeus*	1	3	0	0

Table 11B. (continued)

Atlantic Mackerel Fishery					
Common Name	Scientific Name	Number Discarded	Weight (lbs) Discarded	Number Kept	Weight (lbs) Kept
SWORDFISH	*Xiphias gladius*	0	0	2	50
SHARK, THRESHER	*Alopias vulpinus*	1	300	0	0

The relative contribution of SMB fisheries to the total observed discards of the species listed in Table 11A was evaluated in order to consider the importance of SMB fisheries to discards from a cumulative effects perspective. From this analysis, the *Illex* and Atlantic mackerel fisheries appear to be relatively less important contributors to the overall discards than the *Loligo* and butterfish fisheries (Table 12). However, the landings data indicate that since 2002 there has been no directed butterfish fishery. During 1989-2003, the *Loligo* fishery was responsible for 27%, 26%, 16%, 10%, and 3% of the all Observer Program discards of scup, silver hake, red hake, spiny dogfish and skates, respectively. Both scup and the southern silver hake stocks are in the process of rebuilding (NMFS 2006).

Table 12. Average contribution of species discarded in the SMB fisheries in relation to total observer program discards of these species, by SMB fishery, from 1989-2003.

Non-Target Species	Directed SMB Fishery			
	Atl. Mackerel	*Illex*	*Loligo*	Butterfish
SPINY DOGFISH	2%	0%	10%	12%
FOURSPOT FLOUNDER	4%	0%	21%	30%
RED HAKE	4%	1%	16%	32%
SILVER HAKE	3%	1%	26%	27%
ATLANTIC HERRING	22%	0%	7%	19%
BLUEBACK HERRING	20%	0%	19%	18%
JOHN DORY	7%	34%	39%	29%
CHUB MACKEREL	0%	40%	7%	10%
SCUP	11%	0%	27%	27%
SEA ROBINS	4%	0%	27%	13%
SKATES	0%	0%	3%	3%

Since the early 1990's, the NEFSC Observer Program has conducted at-sea sampling of otter trawlers and other fleet sectors for the purpose of providing bycatch estimates of commercial finfish and invertebrate species, and fishery encounters with protected species. The total weight of the discarded as well as the kept portions of the catch, by species, are collected during observed tows (NEFSC 2001); the majority of tows sampled in the SMB fisheries. According to staff from the NEFSC Fisheries Sampling Branch, random sampling of vessels selected from a master list of all vessels participating in a particular fishery is conducted. Prior to 2003, Observer Program trips sampled for finfish and invertebrate bycatch were not allocated by fishery fleet sector and species group (Rago et al. 2005). Therefore, the representativeness of sampling coverage of each fishery, in time and space, should be evaluated on a case-by-case basis.

6.3 Description of Habitat and Evaluation of Fishing Impacts

In the description of the habitat VEC presented here, the focus is on habitat and EFH for the managed resources as well as other federally managed non-target species. Specifically, this section addresses the vulnerability of benthic marine habitat utilized by the managed resources and non-target species to gears used in the prosecution of the Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries.

This section begins with a general discussion of habitat association and function and characteristics of the Northeast Shelf Ecosystem. The Northeast Shelf Ecosystem encompasses the core geographic scope where the targeted resource fisheries are prosecuted, and is a subset of habitat within the management unit and the total geographic scope, which is described for this VEC in section 6.0. For the purposes of discussing potential gear impacts on habitat throughout this section, the discussion will be limited to the role of benthic marine habitats in meeting the basic biological and physical requirements of federally managed species in the NOAA Fisheries Northeast Region. This is not to be confused with the susceptibility of the managed resources or non-target species to various gear types, which are addressed in sections 6.1 and 6.2 of this document.

A report entitled "Characterization of Fishing Practices and the Marine Benthic Ecosystems of the Northeast U.S. Shelf, and an Evaluation of the Potential Effects of Fishing on Essential Fish Habitat" was developed by NMFS (Stevenson et al. 2004; Appendix 4). A draft of this report was used as the background document for a "Workshop of the Effects of Fishing Gear on Marine Habitats off the Northeastern United States October 23-25, 2001 Boston, Massachusetts (NMFS 2002). These documents provide additional descriptive information on habitat association and function, coastal features and regional subsystems in the Northeast Shelf Ecosystem, and how they relate to federally managed species in the northeast region. These documents are available by request through the NMFS Northeast Regional Office or electronically at: http://www.nefsc.noaa.gov/nefsc/publications

Habitat Association and Function

Knowledge of the functional value of certain types of habitat to the ecosystem is relevant to understanding impacts of fishing gears on habitat. Habitats not only provide the basic biological and physical requirements for a fish species, such a forage and shelter, but they may also influence a broader range of ecosystem functions (i.e. sediment stabilization, water circulation patterns, the movement of nutrients and dissolved gases such as oxygen).

Spatial and temporal variation in prey abundance can influence survivorship, recruitment, development, and the spatial distribution of species present at every trophic level. The migratory behavior of juvenile and adult fish is often directly related to seasonal patterns of prey abundance and changes in environmental conditions, particularly water temperature. The supply and timing of availability of prey items and other factors influencing larval fish growth rates are particularly critical for the starvation-prone early life history stages of fish (Houde 1997). Food availability for planktivorous fishes is strongly influenced by oceanographic processes. Seasonal warming of surface waters at temperate latitudes produces vertical stratification of the water column, which isolates sunlit surface waters from deeper, nutrient-rich waters, leading to reduced primary productivity. In some areas, upwelling, induced by wind, storms, and tidal mixing, inject nutrients back into the photic zone, stimulating primary production. Some of the organic matter produced in the photic zone then sinks to the bottom and this detritus acts as a source of food and nutrients for the benthic community. In shallower water where light penetrates to the bottom, benthic macro and microalgae also contribute to primary production. Recent research on benthic primary productivity indicates that benthic microalgae may provide a greater contribution to primary production than has been originally estimated (Cahoon 1999).

Benthic organisms are an important food source for many fish species. Temporal and spatial variations in benthic community structure can affect the distribution and abundance of fish utilizing benthic food sources. The abundance and species composition of these benthic communities are affected by a number of environmental factors including temperature, sediment type, and the availability of organic matter.

When considering habitat value and ecological function for a species life stage, a broad range of characteristics associated with that habitat should be considered. Considerations should extend beyond individual aspects such as substrate type. Data are, however, limited for many components needed to describe the benthic habitat and its relationship to species survival and productivity. Further development of multivariate relationships between biological, chemical, and physical habitat characteristics will increase our understanding of the marine environment and advance the evidence of direct links between habitat and fishery productivity.

6.3.1 Description of Regional Subsystems

The Northeast Shelf Ecosystem has been described as the area from the Gulf of Maine south to Cape Hatteras, extending from the coast seaward to the edge of the continental shelf, including the slope sea offshore to the Gulf Stream (Sherman et al. 1996). The Gulf of Maine, Georges Bank, and mid-Atlantic Bight are distinct subsystems within this region.

The Gulf of Maine is an enclosed coastal sea, characterized by relatively cold waters and deep basins, with a patchwork of sediment types. Georges Bank is a relatively shallow coastal plateau that slopes gently from north to south and has steep submarine canyons on its eastern and southeastern edge. It is characterized by highly productive, well-mixed waters and fast-moving currents. The mid-Atlantic Bight is comprised of the sandy, relatively flat, gently sloping continental shelf from southern New England to Cape Hatteras, NC. Pertinent aspects of the physical characteristics of each of these subsystems are described below. The description provided is based on several review documents (Cook 1988; Pacheco 1988; Stumpf and Biggs 1988; Abernathy 1989; Townsend 1992;

Mountain et al. 1994; Beardsley et al. 1996; Brooks 1996; Sherman et al. 1996; NEFMC 1998; Steimle et al. 1999).

Gulf of Maine: Although not obvious in appearance, the Gulf of Maine is actually an enclosed coastal sea, bounded on the east by Browns Bank, on the north by the Nova Scotia (Scotian) Shelf, on the west by the New England states and on the south by Cape Cod and Georges Bank. The Gulf of Maine (GOM) was glacially derived, and is characterized by a system of deep basins, moraines and rocky protrusions with limited access to the open ocean. This geomorphology influences complex oceanographic processes which result in a rich biological community.

Topographic highlights of the area include three basins that exceed 800 feet in depth; Jordan to the north, Wilkinson to the west, and Georges just north of Georges Bank. The average depth in the Gulf of Maine is 450 feet. The Gulf of Maine's geologic features, when coupled with the vertical variation in water properties, result in a great diversity of habitat types (Watling et al. 1988). An in-depth review of GOM habitat types has been prepared by Brown (1993).

Georges Bank: Georges Bank is a shallow (10 to 500 foot depth), elongate (100 miles wide by 200 miles long) extension of the continental shelf formed by the Wisconsinian glacial episode. It is characterized by a steep slope on its northern edge and a broad, flat, gently sloping southern flank. It is separated from the rest of the continental shelf to the west by the Great South Channel. The nature of the sea bed sediments varies widely, ranging from clay to gravel (Valentine and Lough 1991). Surficial sediments composed of a gravel-sand mix have been noted as important postlarval habitat for Atlantic cod, haddock, winter flounder, yellowtail flounder and other species. American plaice adults have been demonstrated to associate with gravel-sand sediments for a variety of potential reasons. Gravel-sand sediments have been noted as habitat for sea scallops, where movement of sand is relatively minor (Langton and Uzmann 1990; Valentine and Lough 1991). The gravel-sand mixture is usually a transition zone between coarse gravel and finer sediments.

Georges Bank is characterized by high levels of primary productivity, and historically, high levels of fish production. It has a diverse biological community that is influenced by many environmental conditions. Several studies have attempted to identify demersal fish assemblages over large spatial scales on Georges Bank. Overholtz and Tyler (1985) found five depth-related groundfish assemblages for Georges Bank and Gulf of Maine that were persistent temporally and spatially. Depth and salinity were identified as major physical influences explaining assemblage structure.

Mid-Atlantic Bight: The Mid-Atlantic Bight includes the shelf and slope waters from Georges Bank south to Cape Hatteras, and east to the Gulf Stream. Like the rest of the continental shelf, the Mid-Atlantic Bight was shaped largely by sea level fluctuations caused by past ice ages. The shelf's basic morphology and sediments are derived from the retreat of the last ice sheet, and the subsequent rise in sea level. Since that time, currents and waves have modified this basic structure.

The shelf slopes gently from shore out to between 75 and 150 miles offshore where it transforms to the slope (300 to 600 ft water depth) at the shelf break. In both the mid-Atlantic and on Georges Bank, numerous canyons incise the slope, and some cut up onto the shelf itself. The primary morphological features of the shelf include shelf valleys and channels, shoal massifs, scarps, and sand ridges and swales.

The sediment type covering most of the shelf in the Mid-Atlantic Bight is sand, with some relatively small, localized areas of sand-shell and sand-gravel. On the slope, silty sand, silt, and clay predominate. Sand provides suitable habitat properties for a variety of fishes, invertebrates, and microorganisms. Invertebrates, such as surfclams, razor clams, and ocean quahogs, burrow between the grains to support their characteristic sessile behavior. Dunes and ridges provide refuge from currents and predators and habitat for ambush predators. Several species inhabit sand habitats (e.g. amphipods, polychaetes) that are important prey for flounder. Yellowtail and winter flounder distribution has been correlated to sand (Langton and Uzmann 1990). In general, flatfish are more closely associated with sand and finer sediments than are other demersal fishes.

Canyons occur near the shelf break along Georges Bank and the Mid-Atlantic Bight, cutting into the slope and occasionally up into the shelf as well. They exhibit a more diverse fauna, topography, and hydrography than the surrounding shelf and slope environments. The relative biological richness of canyons is in part due to the diversity of substrate types found in the canyons, and the greater abundance of organic matter.

Faunal assemblages were described at a broad geographic scale for Mid-Atlantic Bight continental shelf demersal fishes, based on NMFS bottom trawl survey data between 1967 and 1976 (Colvocoresses and Musick 1983). There were clear variations in species abundance, yet they demonstrated consistent patterns of community composition and distribution among demersal fishes of the mid-Atlantic shelf. The boundaries between fish assemblages generally followed isotherms and isobaths.

Coastal Features

Coastal and estuarine features in the Northeast Shelf Ecosystem include salt marshes, mud flats, intertidal zones, and submerged aquatic vegetation, all of which provide critical to habitats for inshore and offshore fishery resources. Coastal areas and estuaries are important for nutrient recycling and primary productivity, and many economically important finfish and shellfish species use these as spawning areas and nurseries for juvenile life stages.

Rocky intertidal zones are periodically submerged, high energy environments found in the northern portion of the Northeast system. Specially adapted residents may include sessile invertebrates, finfish species, and algae, e.g., kelp and rockweed (which also function as habitat). Fishery resources may depend upon particular habitat features of the rocky intertidal zones that provide specific prey items and refuge from predators. Sandy beaches are most extensive along the Northeast coast. Different zones of the beach present habitat conditions ideal for a variety of marine and terrestrial organisms. For example, the intertidal zone is suitable habitat for many invertebrates and transient fish which forage in these areas during high tide. Several invertebrate and fish species are adapted for living in the high energy subtidal zone adjacent to sandy beaches.

6.3.2 Description and Identification of EFH for the Target Species

Pursuant to the Magnuson Stevens Act / EFH Provisions (50 CFR Part 600.815 (a)(1)), an FMP must describe EFH by life history stage for each of the managed species in the plan. This information was previously described in Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish FMP (MAFMC 1998). EFH for the managed resource is described using fundamental information on habitat requirements by life history stage that was summarized in a series of documents produced by NMFS. These documents are entitled "Essential Fish Habitat Source Document: Atlantic mackerel, *Scomber scombrus*, Life History and Habitat Characteristics" (Studholme et al. 1999; Appendix 5), "Essential Fish Habitat Source Document: Northern Shortfin Squid, *Illex illecebrosus*, Life History and Habitat Characteristics" (Hendrickson and Holmes 2004; Appendix 6), "Essential Fish Habitat Source Document: Longfin Inshore Squid, *Loligo pealeii*, Life History and Habitat Characteristics" (Appendix 7), and "Essential Fish Habitat Source Document: Butterfish, *Peprilus triacanthus*, Life History and Habitat Characteristics" (Cross et al. 1999; Appendix 8). This series of documents, as well as additional reports and publications, were used to provide the best available information on life history characteristics, habitat requirements, as well as ecological relationships at this time. Electronic versions of these source documents are available at the following website: http://www.nefsc.noaa.gov/nefsc/habitat/efh/

The following are the official EFH designation definitions by life history stage for Atlantic mackerel, *Illex*, *Loligo*, and butterfish. Electronic versions of these definitions are available at the following website: http://www.nero.noaa.gov/hcd/list.htm

It should also be noted that within designated EFH, FMPs should identify habitat areas of particular concern (HAPC) within EFH where one or more of the following four criteria must be met: ecological function, sensitive to human induced environmental degradation, developing activities stressing habitat type, or rarity of habitat (50 CFR Part 600.815 (a)(9)). The MAFMC has not recommended any portions of EFH as HAPC for Atlantic mackerel, *Illex*, *Loligo*, or butterfish in Amendment 9, or in past Amendments to the FMP.

Atlantic mackerel

Eggs: Offshore, EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from Maine through Cape Hatteras, North Carolina in areas that comprise the highest 75% of the catch where Atlantic mackerel eggs were collected in MARMAP ichthyoplankton surveys. Inshore, EFH is the “mixing” and/or “seawater” portions of all the estuaries where Atlantic mackerel eggs are “common,” “abundant,” or “highly abundant” on the Atlantic coast, from Passamaquaddy Bay, Maine to James River, Virginia. Generally, Atlantic mackerel eggs are collected from shore to 50 ft and temperatures between 41° F and 73° F.

Larvae: Offshore, EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras, North Carolina that comprise the highest 75% of the catch where Atlantic mackerel larvae were collected in the MARMAP ichthyoplankton survey. Inshore, EFH is also the "mixing" and/or "seawater" portions of all the estuaries where Atlantic mackerel larvae are "common," "abundant," or "highly abundant" on the Atlantic coast, from Passamaquaddy Bay, Maine to James River, Virginia. Generally, Atlantic mackerel larvae are collected in depths between 33 ft and 425 ft and temperatures between 43° F and 72° F.

Juveniles: Offshore, EFH is the pelagic water found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras, North Carolina in areas that comprise the highest 75% of the catch where juvenile Atlantic mackerel were collected in the NEFSC trawl surveys. Inshore, EFH is the "mixing" and/or "seawater" portions of all the estuaries where juvenile Atlantic mackerel are "common," "abundant," or "highly abundant" on the Atlantic coast, from Passamaquaddy Bay, Maine to James River, Virginia. Generally, juvenile Atlantic mackerel are collected from shore to 1050 ft and temperatures between 39° F and 72° F.

Adults: Offshore, EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras, North Carolina, in areas that comprise the highest 75% of the catch where adult Atlantic mackerel were collected in the NEFSC trawl surveys. Inshore, EFH is the "mixing" and/or "seawater" portions of all the estuaries where adult Atlantic mackerel are "common," "abundant," or "highly abundant" on the Atlantic coast, from Passamaquaddy Bay, Maine to James River, Virginia. Generally, adult Atlantic mackerel are collected from shore to 1250 ft and temperatures between 39° F and 61° F.

Illex

Pre-recruits: EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras, North Carolina in areas that comprise the highest 75% of the catch where pre-recruit *Illex* were collected in the NEFSC trawl surveys. Generally, pre-recruit *Illex* are collected from shore to 600 ft and temperatures between 36° F and 73° F.

Recruits: EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras, North Carolina in areas that comprise the highest 75% of the catch where recruited *Illex* were collected in the NEFSC trawl surveys. Generally, recruited *Illex* are collected from shore to 600 ft and temperatures between 39° F and 66° F.

Pre-recruits and recruits are stock assessment terms which relate to whether or not an individual is selected by the directed bottom trawl fishery and correspond roughly to the life history stages of juveniles and adults, respectively. *Illex* pre-recruits are less than or equal to 10 cm and recruits are greater than 10 cm.

Loligo

Eggs: EFH for this life stage have not yet been designated, therefore, there is no official EFH designation definition. Alternatives proposed for the designation of EFH for *Loligo* eggs in Amendment 9 are available in the Description of Alternatives in section 5.4. The definition based on Alternative 4B would be as follows:

Primarily coastal bottom substrates from Georges Bank southward to Cape Hatteras as depicted in Figure 1. *Loligo* egg masses are found attached to rocks and boulders on sand or mud bottom, as well as attached to aquatic vegetation. Generally, the following conditions exist where *Loligo* egg masses are found: sea surface temperatures between 10^{o} C and 23^{o} C, a salinity of 30 to 32 ppt, and water less than 50m in depth, although they can also be found offshore.

Pre-recruits: EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras, North Carolina in areas that comprise the highest 75% of the catch where pre-recruit *Loligo* were collected in the NEFSC trawl surveys. Generally, pre-recruit *Loligo* are collected from shore to 700 ft and temperatures between 4^{o} F and 27^{o} F.

Recruits: EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras, North Carolina in areas that comprise the highest 75% of the catch where recruited *Loligo* were collected in the NEFSC trawl surveys. Generally, recruited *Loligo* are collected from shore to 1000 ft and temperatures between 39^{o} F and 81^{o} F.

Pre-recruits and recruits are stock assessment terms which relate to whether or not an individual is selected by the directed bottom trawl fishery and correspond roughly to the life history stages juveniles and adults, respectively. *Loligo* pre-recruits are less than or equal to 8 cm and recruits are greater than 8 cm.

Butterfish

Eggs: Offshore, EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras, North Carolina in areas that comprise the highest 75% of the catch where butterfish eggs were collected in MARMAP ichthyoplankton surveys. Inshore, EFH is the “mixing” and/or “seawater” portions of all the estuaries where butterfish eggs are “common,” “abundant,” or “highly abundant” on the Atlantic coast, from Passamaquaddy Bay, Maine to James River, Virginia. Generally, butterfish eggs are collected from shore to 6000 ft and temperatures between 52^{o} F and 63^{o} F.

Larvae: Offshore, EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras, North Carolina areas that comprise the highest 75% of the catch where butterfish larvae were collected in the NEFSC trawl surveys. Inshore, EFH is the “mixing” and/or “seawater” portions of all the estuaries where butterfish larvae are “common,” “abundant,” or “highly abundant” on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia. Generally, butterfish larvae are collected in depths between 33 ft and 6000 ft and temperatures between 48^o F and 66^o F.

Juveniles: Offshore, EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras, North Carolina in areas that comprise the highest 75% of the catch where juvenile butterfish were collected in the NEFSC trawl surveys. Inshore, EFH is the “mixing” and/or “seawater” portions of all the estuaries where juvenile butterfish are “common,” “abundant,” or “highly abundant” on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia. Generally, juvenile butterfish are collected in depths between 33 ft and 1200 ft and temperatures between 37^o F and 82^o F.

Adults: Offshore, EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras, North Carolina in areas that comprise the highest 75% of the catch where adult butterfish were collected in the NEFSC trawl surveys. Inshore, EFH is the “mixing” and/or “seawater” portions of all the estuaries where adult butterfish are “common,” “abundant,” or “highly abundant” on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia. Generally, adult butterfish are collected in depths between 33 ft and 1200 ft and temperatures between 37^o F and 82^o F.

6.3.3 Fishing Activities that May Adversely Affect EFH

To minimize to the extent practicable adverse effects on EFH, as required by the Magnuson Stevens Act / EFH Provisions (50 CFR Part 600.815 (a)(2)), it is necessary to summarize the information available on the impacts of fishing gears in the Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries. This evaluation should include any information available on the intensity, extent, and frequency of impacts to EFH, as well as identify the habitat functions that may be impacted by these activities. Based on analyses in section 6.3.4, greater than 99% of the Atlantic mackerel landings were taken using four types of fishing gear: mid-water otter trawl, paired mid-water otter trawl, bottom otter trawl (fish), and floating trap. Greater than 99% of the *Illex* landings were taken using two types of fishing gear: mid-water otter trawl and bottom otter trawl (fish). An examination of the cumulative landings from *Loligo* directed trips indicates that greater than 99% of those landings were taken using two types of fishing gear: mid-water otter trawl and bottom otter trawl (fish). Greater than 99% of the butterfish landings were taken using three types of fishing gear: mid-water otter trawl, bottom otter trawl (fish), and floating traps. These gears fall into three major categories which are defined as bottom-tending mobile gear, bottom-tending static gear, and mobile pelagic gear. Therefore, the following discussion will focus on summarizing the literature available on potential impact on EFH relative to these fishing gear categories where gear specific information on impacts is unavailable.

NMFS compiled available information on the impacts of fishing gears on marine habitats in the Northeast region of the United States in the "Characterization of Fishing Practices and the Marine Benthic Ecosystems of the Northeast U.S. Shelf, and an Evaluation of the Potential Effects of Fishing on Essential Fish Habitat" (Stevenson et al. 2004). The results of this report provide the basis for the following summary of fishing gear effects that describes both generalized effects and those specific to the gear types used in this fishery.

General Impacts of Fishing on Habitat

The effects of fishing gear on habitat have been addressed in a number of scientific reviews, with several types of gear effects being identified including the alteration of physical structure, sediment suspension, chemical modification, change to benthic community, and ecosystem effects (McAllister 1991; ICES 1992; Jennings and Kaiser 1998; Auster and Langton 1999; Blaber et al. 2000; Collie et al. 2000a). These studies suggest it is important to consider the long-term and short-term effects of fishing gear on the environment.

Fishing gear can impact the physical structure of habitat by scraping, ploughing, burying mounds, smoothing sand ripples, removing stones, dragging and turning boulders, eliminating structure providing taxa, and eliminating or damaging submerged aquatic vegetation (Fonseca et al. 1984; Messieh et al. 1991; Black and Parry 1994; Gordon et al. 1998; Kaiser et al. 1998; Lindeboom and deGroot 1998; Schwinghamer et al. 1998; Auster and Langton 1999; Kaiser et al. 1999; Ardizzone et al. 2000). Physical alterations may reduce the heterogeneity of the sediment surface, alter sediment texture, and reduce the structured habitat available to biota. The magnitude and duration of physical alteration varies with fishing gear types and habitat or sediment types.

Sediment suspension (turbidity), which occurs as fishing gears are dragged across the bottom, can cause reduced light penetration in the water column, smother benthic species and spawning areas, and negatively effects feeding and metabolic rates of organisms. It can also affect regional nutrient budgets by burying fresh organic matter or exposing deep anaerobic sediments. Re-suspension over a large enough area can actually cause large scale redistribution of sediments (Messieh et al. 1991; Black and Parry 1994). In addition, species reaction to turbidity depends on life history characteristics of the species. Mobile organisms can move out of the affected area and quickly return once the disturbance dissipates (Simenstad 1990; Coen 1995), while sessile benthic organisms cannot. Even if species experience high mortality within the affected area, those with short life history stages, high levels of recruitment, and high mobility can repopulate the affected area quickly. However, if effects are protracted and occur over a large area, recovery through recruitment or immigration may be hampered. Furthermore, chronic resuspension of sediments may lead to shifts in species composition, by favoring rapid colonists or those that can take advantage of the pulsed nutrient supply released from the seafloor to the euphotic zone (Churchill 1998).

Alteration of the chemical composition of both the sediments and overlying water mass can occur through mixing of sediments with overlaying waters. In shallow water this mixing might be insignificant relative to tides, storm surge, and wave action, but in deeper, stable waters this mixing can have significant effects (Rumohr 1989). It remains unclear how the alteration of sediment and water chemistry may impact fish populations. When nutrients supplies are low, the effective mixing of sediments could cause increased phytoplankton primary productivity and/or eutrophication (Rjinsdorp and Van Leeuwen 1996). Alternatively, ICES (1992) concluded pulses of nutrients are compensated by lower fluxes after the trawl has passed, and nutrient releases due to fishing gear activity that simply recycle existing nutrients are probably less influential than new inputs, such as from rivers and land runoff (ICES 1992).

Fishing impacts on benthic species depend on life history, ecology and physical characteristics of the species in question (Bergman and Van Santbrink 2000). Mobile species that exhibit high fecundity and rapid generation time will recover more quickly than sessile, slow-growing species. Species such as mollusks and crustaceans are also vulnerable to bottom-tending gear impacts because of potential damage to their hard parts. Thin shelled bivalves and starfish show higher damage than solid-shelled bivalves in fished areas (Rumohr and Krost 1991). Species which retract into the sediments or reside below the penetration depth of the fishing gear will typically sustain less damage than epibenthic organisms. Species that are more elastic (flexible) will suffer much less damage than those that are hard and inflexible (Eno et al. 2001).

Increased fishing pressure can also lead to redistribution of species, either away from or towards the fished area (Kaiser and Spencer 1993, 1996; Ramsay et al. 1996; Kaiser and Ramsay 1997; Morgan et al. 1997; Ramsay et al. 1998; Bradshaw et al. 2000; Demestre et al. 2000). Opportunistic feeders may, however, be attracted to areas disturbed by mobile fishing gear (Kaiser and Spencer 1994; Frid and Hall 1999).

The roles the alterations of physical structure, sediment suspension, chemical modifications, and changes to benthic community have on the production of many important finfish species is in many cases unknown. However, increasing empirical observations and modeling suggests that effects can indeed be seen in population responses. The data on this subject are somewhat limited and therefore in 2002, at the request of NMFS, the National Research Council evaluated the effects of trawling and dredging on seafloor habitats (NRC 2002). This NRC report provides a series of recommendations to improve our understanding of the effects of fishing on benthic habitats.

While many of the studies described throughout this section focus on specific aspects of gear impacts on seafloor habitats, most agree that there is some alteration of habitat, which in many cases are negative. It remains important to consider the long-term and short-term effects of fishing gear on structural components of habitat, community structure, and ecosystem processes, as well as the implications of these effects for management (Auster and Langton 1999).

Gear-Specific Impacts on Habitat

The report entitled "Characterization of Fishing Practices and the Marine Benthic Ecosystems of the Northeast U.S. Shelf, and an Evaluation of the Potential Effects of Fishing on Essential Fish Habitat" (Stevenson et al. 2004) reviews the impacts of specific fishing gear utilized within the Northeast region, and their potential impacts on marine habitat types typical of the Northeast Shelf Ecosystem. The following paragraph summarizes the findings of this report as it applies to the fishing gears that contact the bottom habitat and are used in the Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries.

In studies examining the effect of bottom otter trawling on a variety of substrate types, it was demonstrated that the physical effects of trawl doors contacting the bottom produced furrows and some shifts in surface sediment composition, although there is a large variation in the duration of these impacts. Typically the more dynamic environment and less structured bottom composition, the shorter the duration of impact. This type of fishing was demonstrated to have some effects on composition and biomass of benthic species in the effected areas, but the directionality and duration of these effects varied by study and substrate types. Studies conducted examining the effects of traps and pots in a variety of mixed substrates concluded that while attached epibenthic megafauna (in this case sea pens) were bent over or up-rooted when pots were fished or dragged over mud sediments, the effects were short term and did not appear to effect the abundance of attached benthic epifauna.

6.3.4 Evaluation of Gear Impacts of the Target Fishery

Pursuant to the Magnuson Stevens Act / EFH Provisions (50 CFR Part 600.815(a)(2)(i)), it is mandated that this FMP must evaluate the potential adverse effects of fishing on EFH designated under this FMP, including the effects of fishing activities for Atlantic mackerel, *Illex*, *Loligo*, and butterfish, and fishing activities regulated under other Federal FMPs. This evaluation should consider the effects of each fishing activity occurring in the four managed resource fisheries on each type of habitat found within designated EFH. It should develop conclusions as to the whether EFH is being impacted, and if so how it is being impacted, based on examination of the distribution of fishing effort and all relevant information on the subject. The evaluation should also consider the cumulative effects of multiple fishing activities on EFH. The evaluation provided in this section satisfies these requirements.

The management of many different fisheries within the Northeast region falls within the jurisdiction of the New England and Mid-Atlantic Fishery Management Councils, as well individual states from Maine through North Carolina under the jurisdiction of the Atlantic States Marine Fisheries Commission. Therefore all gear types within this region are considered in this evaluation. Within this region, sixty different categories of fishing gear were identified as being used in estuaries and bays, coastal waters (0 to 3 miles) and offshore waters of the EEZ (3 to 200 miles) based on 1999 NMFS commercial fisheries landings data for all managed species (Stephan et al. 2000). Of those gears identified by Stephan et al. (2000), 42 are known to contact the seabed. Descriptions of each of these gears are provided in a report by Stevenson et al. (2004) entitled "The Effects of Fishing on Marine Habitats in the Northeastern United States".

To determine which of these gears are used in directed fishery for Atlantic mackerel, *Illex*, *Loligo*, and butterfish, the percentage of landings from directed trips for each of these managed resources were described by gear using VTR data (1996 to 2004; Tables 13, 14, 15, and 16). Directed trips for *Loligo* and *Illex* were each defined as those trips where the landings in pounds constituted greater than 50% of the total landings of all species. For Atlantic mackerel, directed trips were defined as those trips where greater than 5000 lbs of Atlantic mackerel were landed. Butterfish directed trips were defined as trips where greater than 500 lbs of butterfish were landed. These definitions identified the trips that contribute to the majority of the landings. VTR are required for all federally permitted vessels, whether they are fishing in Federal or state waters. Information on the distribution of landings by gear for vessels fishing exclusively in state waters is unavailable. It is however, unlikely that the gears used to prosecute these fisheries in state waters would differ from those used exclusively in Federal waters, or fishing in both state and Federal waters.

Because VTR data are self reported, there is missing information for the ten minute squares fished for some of the directed trips. Trips that lack adequate spatial information could not be used for mapping purposes and were removed from subsequent spatial analyses. Specifically, the numbers of trips without spatial information were 12, 4, 20, and 21 for Atlantic mackerel, *Illex*, *Loligo*, and butterfish respectively. These trips accounted for less than 1% of all directed trips for each of the four fisheries. After minor auditing of this information, the directed trips for Atlantic mackerel reported with adequate spatial referencing for these analyses represented 10.0% of all reported VTR trips and accounted for 86.5% of all reported landings. For *Illex*, these audited directed trips represented 48.0% of all reported trips and 92.6 % of total reported landings. For *Loligo* and butterfish they represented 34.3% of all reported trips and 79.9% of total landings, and 13.2% of total trips and 75.0% of total reported landings, respectively. Using this information, the distribution of use of each of these primary gear types, for each of these fisheries are given in Figures 34-48, along with "other gears types" including all other gears that land less than 1% of the cumulative landings from directed trips.

General descriptions of the primary gears used in these fisheries are provided below, although additional description of these gears can be found in the NOAA Technical Memorandum entitled "Characterization of Fishing Practices and the Marine Benthic Ecosystems of the Northeast U.S. Shelf" and the "Workshop on the Effects of Fishing Gear on Marine Habitats off the Northeastern United States October 23-25, 2001 Boston, Massachusetts" (Stevenson et al. 2004; NMFS 2002; respectively). Gear types have been aggregated into broad-based categories that include bottom-tending mobile gear, bottom-tending static gear, and mobile pelagic gear, to allow for a generalized discussion of potential impacts due to a lack of specific scientific information regarding all gear types within each of these three categories.

Bottom-Tending Mobile Gears

Otter Trawls: Trawls are classified by their function, bag construction, or method of maintaining the mouth opening. Function may be defined by the part of the water column where the trawl operates (e.g., bottom) or by the species that it targets (Hayes 1983). There is a wide range of otter trawl types used in the NMFS Northeast Region because of the diversity of fisheries prosecuted and bottom types encountered in the region (NMFS 2002). The specific gear design used is often a result of the target species (whether they are found on or off the bottom) as well as the composition of the bottom (smooth versus rough and soft versus hard). There are several components of the otter trawl that come in contact with the sea bottom: the doors, the ground cables and bridles which attach the doors to the wings of the net, and the sweep (or foot-rope) which runs along the bottom of the net mouth. Bottom trawls are towed at a variety of speeds, but average about 5.5 km/hr (3 knots or nmi/hr). The amount of time the gear is in contact with the bottom is also variable and can range from 15 minutes to about six hours according to the Vessel Trip Report Database.

The traditional otter board is a flat, rectangular wood structure with steel fittings and a steel “shoe” along the bottom, which prevents the bottom of the door from damage and wear as it drags over the bottom. Other types include the V type (steel), polyvalent (steel), oval (wood), and slotted spherical otter board (steel) (Sainsbury 1996). It is the spreading action of the doors resulting from the angle at which they are mounted that creates the hydrodynamic forces needed to push them apart. These forces also push them down towards the sea floor. On fine grained sediments, the doors also function to create a silt cloud that aids in herding fish into the mouth of the net (Carr and Milliken 1998). In shallow waters, lightweight doors are typically used to ensure that the doors and the net spread fully. In these cases, light, foam filled doors can be used (Sainsbury 1996). Vessels fishing large nets in deeper water require very large spreading forces from the doors. In these cases, a 15 m^2 (49 ft^2) V-door weighing 640 kg (1480 lbs) can provide 9 metric tons of spreading force (Sainsbury 1996). Some door types (e.g Thyboron Type II) are designed so the gear can be fished on the seabed or in midwater, depending on vessel speed and the type of floatation that is attached to the headrope (e.g. fabric kites). Most vessels involved in the *Illex* and *Loligo* fisheries utilize these types of doors and can regulate whether they fish on the bottom or slightly above it (L. Hendrickson pers. comm.)

Bottom-Tending Static Gears

Shallow Floating Traps: The shallow floating trap (also referred to as a "floating trap") is designed to fish from top to bottom, and is built especially to suit its location. In New England, much of the shoreline and shallow subtidal environment is rocky and stakes cannot be driven into the bottom. Therefore, the netting of this trap is held in position by a series of anchors and buoys. The net is usually somewhat “T-shaped,” with the long portion of the net (the leader net) designed to funnel fish into a box of net at the top of the T-shaped area. The leader net is often made fast to a ring bolt ashore (Sainsbury 1996). The catch, design elements, and scale of these floating traps are similar to pound nets (DeAlteris 1998). This activity is not managed under a Federal fishery management plan.

Mobile Pelagic Gears

Paired Mid-Water Trawl: Pair-trawling is used by vessels which herd small pelagics such as herring and mackerel into the net (Sainsbury 1996). Large pelagic species are also harvested with a huge pelagic pair trawl towed at high speed near the surface. The nets have meshes exceeding 10 m (33 ft) in length in the jibs and first belly sections, and reduce to cod-end mesh sizes of 20 cm (8 in) (DeAlteris 1998). This activity is managed under Federal fishery management plans. When being fished, this gear does not make contact with the seabed.

Mid-Water Otter Trawl: The mid-water otter trawl is used to capture pelagic species that school between the surface and the seabed throughout the water column. The mouth of the net can range in size from 110 to 170 m (360 to 560 ft) and requires the use of large vessels (Sainsbury 1996). Successful mid-water trawling requires the effective use of various electronic aids to find the fish and maneuver the vessel while catching them (Sainsbury 1996). This activity is managed under Federal fishery management plans. This gear does not make contact with the seabed.

Conclusions

Based on examination of research studies of gear effects on habitat described in section 6.3.3, bottom-tending mobile gears and bottom tending static gear are the only gear types expected to impact bottom habitat or EFH. While the information on the effects of floating traps in not extensive, studies imply the effects may not be long-term. Mobile pelagic gears, by nature of the manner in which they are fished, do not contact the bottom and therefore have no bottom habitat or EFH impacts.

6.3.5 Analysis of Overlapping Fishing Effort and EFH

The purpose of the following overlap analysis is to identify potential adverse impacts from the Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries use of bottom-tending gears on benthic EFH in the Northeast region of the U.S. This analysis will build off the evaluation of gear impacts (section 6.3.4) to develop a measure of fishery effort, and then spatially integrate the distribution of effort and designated EFH into an "overlap analysis" to identify areas of potential adverse impact to habitat.

Effort Overlap Component

In section 6.3.4 above, the primary fishing gears used in directed trips in the Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries that account for greater than 99% of the cumulative landings were identified. These primary gears are believed to be characteristic of the directed fishery, based on the steps taken to define directed trips that accounted for the vast majority of the landings using VTR data from 1996 to 2004.

Detailed descriptions of the primary gears used in these fisheries, and the distribution of their reported use by ten minute square are presented in section 6.3.4 (Figures 34-48). Based on descriptions of habitat impacts by gear types for all four species (section 6.3.3), it was concluded that bottom otter trawls (fish) and floating traps are gear types in the Atlantic mackerel fishery that may impact bottom habitat or EFH; use of bottom otter trawls in the *Illex* fishery may impact bottom habitat or EFH; bottom otter trawl use in the *Loligo* fishery that may impacts bottom habitat or EFH; and in the butterfish fishery, it was determined that bottom otter trawls (fish) and floating traps may impact bottom habitat or EFH. While the information on the effects of floating traps in not extensive, studies described in section 6.3.3 imply the effects may not be long-term. In addition, the distribution of use by shallow floating traps in the Atlantic mackerel fishery is limited (Figure 35) and accounts for a small percentage of landings relative to bottom otter trawls (Table 13). In the butterfish fishery, as in the Atlantic mackerel fishery, the use of floating traps is limited and it accounts for a very small proportion of landings (Figure 46, Table 16).

Based on these conclusions, bottom otter trawls were identified as the gear most likely to have adverse impacts on benthic EFH. Therefore trips that used bottom otter trawls will be used to define the effort component used in the overlap analysis. Fishing effort using bottom otter trawls for each of these fisheries was defined as the time the gear was fished (in days) for directed trips using VTR data from 1996 through 2004. More specifically, days fished was calculated for each vessel trip as the product of the average reported tow duration and the number of trawl tows, and then summed by ten minute square. This resulted in days fished by bottom otter trawl for each ten minute square, for each of the fisheries. In addition, the days fished for all four fisheries were summed by ten minute square to produce a composite measure of fishing effort by bottom otter trawl, referred to as composite effort. More specifically composite effort provides a measure of the days spent actively fishing with bottom otter trawl during Atlantic mackerel, *Illex*, *Loligo*, and butterfish directed trips. These data form the basis for the effort overlap components used in the overlap analysis (Figures 49 - 53). It should be noted that because the data are self-reported there are errors in the spatial information which could be due to inaccurate reporting, unclear handwriting, or error in transcribing the written information. This results in some fishing activity being reported in “unrealistic” locations. These data points do not, however, have a major effect on the results of the overlap analysis.

EFH Overlap Component

EFH designations in the Northeast region are based primarily on Level 2 information, or quantitative data such as density and relative abundance. A complete list of EFH definitions by life history stage for Atlantic mackerel, *Illex*, *Loligo*, and butterfish (also described in section 6.3.2), as well as other Federally-managed species are available at the following website: http://www.nero.noaa.gov/hcd/list.htm

The EFH overlap component used in this analysis is defined as those species that are greater than minimally vulnerable to bottom otter trawling and overlap more than minimally with the Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries. A report by Stevenson et al. (2004) identified Federally-managed species and their life stages with designated EFH that are moderately to highly vulnerable to impacts from bottom otter trawling (Table 17). Vulnerability in this case was defined as the likelihood that the functional value of EFH would be adversely affected as a result of that specific fishing activity, in this case bottom otter trawling. EFH for these vulnerable life stages can then be examined more closely to determine the extent of interaction with the Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries.

While the Stevenson et al. (2004) report described vulnerability for spawning adults and adult life stages independently, the level of data available for these designations does not warrant independent treatment in this overlap analysis. In addition, distributions of designated EFH for ocean pout and black sea bass larvae were not included in the EFH overlap component because both species have a benthic larval stage that are poorly described. Ocean pout larvae occurred in only 0.3% of NEFSC MARMAP ichthyoplankton tows, making encounters with this benthic larvae rare (Steimle et al. 1999). The limited data available suggest that larvae may be widely distributed north and south of Cape Cod across the continental shelf. However, specifics about the benthic habitats associated with this life stage are unavailable (Steimle et al. 1999). Black sea bass larvae have both a pelagic and benthic stage. The duration of the pelagic larval stage is unknown. Larvae settle and become demersal at about 10 to 16 mm total length (TL) (Able and Fahay 1998), although settlement might be delayed until 25 mm TL (Kendall 1972). Allen et al. (1978) found that 15 to 17 mm TL black sea bass larvae transitioned to juveniles in epibenthic sled collections off southern New Jersey in July. Although the data available on duration of this life stage are extremely limited (Steimle et al. 1999), the transitional sizes suggest the benthic component of the larval stage for black sea bass may only be vulnerable to bottom trawling gear for a short duration. Because information on the habitat utilization, distribution, and duration of these life stages is limited, the impacts of otter trawling on designated black sea bass and ocean pout larval EFH, definitions which have only spatial not temporal components, can not be determined at the present time. EFH for *Loligo* eggs has not been designated at this time and it is therefore not included in subsequent analyses.

To determine the extent to which these moderate and highly vulnerable life stages (identified above) interact with the four target fisheries, ten minute square areas that had directed fishing activity across all gear types, regardless of magnitude, for Atlantic mackerel, *Illex*, *Loligo*, and butterfish were identified. These ten minute squares of fishery activity were superimposed on the designated EFH by ten minute square for each life stage that was identified as moderately and highly vulnerable to bottom otter trawling. A minimal overlap criterion was defined by calculating the percentage of ten minute squares of EFH for each species life stage that overlapped with fishing activity. Once that was completed it became clear that EFH for life stages either overlapped to a large extent with the areas of fishing activity, or very little, therefore 20% appeared to be a reasonable threshold. Those species life stages whose EFH overlapped by less than 20% with the directed fishery activity (minimal overlap criteria) were not included in the EFH component of the overlap analysis. The remaining moderately and highly vulnerable life stages whose designated EFH overlapped greater than minimally with these fisheries are given in Table 18. The number of EFH life stages for these species were summed by ten minute square and form the EFH overlap component of the overlap analysis (Figure 54).

Overlapping of Effort and EFH Components

The effort overlap components (defined above), for the Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries and the single EFH overlap component (also defined above) were overlapped by ten minute square to produce five maps (Figures 55-59). These maps were examined for areas of interaction between high numbers of days fished with bottom otter trawls in each fishery, and as composite effort across all fisheries, and large numbers of EFH designated species life stages by ten minute square from the EFH overlap component. The EFH components were scaled into four groups for mapping purposes using Jenks algorithm, which determines natural breaks in the distributions through an iterative process to minimize within group variation, and maximize variation across groups. This enhanced the contrast among the EFH number of life stage groupings, as opposed to using quartiles. The effort components were scaled into four groups using quartiles. By scaling the data, those ten minute squares with highest numbers of days fished using bottom otter trawls and the largest number species life stages that have vulnerable EFH designations could be identified visually.

6.3.5.1 Potential Adverse Fishing Impact Areas

Potential Adverse Fishing Impact Areas Identified by Overlap Analysis

Based on the overlap analysis, with effort and EFH components, several benthic areas and associated EFH may be at risk for potential adverse impacts from the Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries use of bottom otter trawls. The inshore areas adjacent to Long Island Sound and inshore areas off Massachusetts were identified as areas that that had high numbers of life-stage specific EFH designations and high numbers of days fished with bottom otter trawls in the *Loligo* and butterfish fisheries (Figures 57, 58). There does not appear to be extensive bottom otter trawling activity in the Atlantic mackerel and *Illex* directed fisheries in these areas (Figures 55, 56). The number of days also appears to be extensive in areas adjacent to Long Island Sound and inshore areas off Massachusetts when examined against composite landings (Figure 59). Therefore, these two areas were considered vulnerable to adverse fishing effects from bottom otter trawls from the managed resource fisheries. The mouth of Hudson canyon was also subject to high numbers of days fished with bottom otter trawls in the *Loligo* and butterfish fisheries with a high number of species that had EFH designated in that area (Figures 57, 58). This is also clearly shown in the composite landings as well (Figure 59), therefore the mouth of Hudson Canyon is considered vulnerable to adverse fishing effects in the Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries. The area designated as tilefish HAPC also had some areas with high numbers of days fished with bottom otter trawls in the *Loligo* and butterfish fisheries and EFH life stage designations (Figures 57, 58). The numbers of days fished by the *Loligo* and butterfish fisheries tend to dominate the distributions in the composite effort component overlapped with the EFH component (Figure 59). Bottom otter trawls contribute to 6.32% of the Atlantic mackerel landings and the number of days fished using bottom otter trawls in that fishery are much smaller than the *Loligo* and butterfish fisheries (Table 13; Figure 55). The *Illex* fishery also has fewer days fished relative to *Loligo* and butterfish fisheries (Table 14; Figure 56).

The clay outcroppings found on the slopes of submarine canyons that intersect the shelf on the southern edge of Georges Bank and the New York Bight provide important habitat for tilefish (*Lopholatilus chamaelonticeps*) and other benthic organisms which burrow into the clay. The report produced from the "Workshop of the Effects of Fishing Gear on Marine Habitats off the Northeastern United States October 23-25, 2001 Boston, Massachusetts (NMFS 2002) considered removal of hard clay habitat by trawls to be a permanent change to a major physical feature, and was rated as a high degree of impact. A high numbers of day fished using bottom otter trawl were identified in the northeast corners of the tilefish habitat area of particular concern (Figures 55-59). This area is therefore considered to be vulnerable to bottom otter trawling in the Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries.

Other Potential Adverse Fishing Impacts Areas

The New England Fishery Management Council recommended the closure of Lydonia and Oceanographer Canyon to Monkfish days at sea (DAS) to protect EFH for vulnerable species and have the indirect effect of protecting deep sea coral habitat. In Monkfish Amendment 2 to the Monkfish Fishery Management Plan (NEFMC 2005; available electronically at http://www.nefmc.org), EFH life stages that were more than minimally vulnerable to bottom otter trawling, occur at depths greater than 200 meters, and utilize some form of hard bottom/structured habitat were identified and are as follows (note: J=juveniles, A=adults): redfish (J,A), tilefish (J,A), barndoor skate (J), smooth skate (J), thorny skate (J), and winter skate (J). There is concern given the presence of *Illex*, *Loligo*, and butterfish, in Lydonia and Oceanographer canyon, identified in Amendment 2 to the Monkfish FMP and Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries operating on the canyon boundaries, there may be motivation to start fishing within these areas. Figure 60 denotes the composite effort component, from the Atlantic mackerel, *Illex, Loligo*, and butterfish fisheries, and proximity to Oceanographer and Lydonia Canyon. It should be noted that the composite effort component is reported by ten minute square and is displayed at the center of each ten minute square. Fishing activity could be occurring anywhere within those ten minute squares. It is possible in the case of the composite effort displayed within Oceanographer Canyon, that fishing activity is on the canyon margins and not directly in the canyon center. Use of bottom otter trawls in the canyons could potentially damage hard structured habitat and deep sea corals. This would impinge on habitat availability for redfish and tilefish stocks as well as juvenile barndoor, smooth, thorny, and winter skates, all of which have associations with these structured habitats. The canyons are considered vulnerable to the activity of SMB bottom otter trawl activity; however, they are not likely impacted by fishery activity on a regular basis at this time.

6.3.5.2 Description of GRAs to Minimize Impacts to EFH

The Magnuson-Stevens Act requires that Council evaluate potential adverse effects of fishing activities on EFH and include in FMPs management measures necessary to minimize adverse effects to the extent practicable. In this amendment to the FMP, the Council is considering alternatives (described in section 5.5) that could close several areas to the use of bottom otter trawl gear (Gear Restricted Areas - GRAs) for the directed harvest of Atlantic mackerel, squid, and butterfish. These potential area closures were identified through overlap analyses and other areas of concern as described in section 6.3.5.1. Bottom tending mobile gear such as the bottom otter trawl is frequently implicated as having a high potential for adverse impacts on bottom habitats (section 6.3.3).

The following sections describe the GRAs included in the proposed alternatives in greater detail, including the type of sediments/habitat and species life stages for which EFH is designated.

Head of the Hudson Canyon (Alternative 5B GRA)

The head of the Hudson Canyon is described as statistical area 616 in the area surrounding the head of the Hudson Canyon, between the 200-foot and 500-foot isobaths and specific coordinates are as indicated in Figure 2, section 5.5.B. EFH has been designated in this region for several Federally-managed species (Table 1 from 5.5). The proportion of EFH contained within this proposed GRA, relative to the total amount of EFH designated for each species life stage with EFH that is moderate to highly vulnerable to bottom otter trawling and overlaps significantly with the four fisheries, is given in Table 7. The head of Hudson Canyon proposed GRA covers approximately 4,824 km^2 (1,863 mi^2; 1,407 nm^2) and ranges in depth from 64 m to 406 m, based on USGS sediment sampling data (N=30; Poppe and Polloni 2000). These data indicate that sediment types in this area include sand, different combinations of sand, silt, and clay, and gravelly bottom (Figure 63; Poppe and Polloni 2000). Four benthic habitat studies were conducted in October-November 2001, October-November 2002, August 2004, and October-November 2005 in the Hudson Canyon and adjoining shelf areas and would provide additional detail on the composition of the benthic habitat, including sediment types, megabenthos and fish species observed (Guida et al. unpublished).

Tilefish HAPC (Alternative 5C GRA)

Tilefish are “shelter-seeking and habitat limited”, therefore part of their EFH was designated as HAPC because it meets three of four criteria used to designate HAPC for a species (50 CFR Part 600.815 (a)(9)). These criteria are ecological function, sensitive to human-induced environmental degradation, and rarity of habitat. Tilefish HAPC is described as statistical areas 616 and 537, between the 300-foot and 850-foot isobaths and specific coordinates are as indicated in Section 5.5.C. EFH has been designated in this region for several Federally-managed species (Table 1 from 5.5). The proportion of EFH contained within this proposed GRA, relative to the total amount of EFH designated for each species life stage with EFH that is moderate to highly vulnerable to bottom otter trawling and overlaps significantly with the four fisheries, is given in Table 19. The tilefish HAPC proposed GRA covers approximately 41,645 km^2 (16,079 mi^2; 12,144 nm^2) and ranges in depth from 60 m to 2722 m, based on USGS sediment sampling data (N=592; Poppe and Polloni 2000). These data indicate that sediment types in this region include mainly sand and combinations of sand, silt, and clay, although some gravelly sediment was identified (Figure 63; Poppe and Polloni 2000).

Lydonia and Oceanographer Canyons (Alternative 5D GRA)

The proposed Lydonia and Oceanographer Canyon GRAs are located offshore along the continental shelf and coordinates are as indicated in Section 5.5.D. EFH has been designated in these areas for several Federally-managed species (Table 1 from 5.5). The proportion of EFH contained within these proposed GRAs, relative to the total amount of EFH designated for each species life stage with EFH that is moderate to highly vulnerable to bottom otter trawling and overlaps significantly with the four fisheries, is given in Table 19. The Lydonia and Oceanographer proposed GRAs cover approximately 223 km^2 (86 mi^2; 67 nm^2) and 337 km^2 (130 mi^2; 100 nm^2), respectively and range in depth from 197 m to 1660 m based on USGS sediment sampling data (N=81; Poppe and Polloni 2000). These data indicate that sediment types in these two canyons include combinations of clay, silt, and sand (Figure 63; Poppe and Polloni 2000). Additional studies in the 1960's indicate that these canyons have sediment comprised of clay, sand, and silt, small boulders made of silestone, granite, and basaltic rocks, as well as coral debris (Poppe and Polloni 2000). Another study conducted using a towed underwater camera sled in Lydonia and Oceanographer Canyon noted outcrops of rock, talus, glacial erratics and areas of extensive coral debris in the canyons (Hecker et al. 1980). In addition Hecker et al. (1980) noted that both Lydonia and Oceanographer canyon had high concentrations of alcyonarian and scleractinian corals, with the dominant species being restricted to hard substrates. Shallow water fauna in the canyon areas are similar in composition to that on the continental slope, with deeper water fauna being less variable except in areas with hard substrates (Hecker et al. 1980). Additional description of these canyon areas and the species that utilize these habitats are available in Monkfish Amendment 2 to the Monkfish Fishery Management Plan (NEFMC 2005; available electronically at http://www.nefmc.org)

EEZ (Alternative 5E GRA)

The proposed EEZ GRA covers a broad area (approximately 11.7 million km^2; 4.5 million mi^2; 3.4 million nm^2) from 3 to 200 miles and the outer boundary is as indicated in Section 5.5.E. Sediment types cover the whole suite described and include bedrock, gravel, sand, silt, and clay in various combination (Figure 63). Habitat in the EEZ is varied and is described in section 6.3.1. As shown in Table 19, the EEZ contains all EFH designated in Federal waters for the species life stages identified in the EFH overlap component of this analysis.

Inshore Long Island Sound and Massachusetts (Alternative 5F GRA)

The proposed inshore Long Island and areas off Massachusetts GRAs have coordinates are as indicated in Section 5.5.F. EFH has been designated in these areas for several Federally-managed species (Table 1 from 5.5). The proportion of EFH contained within these proposed GRAs, relative to the total amount of EFH designated for each species life stage with EFH that is moderately to highly vulnerable to bottom otter trawling and overlaps significantly with the four fisheries, is given in Table 19. The Inshore Long Island and Massachusetts proposed GRAs cover a total area of 10,528 km^2 (4,065 mi^2; 3,151 nm^2) and 6,061 km^2 (2,340 mi^2; 1,814 nm^2), respectively and have a maximum depth of about 92 m based on USGS sediment sampling data (N=579; Poppe and Polloni 2000). These data indicate that sediment types in these regions include predominately sand, silty sands and gravelly sediment (Figure 63; Poppe and Polloni 2000).

6.3.5.3 Habitat Protection Index (HPI)

In order to compare the relative value of the proposed alternatives in protecting EFH, a standardized index was developed, called the habitat protection index (HPI). This index is calculated by dividing an estimate of EFH protected by each proposed alternative (numerator) over the total amount of EFH designated (denominator). The numerator is calculated as the sum of EFH designations (ten minute squares) for all species life stages with EFH that are moderate to highly vulnerable to bottom otter trawling, overlap significantly with the four fisheries, and are contained within each of the alternative's proposed GRAs. The denominator is the sum of EFH designations (ten minute squares) for all species life stages with EFH that are moderately to highly vulnerable to bottom otter trawling and overlap significantly with the four fisheries (Table 18). The resulting HPI is given in Table 20. The closure of the EEZ (alternative 5E GRA) to bottom otter trawling in the directed Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries affords the greatest protection to EFH from adverse fishing effects, while the closure of Lydonia and Oceanographer Canyon (alternative 5D GRA) affords the least. It should be noted that this index is reflective of the number of EFH ten minute designations (ten minute squares) in an individual closure and therefore consideration of the sensitivity of the habitat and the species is important. Not all EFH is created equally, and the biological relevance of each ten minute square of designated EFH to each species life stage is variable. As such this index is intended to act as a supplemental piece of information to be considered when comparing the relative value of each of the alternatives.

Table 13. Percentage of Atlantic mackerel landings by gear from directed trips based on VTR data (1996-2004).

Gear	Year								
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Beam Trawl									0.17
Bottom Otter Trawl (Fish)	72.62	48.84	45.19	49.10	27.75	17.75	9.67	12.81	6.32
Bottom Otter Trawl (Other)		0.05							
Bottom Otter Trawl (Paired)				0.09					
Bottom Otter Trawl (Shrimp)		0.33							
Dredge (Sea scallop)	0.02								0.02
Drift Gill Net (Large Pelagic)						0.04			
Drift Gill Net (Other)			0.03			0.09		0.02	
Drift Gill Net (Runaround)						0.06			
Floating Trap	2.90	2.27	0.86	0.78	0.15	0.27	0.21	0.07	0.01
Mid-water Otter Trawl	24.10	47.49	52.71	48.18	68.55	81.03	30.50	36.30	22.58
Mid-water Otter Trawl (Paired)			0.63	0.23	1.44		59.03	50.78	70.46
Pot/Trap (Offshore Lobster)									0.17
Pots and Traps (Hagfish)									0.14
Purse Seine (Other)			0.22	0.06	0.21		0.13		
Sink Gill Net (Other)	0.05	0.07	0.10	0.45	0.25	0.29	0.01	0.01	0.04
Unknown	0.31	0.95	0.03						
Weir			0.23	1.11	1.65	0.47	0.45	0.02	0.09
Total %	100	100	100	100	100	100	100	100	100

Table 14. Percentage of *Illex* landings by gear from directed trips based on VTR data (1996-2004).

Gear	Year								
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Beam Trawl (Other)									2.40
Bottom Otter Trawl (Fish)	79.89	96.54	89.52	93.18	99.34	100.00	100.00	79.89	97.36
Bottom Otter Trawl (Shrimp)	0.08		0.17					0.08	0.24
Floating Trap									<0.01
Gill net (runaround)					<0.01				
Hand line (other)	<0.01							<0.01	<0.01
Mid-water Otter Trawl	20.02	3.07	10.31	6.82	0.65			20.02	
Unknown		0.39							
Total %	100	100	100	100	100	100	100	100	100

Table 15. Percentage of *Loligo* landings by gear from directed trips based on VTR data (1996-2004).

Gear	Year 1996	1997	1998	1999	2000	2001	2002	2003	2004
Beam Trawl (Other)							0.12	0.02	0.11
Bottom Otter Trawl (Fish)	92.76	97.18	93.29	99.30	98.32	98.53	98.81	99.53	99.24
Bottom Otter Trawl (Other)		0.35	0.69		0.05				
Bottom Otter Trawl (Scallop)			<0.01	<0.01	0.02	0.02	<0.01		<0.01
Bottom Otter Trawl (Shrimp)	0.02	0.02	0.10		0.08	0.06			0.01
Common Haul Seine									<0.01
Diving Gear	<0.01								
Dredge (Sea Scallop)	0.04	0.07	<0.01	0.06	0.04	0.05	0.13	0.27	0.34
Floating Trap	0.92	1.27	0.31	0.18	0.58	0.40	0.05	0.08	<0.01
Hand Line (Other)	0.01	0.02	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01
Mid-water Otter Trawl	5.57	1.04	4.94	0.45	0.64	0.70	0.70		0.17
Pot/Trap (Offshore Lobster)		<0.01							
Pots and Traps (Fish)	0.01				0.04				
Pots and Traps (Other)			<0.01						
Scottish Seine			<0.01						
Sink Gill Net (Other)			0.06		<0.01				0.01
Unknown	0.67	0.05	0.60		0.14				
Weir				0.01	0.08	0.24	0.19	0.10	0.11
Total %	100	100	100	100	100	100	100	100	100

Table 16. Percentage of butterfish landings by gear from directed trips based on VTR data (1996-2004).

Gear	Year								
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Beam Trawl (Other)							0.64		
Bottom Otter Trawl (Fish)	90.34	96.42	99.09	99.01	82.70	99.10	98.80	98.32	99.34
Bottom Otter Trawl (Other)		0.21	0.13		0.04				
Bottom Otter Trawl (Paired)				0.25					
Bottom Otter Trawl (Scallop)	0.02								
Bottom Otter Trawl (Shrimp)		0.22	0.06	0.12		0.03			
Dredge (Other)		0.01							
Dredge (Sea Scallop)	0.03								0.11
Drift Gill Net (Other)					0.04				
Floating Trap	1.51	0.89	0.10	0.36	0.09	0.28	0.18	0.14	
Gill Net (Runaround)							0.09		
Hand Line (Other)								0.18	
Mid-water Otter Trawl	7.61	2.12	0.33	0.23	16.92	0.26			
Pots and Traps (Fish)					0.03				
Pots and Traps (Other)				0.02					
Sink Gill Net (Other)	0.08		<0.01	<0.01	0.10	0.02	0.13	0.07	0.44
Unknown	0.41	0.11	0.29		0.09				
Weir						0.31	0.16	1.29	0.11
Total %	100	100	100	100	100	100	100	100	100

Table 17. The vulnerability of Northeast and Mid-Atlantic Federally-managed species, by life stage, to bottom otter trawling.
(E=Egg, L=Larvae, J=Juvenile, A=Adult, SA=Spawning Adult).

Species	**High Impact**	**Medium Impact**	**Low Impact**	**No Impact**	**Not Applicable**
American plaice	A, SA	J			E, L
Atlantic cod		A, SA	J		E, L
Atlantic halibut		J, A, SA		E	L
Atlantic Herring			E, SA		L, J, A
Atlantic Mackerel					E, L, J, A
Atlantic salmon					E, L, J, A, SA
Atlantic sea scallops		J			l
Barndoor Skate		J, A			
Black Sea Bass	L, J, A				E
Bluefish					E, L, J, A
Butterfish					J, A
Clearnose Skate		J, A			
Cobia					E, L, J, A, SA
Golden Crab			E, L, J, A,SA		
Haddock	J, A, SA				E, L
Illex					J, A
King Mackerel					E, L, J, A, SA
Little Skate		J, A	E		
Loligo	E				J, A
Monkfish			J, A, SA		E, L
Ocean pout	E, L, J, A, SA				
Ocean Quahog			J, A,		

Table 17 Continued. The vulnerability of Northeast and Mid-Atlantic Federally-managed species, by life stage, to bottom otter trawling (E=Egg, L=Larvae, J=Juvenile, A=Adult, SA=Spawning Adult).

Species	**High Impact**	**Medium Impact**	**Low Impact**	**No Impact**	**Not Applicable**
Offshore Hake			J, A, SA		E, L
Pollock		A, SA			E, L
Red Crab			J, A, SA		E, L
Red Drum			J, A		
Red Hake	J	A, SA			E, L
Redfish	J	A, SA			E, L
Rosette Skate		J, A			
Scup		J	A		E, L
Silver Hake		J	A, SA		E, L
Smooth Skate		J, A			
Spanish Mackerel					E, L, J, A, SA
Summer Flounder		J, A			E, L
Surfclam			J, A		
Thorny Skate		J, A			
Tilefish	J, A				E, L
White Hake		J	A, SA		E, L
Windowpane Flounder			J, A, SA		E, L
Winter Flounder		A, SA	E, L, J		
Winter Skate		J, A			
Witch Flounder		J, A, SA			
Yellowtail Flounder		J, A, SA			E, L

Table 18. Northeast and Mid-Atlantic Federally-managed species, by life stage, that overlap with the Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries, and have one or more life stages with medium or high vulnerability to bottom otter trawling.
(E=Egg, L=Larvae, J=Juvenile, A=Adult, SA=Spawning Adult).

Species	**High Impact**	**Medium Impact**
Atlantic sea scallops		J
Barndoor skate		J
Black sea bass	L, J, A	
Clearnose skate		J, A
Little skate		J, A
*Loligo**	E	
Ocean pout	E, L, J, A, SA	
Red hake	J	A, SA
Rosette skate		J, A
Scup		J
Silver hake		J
Summer flounder		J, A
Tilefish	J, A	
Winter flounder		A, SA
Winter skate		J, A
Witch flounder		J
Yellowtail flounder		J, A, SA

**Loligo* egg EFH is not designated at this time, and is not included in the overlap analysis

Table 19. The percentage of EFH designated for Federally-managed species, by life stage that overlap with the Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries, and have one or more life stages with medium or high vulnerability to bottom otter trawling, relative to their total designated EFH.
(E=Egg, J=Juvenile, A=Adult).

Species	*Alternatives*				
	5B Mouth of Hudson Canyon[a]	**5C** Tilefish HAPC[a]	**5D** Lydonia and Oceanographer Canyons[a]	**5E** EEZ[ab]	**5F** Inshore Areas off Long Island and MA[a]
Atlantic sea scallops (J)	6	1	0	100	8
Barndoor skate (J)	0	8	2	100	2
Black sea bass (J)	2	3	0	100	12
Black sea bass (A)	4	8	0	100	8
Clearnose skate (J)	1	0	0	100	1
Clearnose skate (A)	0	0	0	100	3
Little skate (J)	2	6	1	100	6
Little skate (A)	2	5	1	100	7
Ocean pout (E)	2	4	0	100	8
Ocean pout (J)	3	2	0	100	9
Ocean pout (A)	2	4	0	100	10
Red hake (J)	2	5	0	100	5
Red hake (A)	2	9	1	100	1
Rosette skate (J)	6	16	0	100	0
Rosette skate (A)	0	56	0	100	0
Scup (J)	0	2	0	100	15
Silver hake (J)	6	19	1	100	23
Summer flounder (J)	0	0	0	100	6
Summer flounder (A)	3	10	0	100	7
Tilefish (J)	3	68	3	100	0
Tilefish (A)	0	68	0	100	0
Winter flounder (A)	0	0	0	100	14
Winter skate (J)	1	2	0	100	7
Winter skate (A)	1	1	0	100	8
Witch flounder (J)	1	7	1	100	0
Yellowtail flounder (J)	5	2	0	100	28
Yellowtail flounder (A)	2	3	0	100	10

[a] EFH designations used in these calculations include those in both state and federal (EEZ) waters.
[b] This value would be slightly less that 100% for species life states that have EFH designations in state (non-EEZ) waters.

Table 20. The habitat protection index (HPI) for the proposed bottom otter trawl GRAs for the Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries in alternatives 5B, 5C, 5D, 5E, and 5F.

	Alternatives	***Habitat Protection Index (HPI)***
5E	**EEZ**[a]	1.0000
5F	**Inshore Areas off Long Island and MA**	0.0747
5C	**Tilefish HAPC**	0.0508
5B	**Mouth of Hudson Canyon**	0.0189
5D	**Lydonia and Oceanographer Canyons**	0.0043

[a] HPI will be slightly less than 1 because calculation included EFH designations in state waters for some species life stages.

Table 21. The presence and absence of EFH for federally managed species that are moderately and highly vulnerable to bottom otter trawling in the proposed closures.
(1=presence, 0=absence).

	Alternatives			
Species	**5B** **Mouth of Hudson Canyon**	**5C** **Tilefish HAPC**	**5D** **Lydonia and Oceanographer Canyons**	**5F** **Inshore Areas off Long Island and MA**
Atlantic cod	0	1	0	1
Atlantic sea scallops	1	1	0	1
Barndoor Skate	0	1	1	1
Black Sea Bass	1	1	0	1
Clearnose Skate	1	1	0	1
Haddock	1	1	0	0
Little Skate	1	1	0	1
Ocean pout	1	1	0	1
Red Hake	1	1	0	1
Redfish	0	1	1	1
Rosette Skate	1	1	0	1
Scup	1	1	0	1
Silver Hake	1	1	0	1
Smooth Skate	1	1	1	1
Summer Flounder	1	1	0	1
Thorny Skate	0	1	1	1
Tilefish	1	1	1	0
White Hake	1	1	0	1
Winter Flounder	0	1	0	1
Winter Skate	1	1	1	1
Witch Flounder	1	1	0	0
Yellowtail Flounder	1	1	0	1
Total Species	17	22	6	19

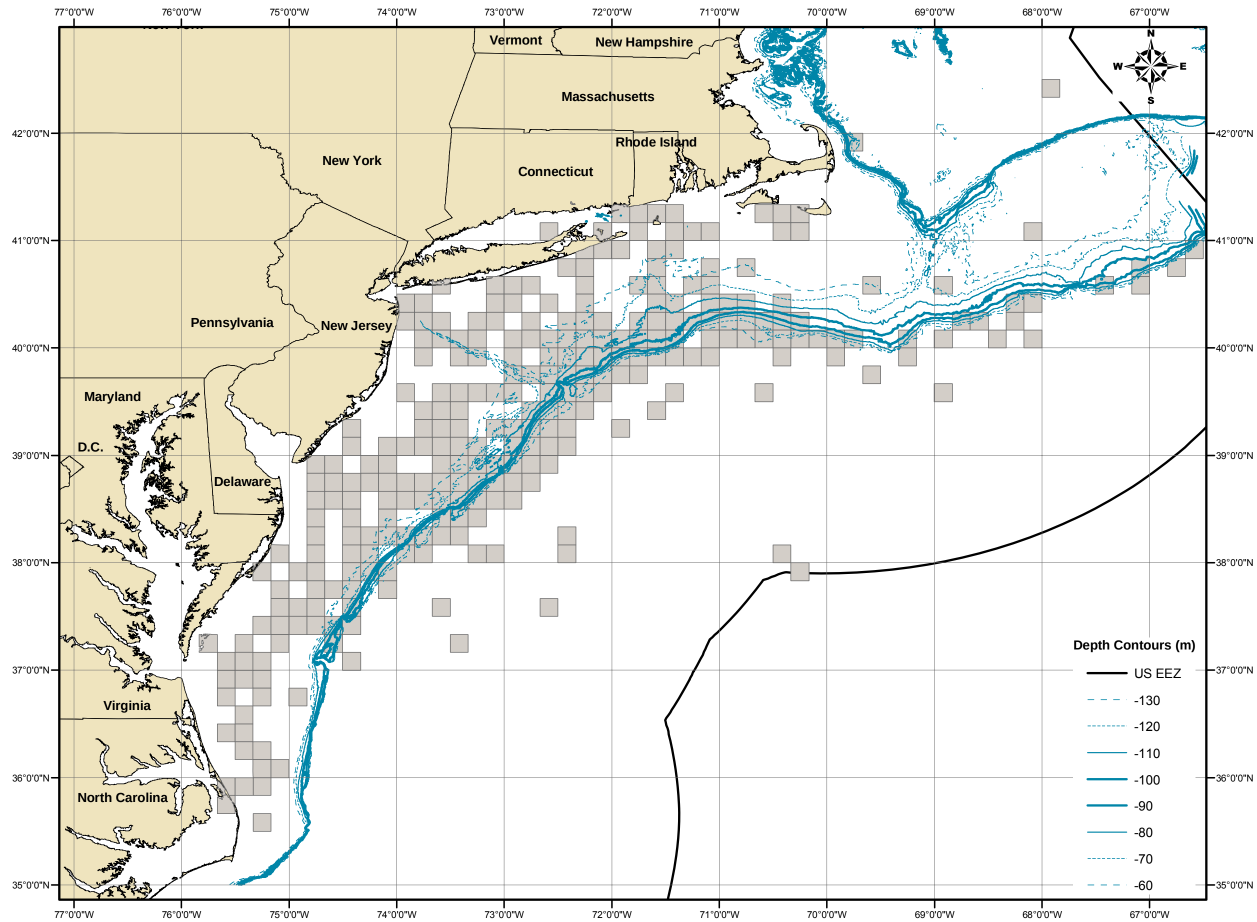


Figure 34. The distribution of bottom otter trawl (fish), by ten-minute square, use in the directed Atlantic mackerel fishery based on VTR data (1996-2004).

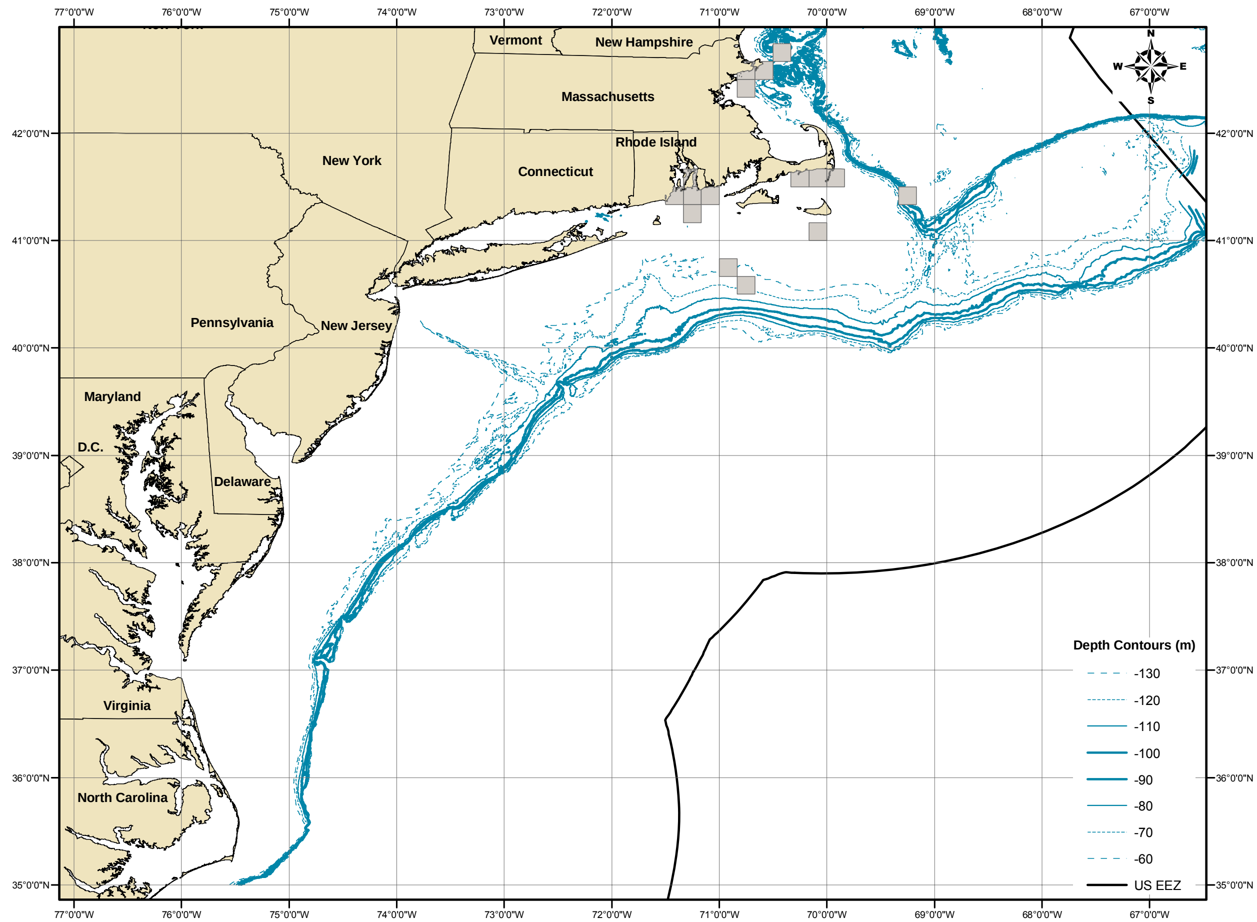


Figure 35. The distribution of floating trap use in the directed Atlantic mackerel fishery based on VTR data (1996-2004).

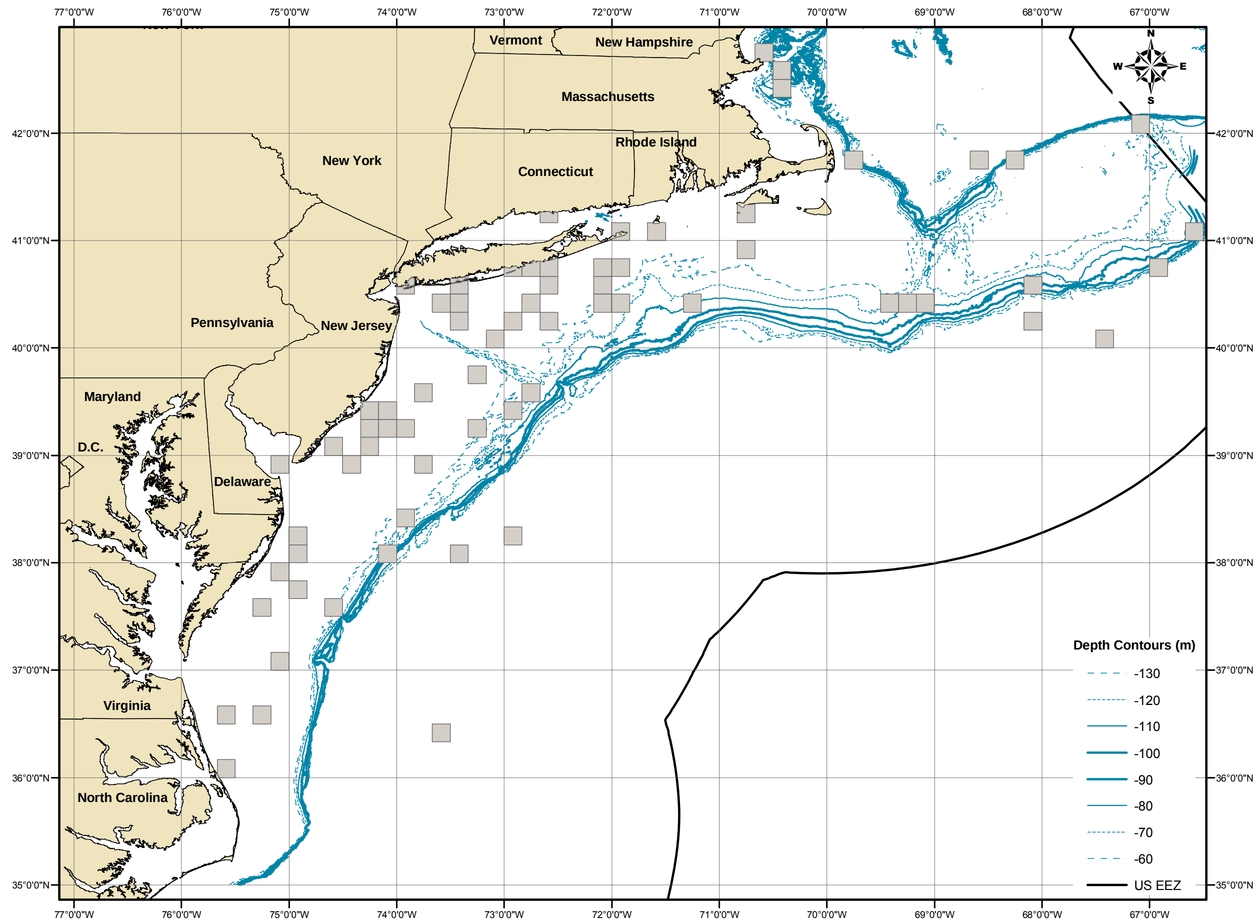


Figure 36. The distribution of mid-water otter trawl use, by ten-minute square, in the directed Atlantic mackerel fishery based on VTR data (1996-2004).

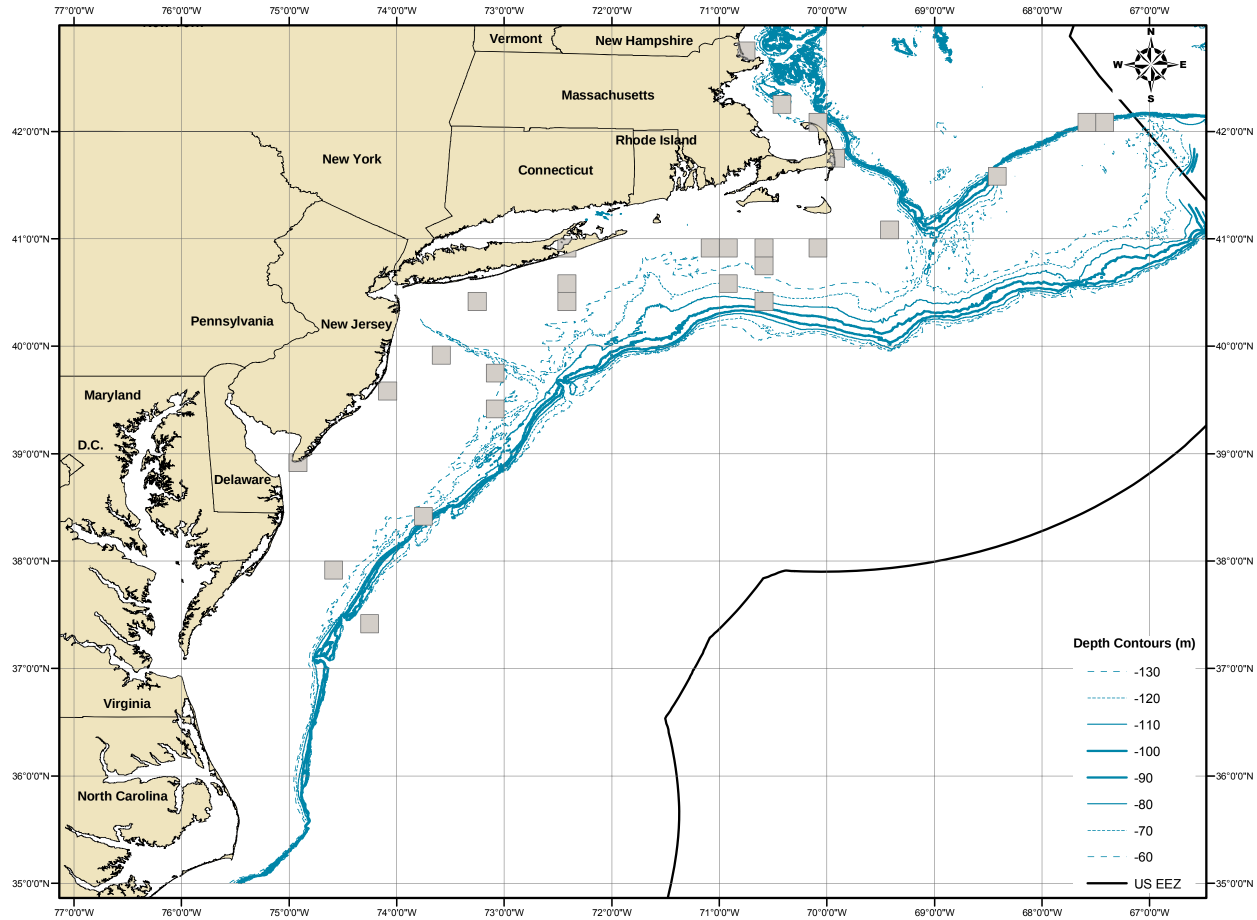


Figure 37. The distribution of paired mid-water otter trawl use in the directed Atlantic mackerel fishery based on VTR data (1996-2004).

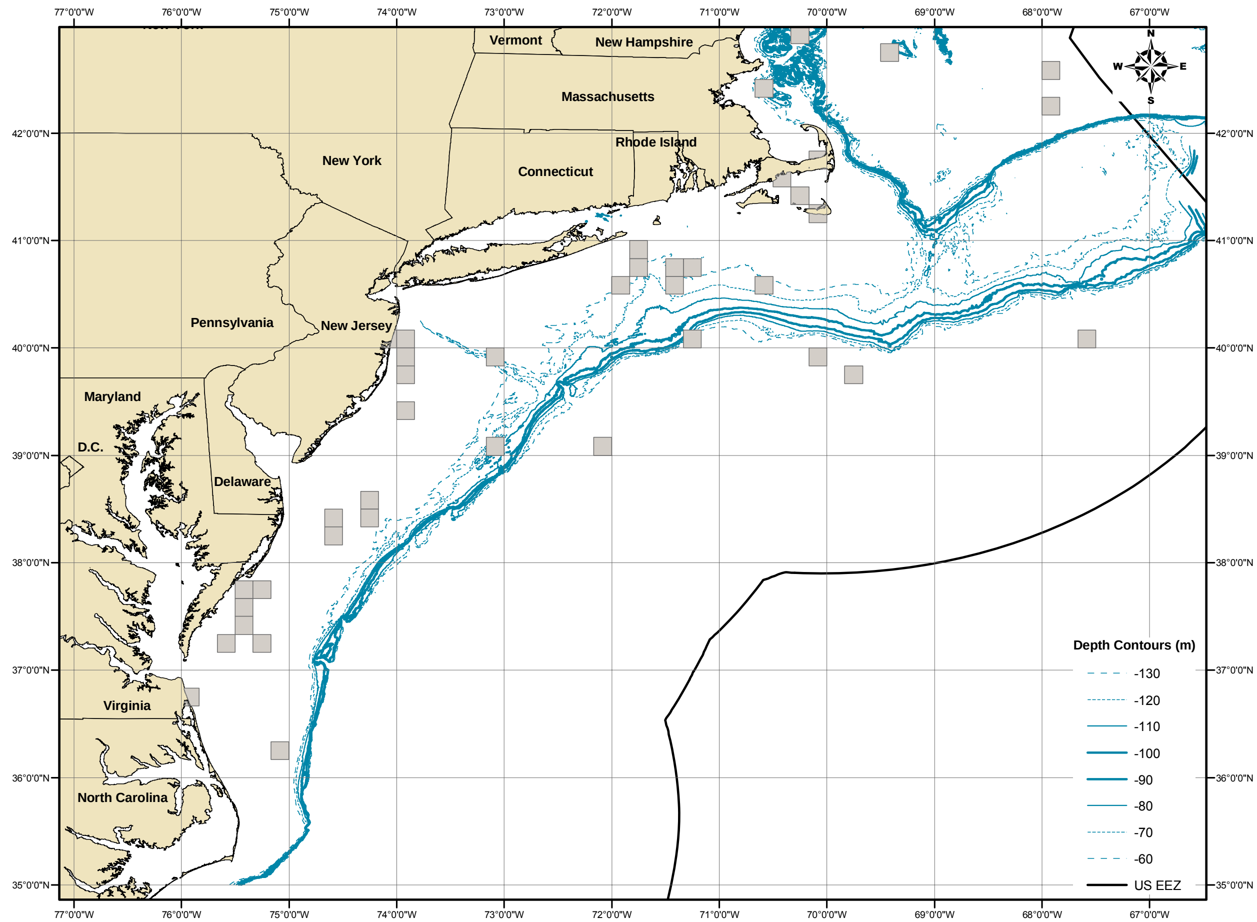


Figure 38. The distribution of other types of fishing gear used in the directed Atlantic mackerel fishery based on VTR data (1996-2004).

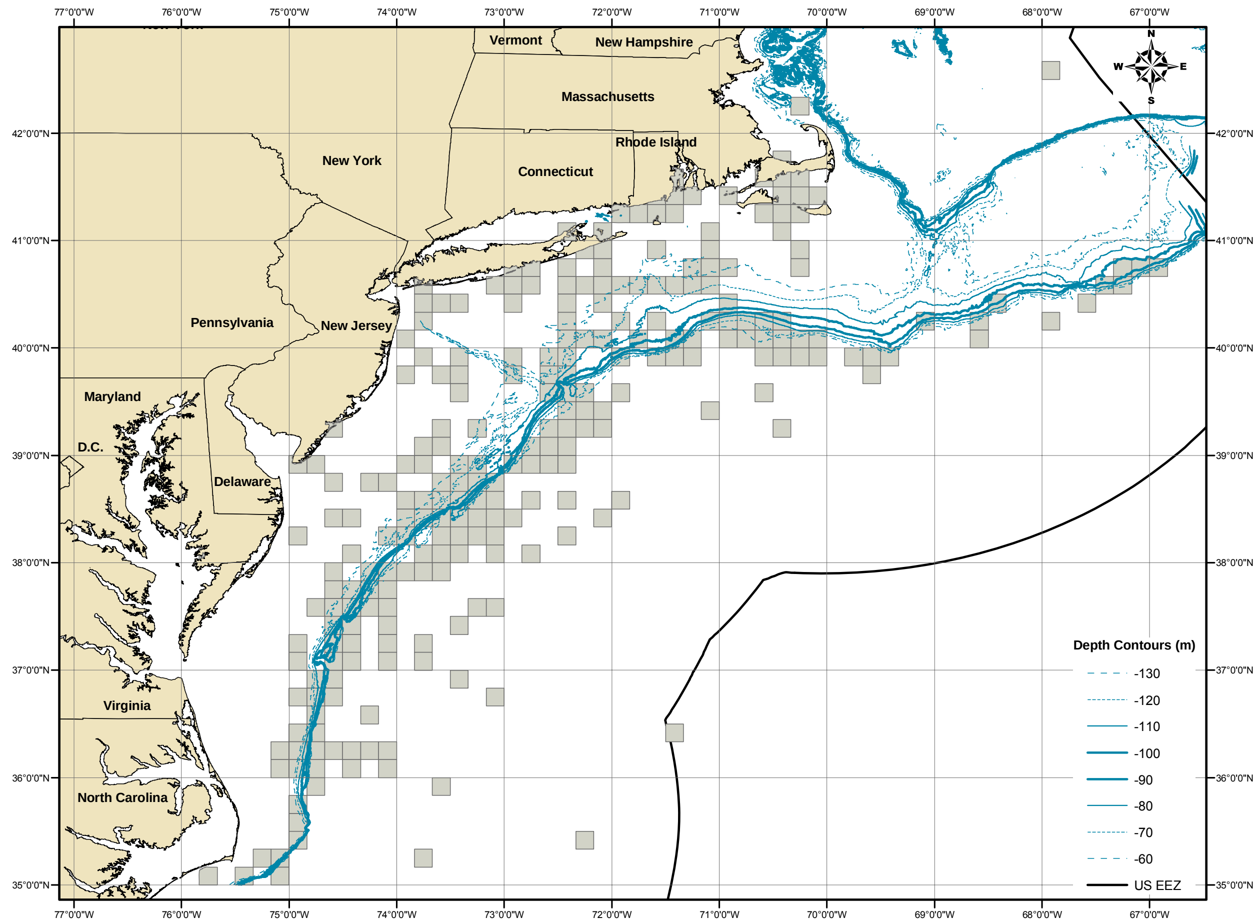


Figure 39. The distribution of bottom otter trawl (fish) use in the directed *Illex* fishery based on VTR data (1996-2004).

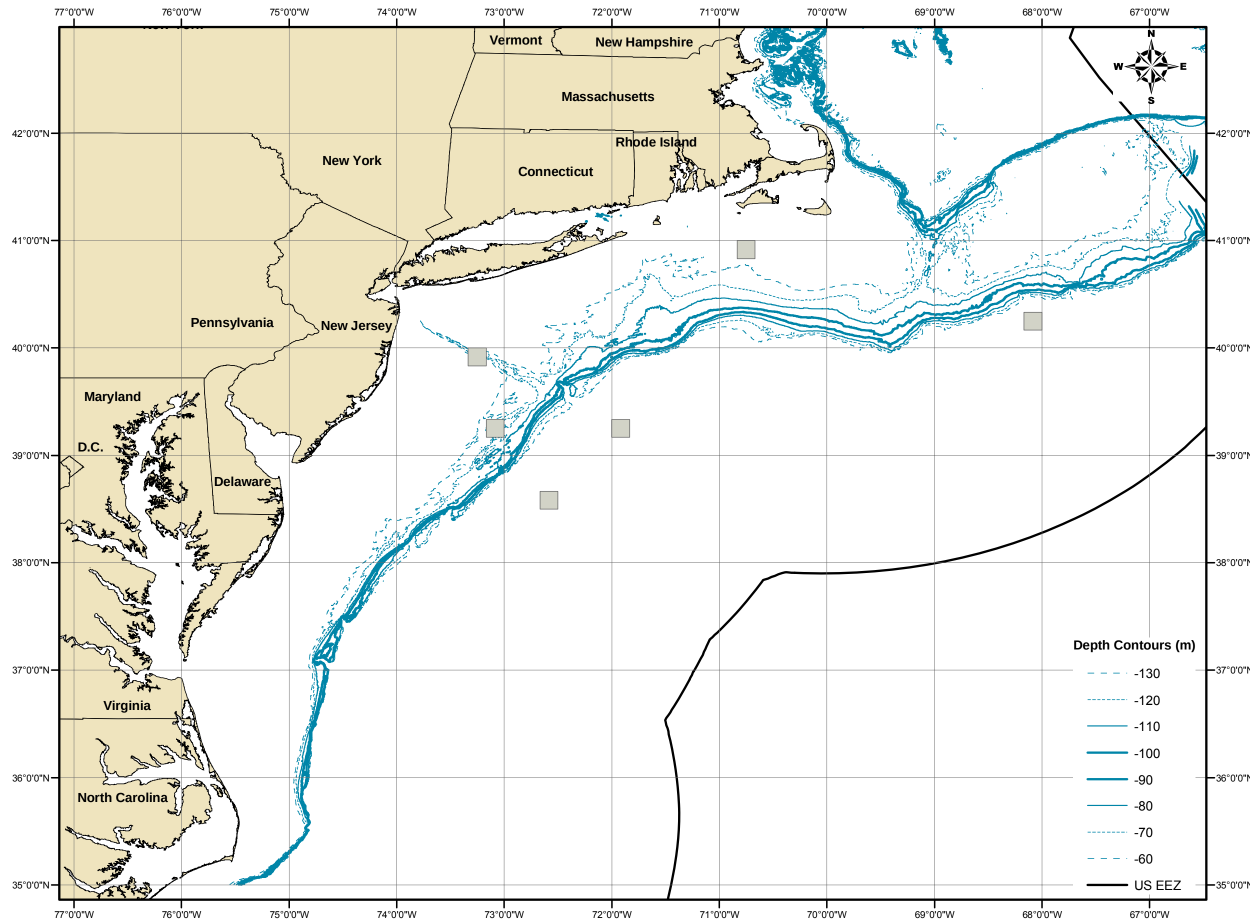


Figure 40. The distribution of mid-water otter trawl use in the directed *Illex* fishery based on VTR data (1996-2004).

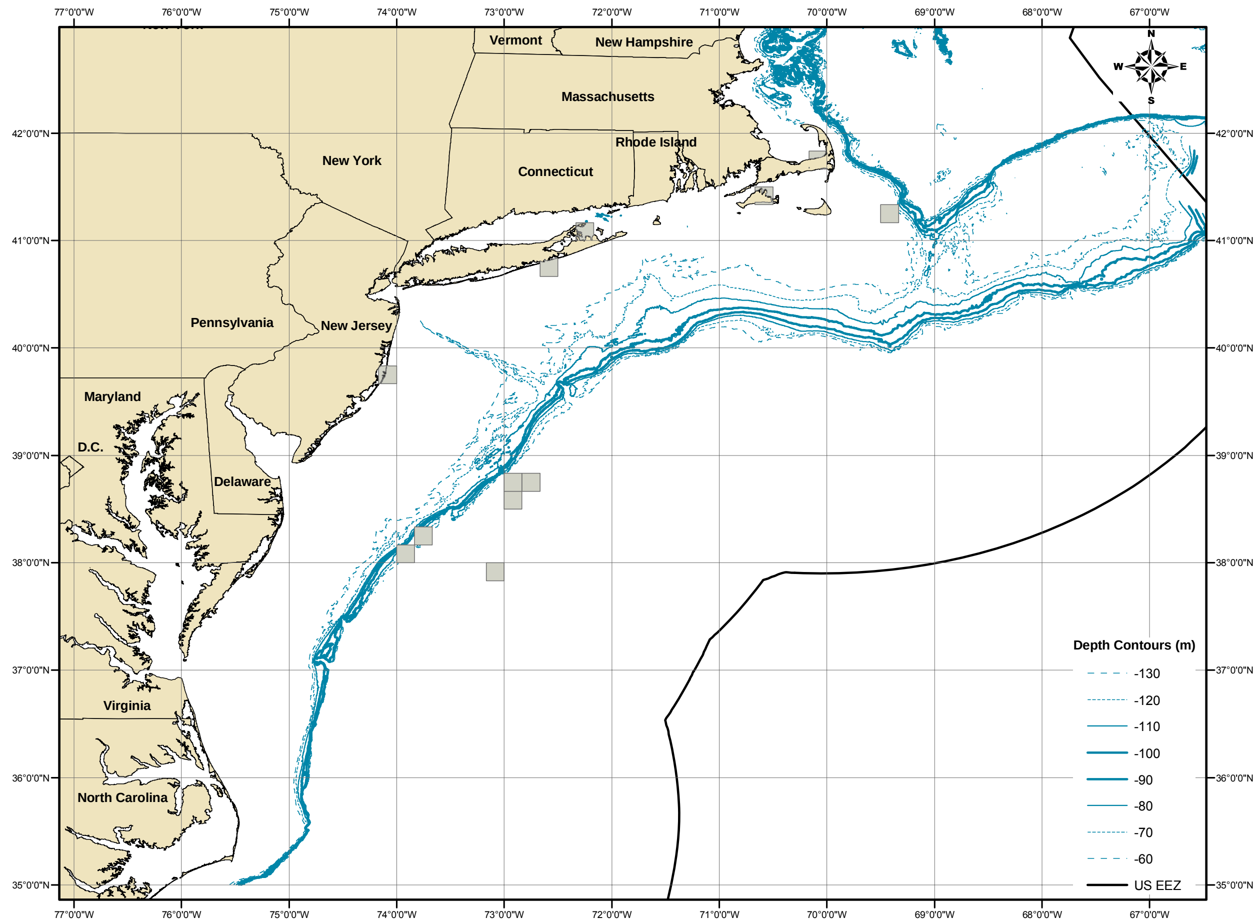


Figure 41. The distribution of other types of fishing gears used in the directed *Illex* fishery based on VTR data (1996-2004).

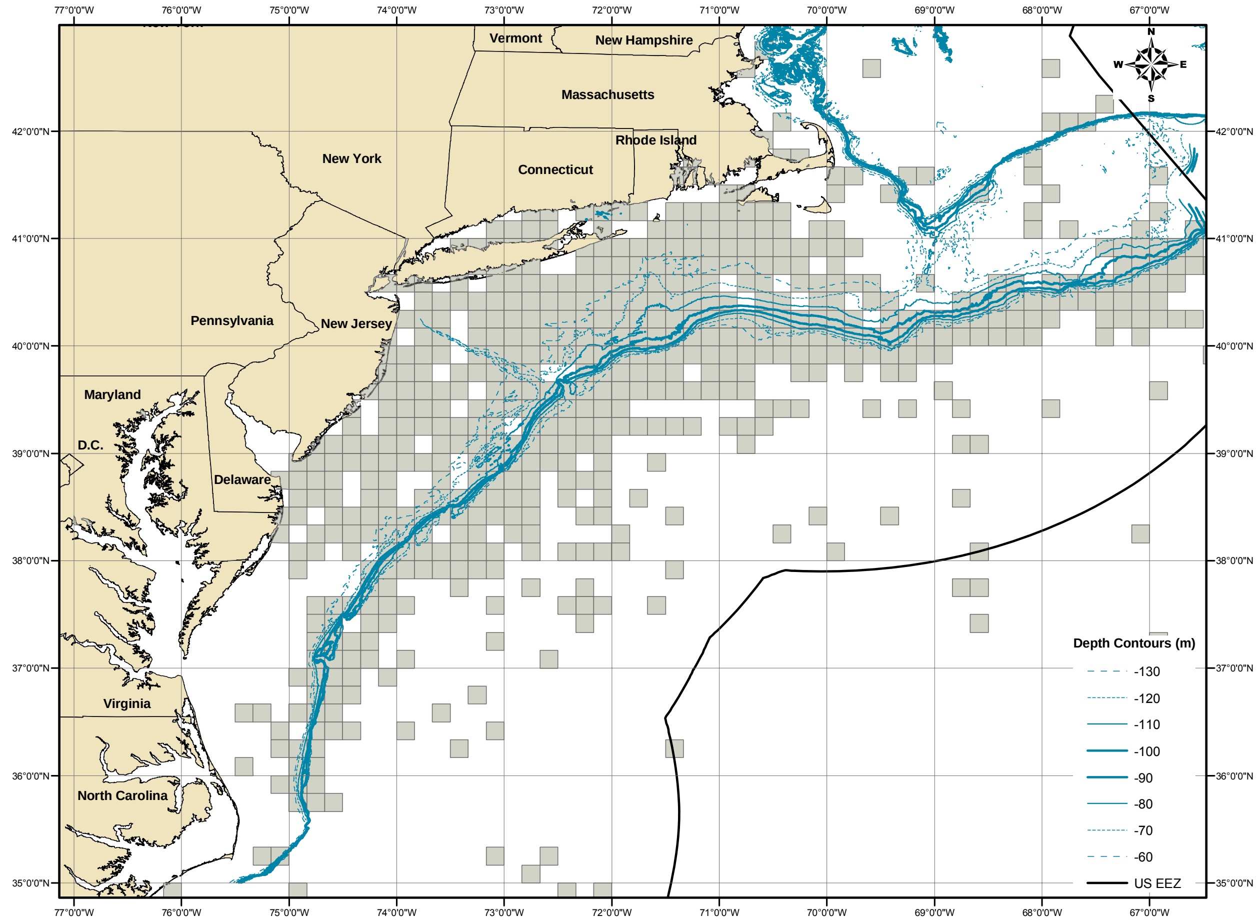


Figure 42. The distribution of bottom otter trawl (fish) use in the directed *Loligo* fishery based on VTR data (1996-2004).

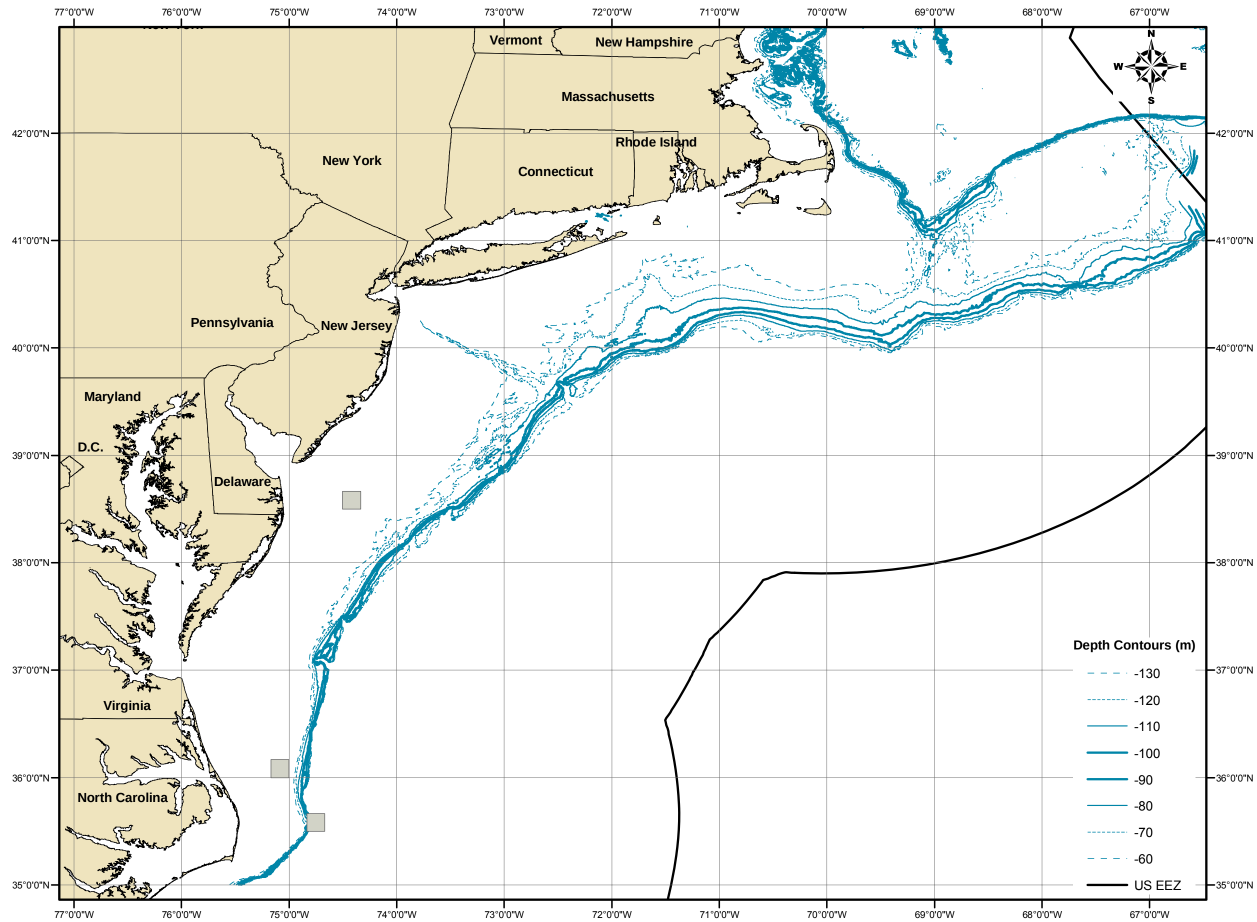


Figure 43. The distribution of mid-water otter trawl use in the directed *Loligo* fishery based on VTR data (1996-2004).

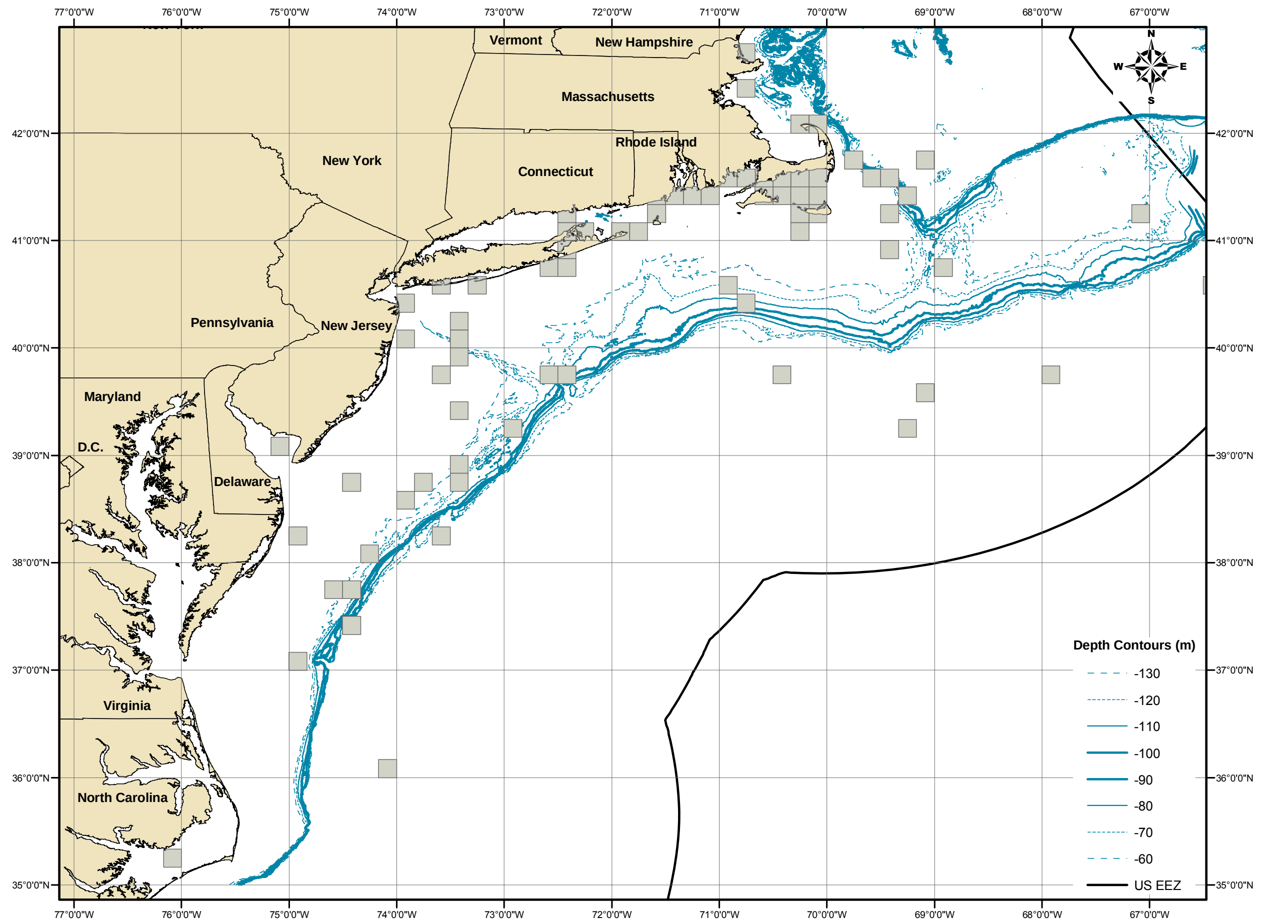


Figure 44. The distribution of other fishing gears used in the directed *Loligo* fishery based on VTR data (1996-2004).

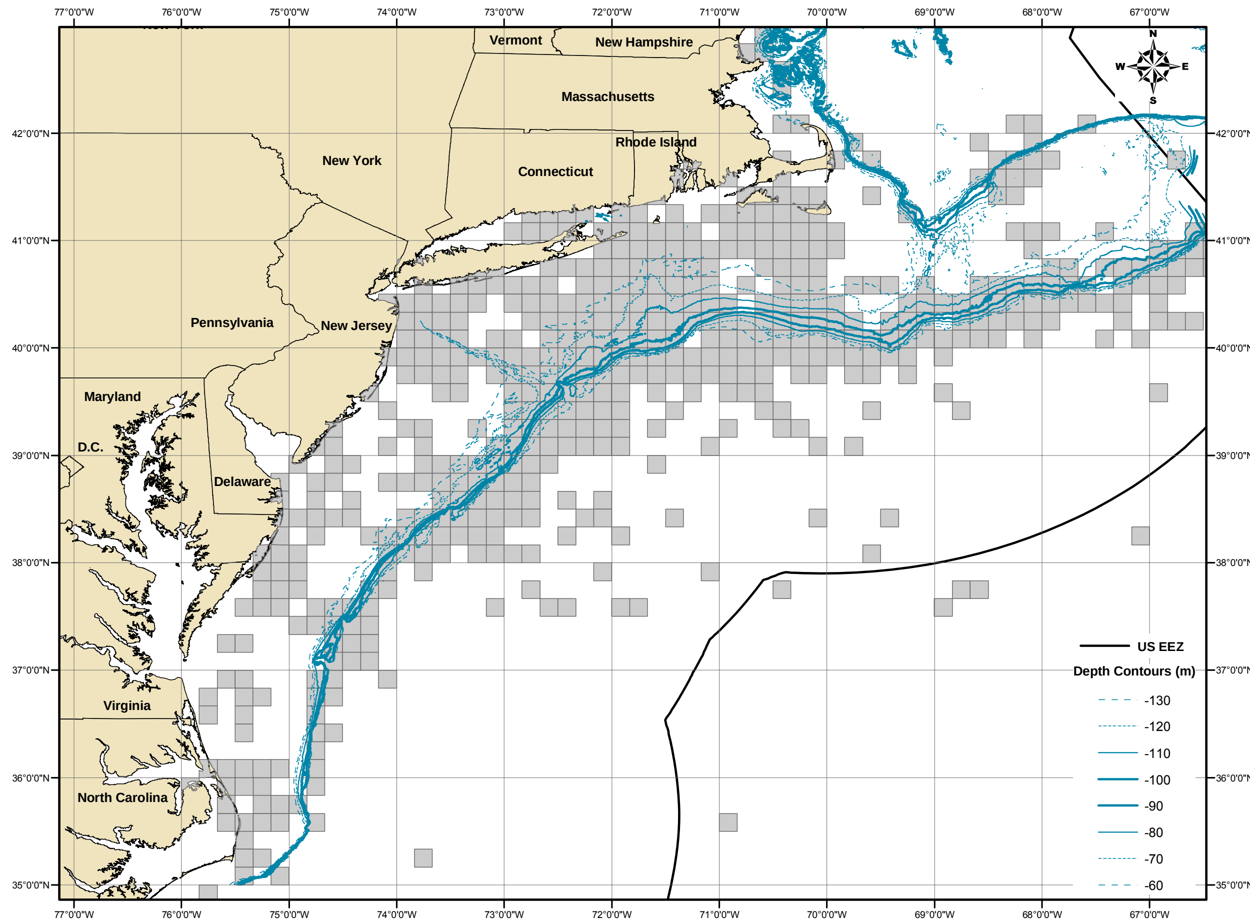


Figure 45. The distribution of bottom otter trawl (fish) use in the directed butterfish fishery based on VTR data (1996-2004).

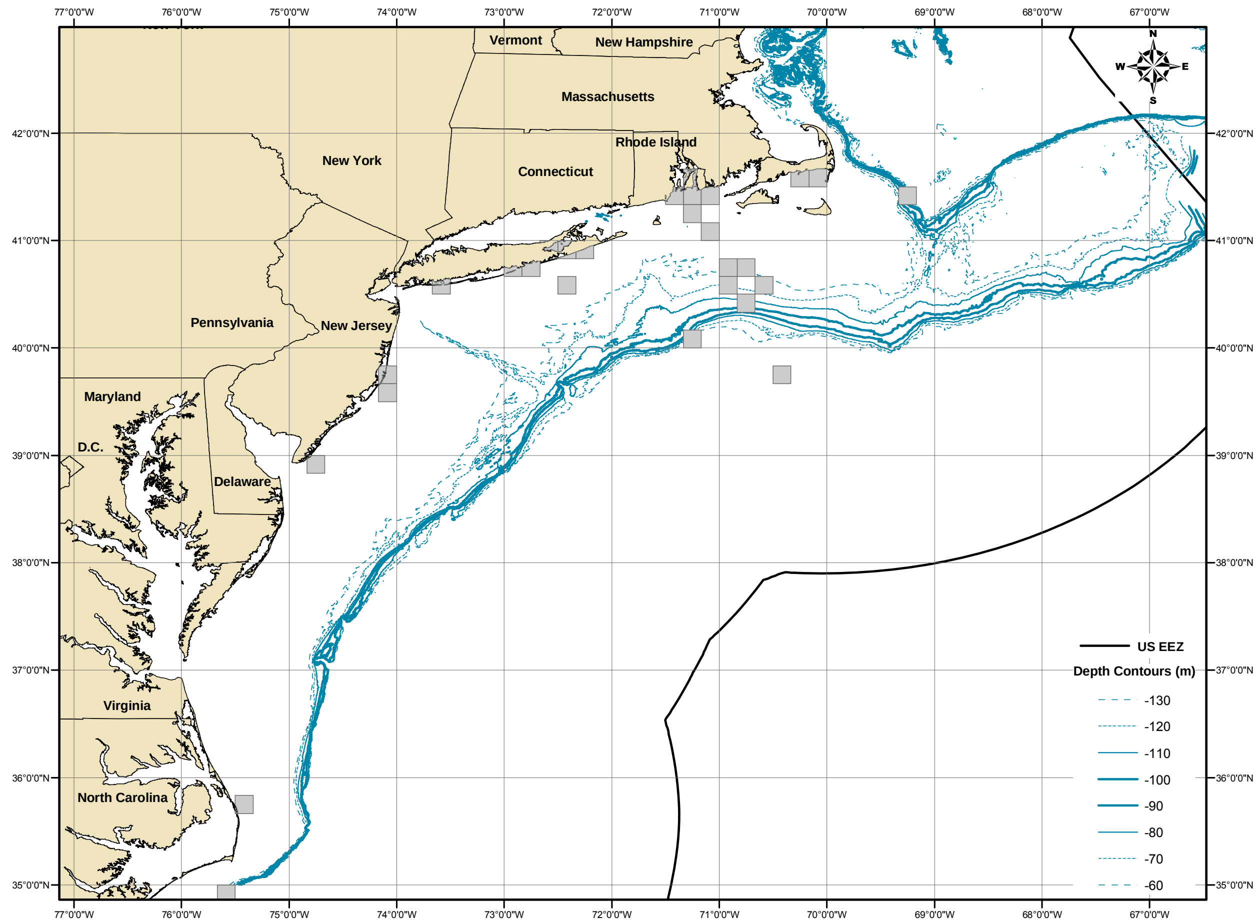


Figure 46. The distribution of floating trap use in the directed butterfish fishery based on VTR data (1996-2004).

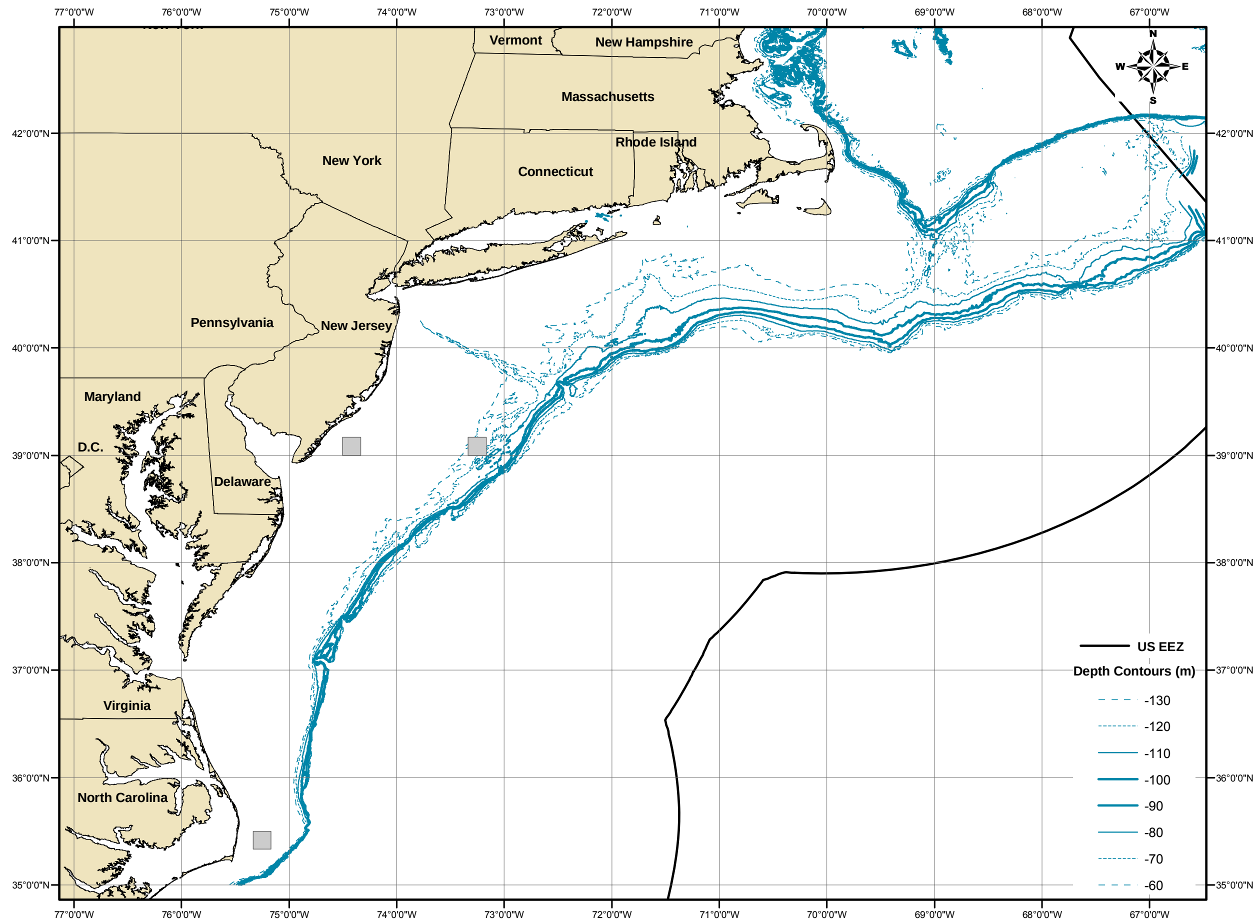


Figure 47. The distribution of mid-water otter trawl use in the directed butterfish fishery based on VTR data (1996-2004).

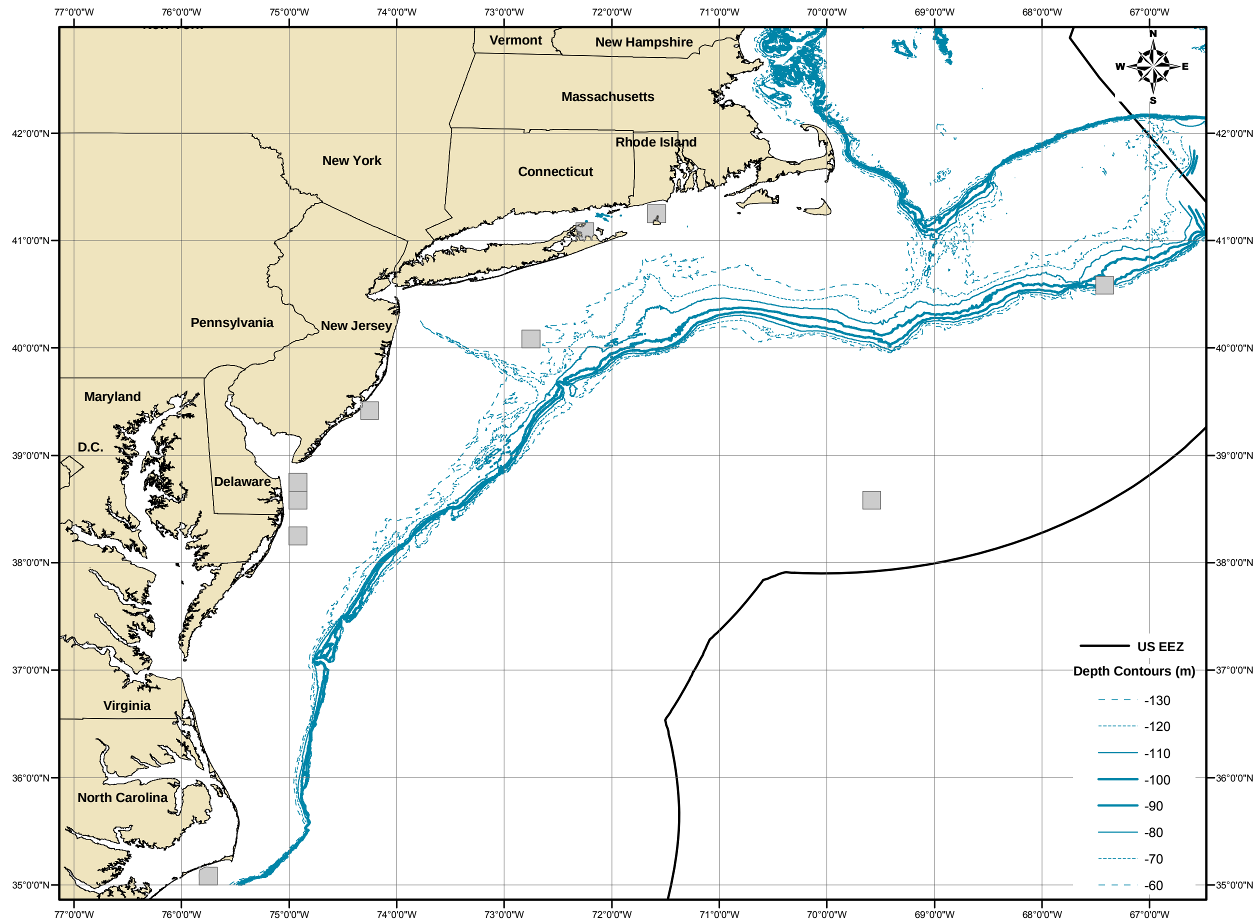


Figure 48. The distribution of other fishing gear types used in the directed butterfish fishery based on VTR data (1996-2004).

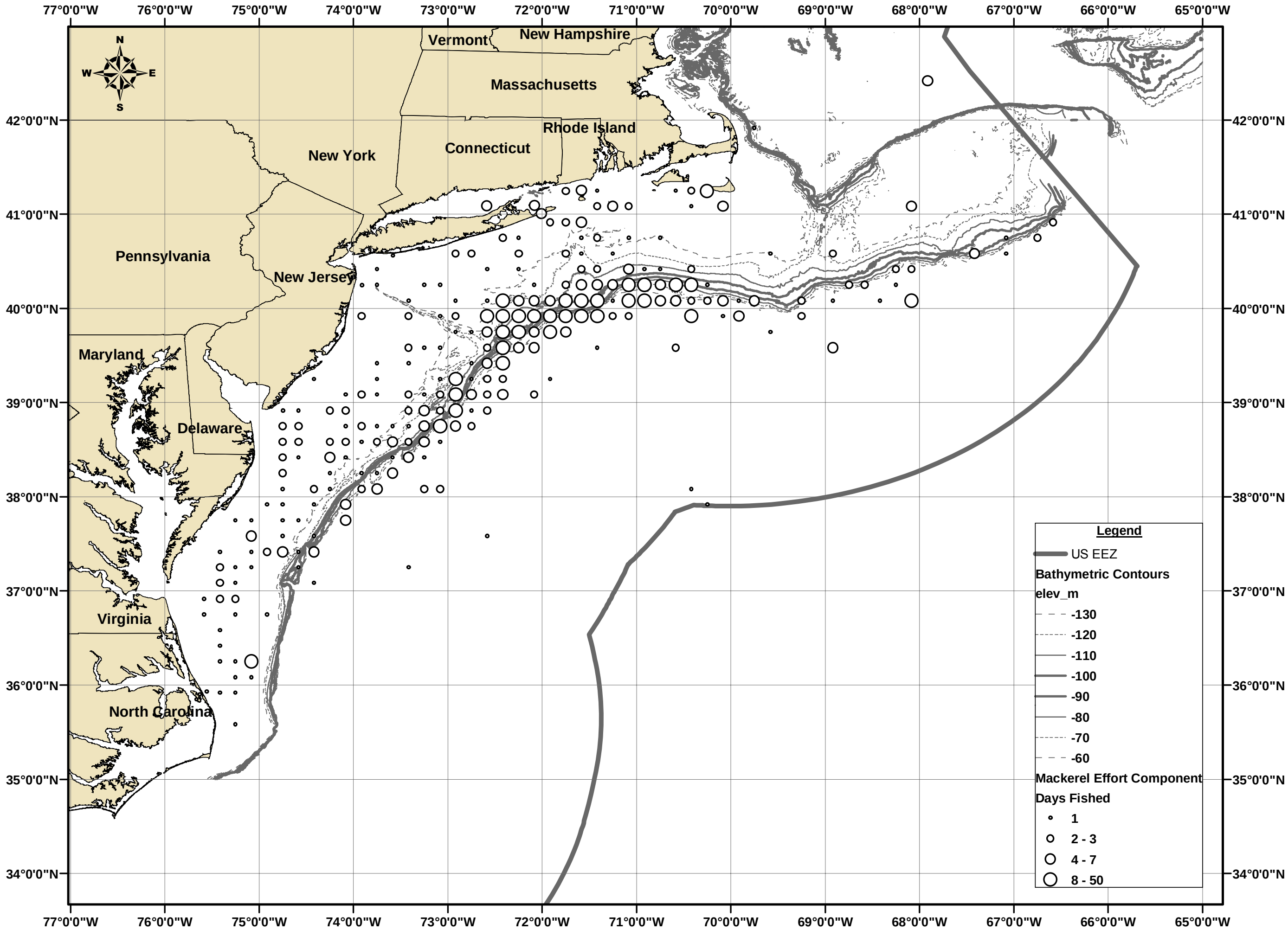


Figure 49. Atlantic mackerel effort overlap component, calculated as days fished by ten minute square, with bottom otter trawls in the Atlantic mackerel directed fishery based on VTR data, 1996 to 2004.

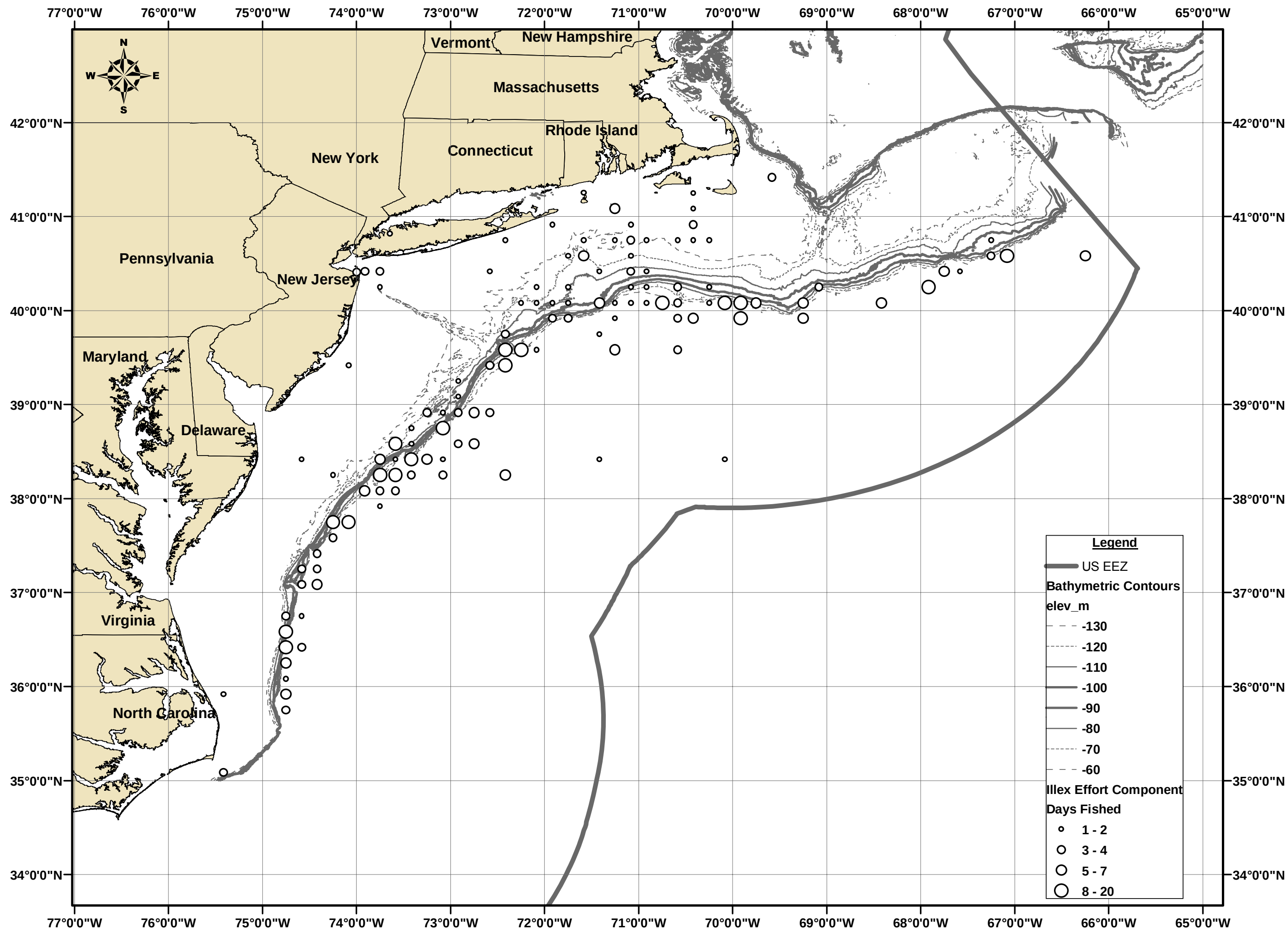


Figure 50. *Illex* effort overlap component, calculated as days fished by ten minute square with bottom otter trawls in the *Illex* directed fishery based on VTR data, 1996 to 2004.

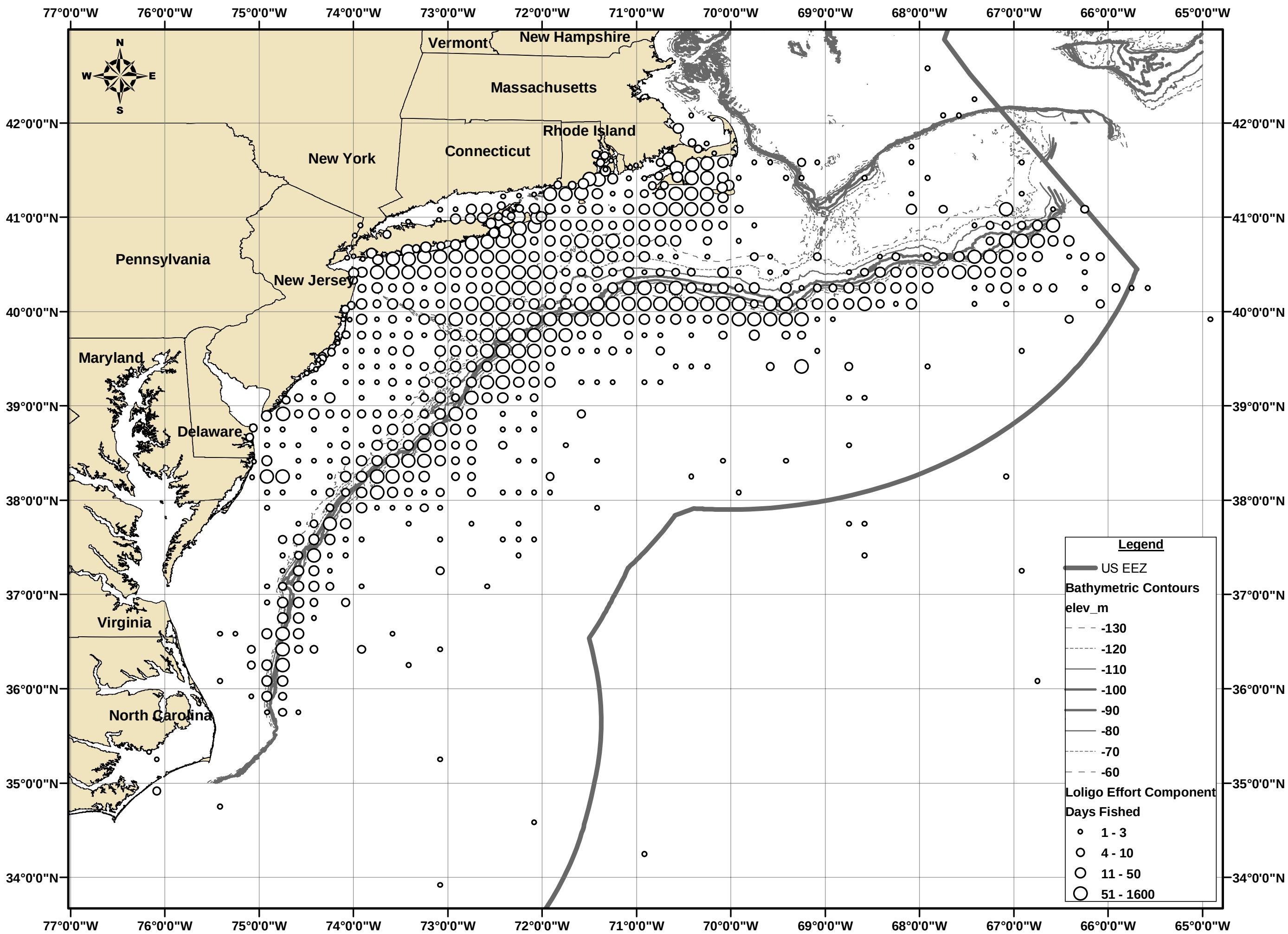


Figure 51. *Loligo* effort overlap component, calculated as days fished by ten minute square with bottom otter trawls in the *Loligo* directed fishery based on VTR data, 1996 to 2004.

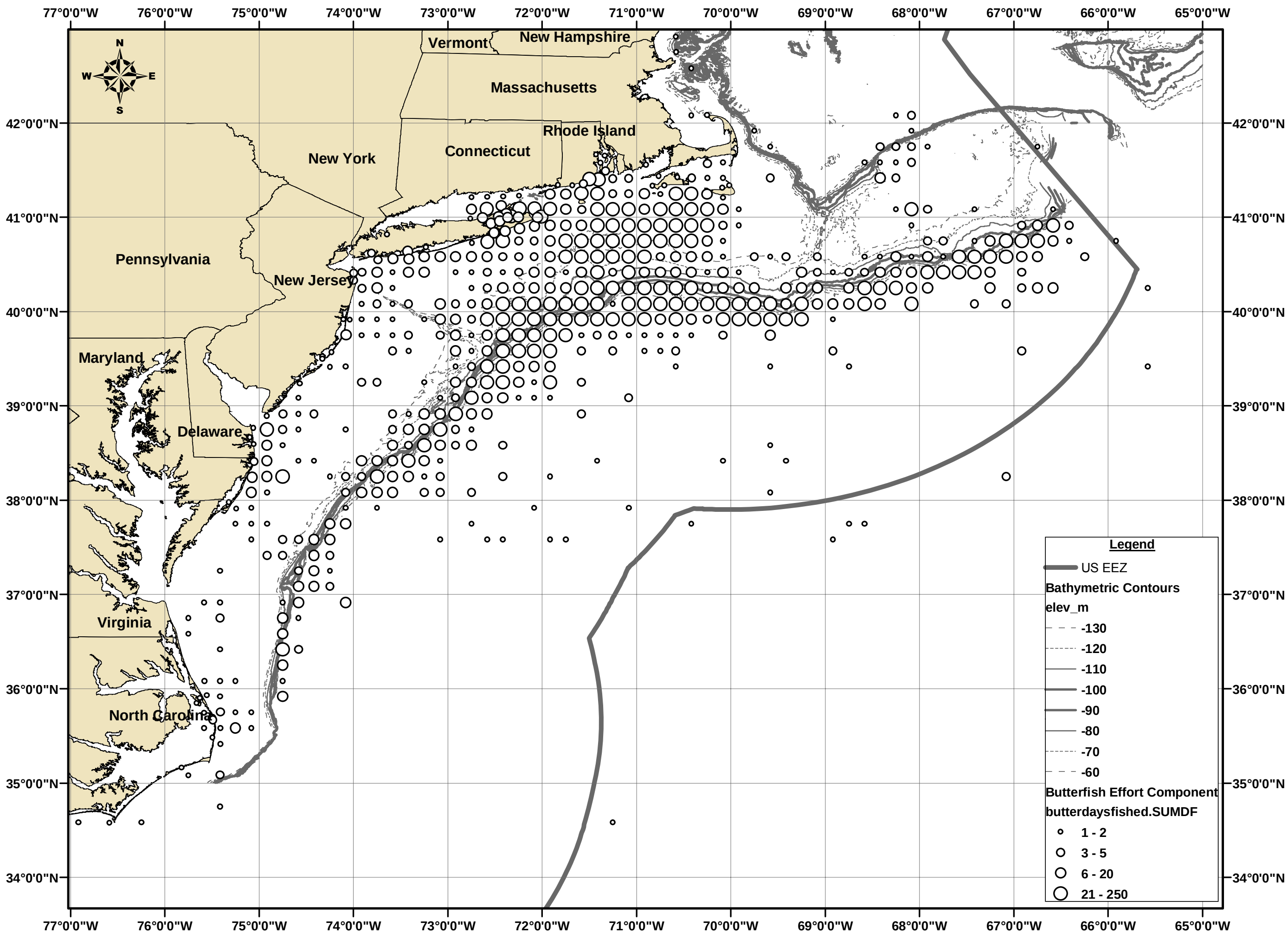


Figure 52. Butterfish effort overlap component, calculated as days fished by ten minute square with bottom otter trawls in the butterfish directed fishery based on VTR data, 1996 to 2004.

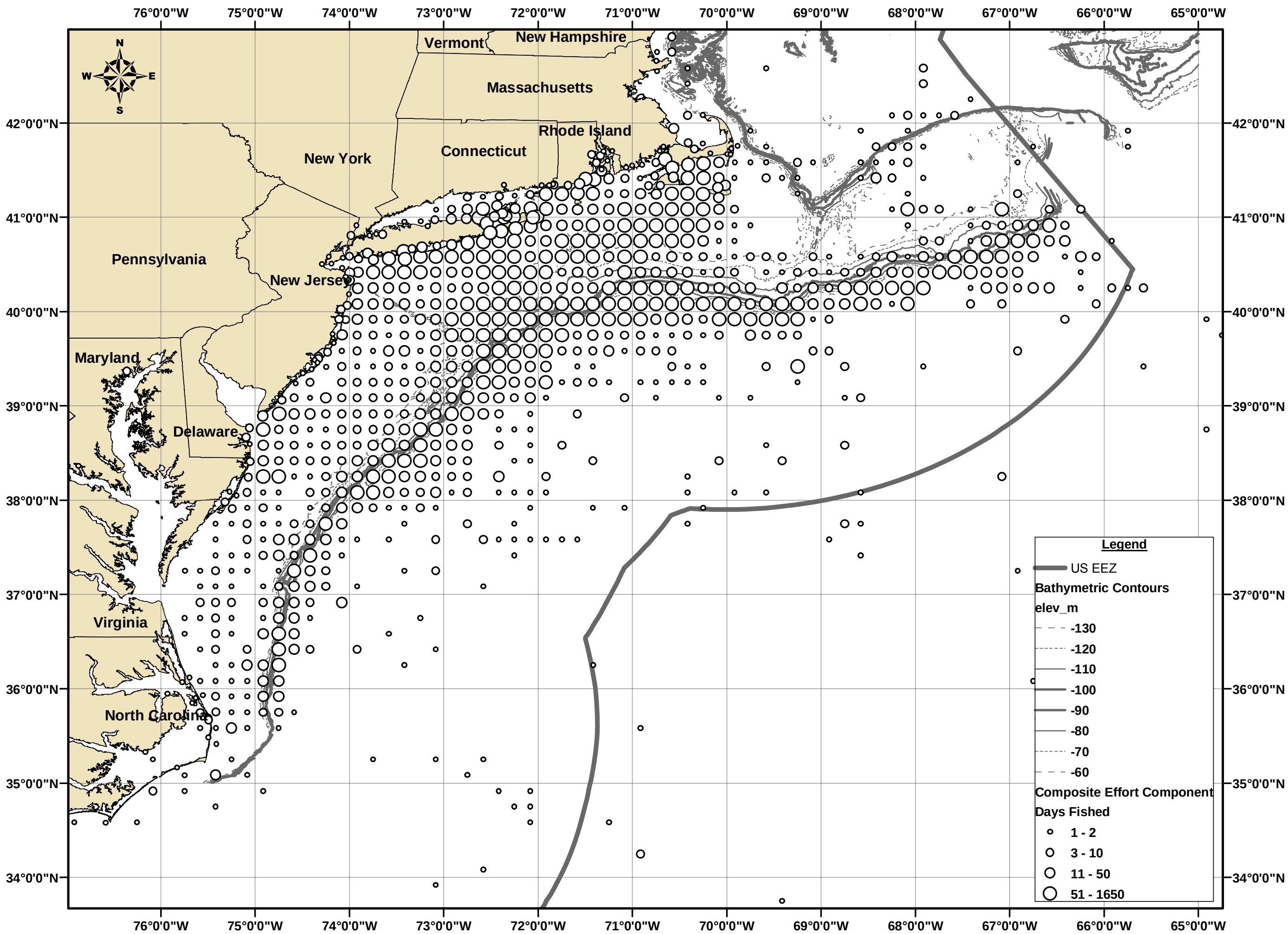


Figure 53. Composite effort overlap component, calculated as days fished by ten minute square with bottom otter trawls in the Atlantic mackerel, *Illex*, *Loligo*, and butterfish directed fisheries based on VTR data, 1996 to 2004.

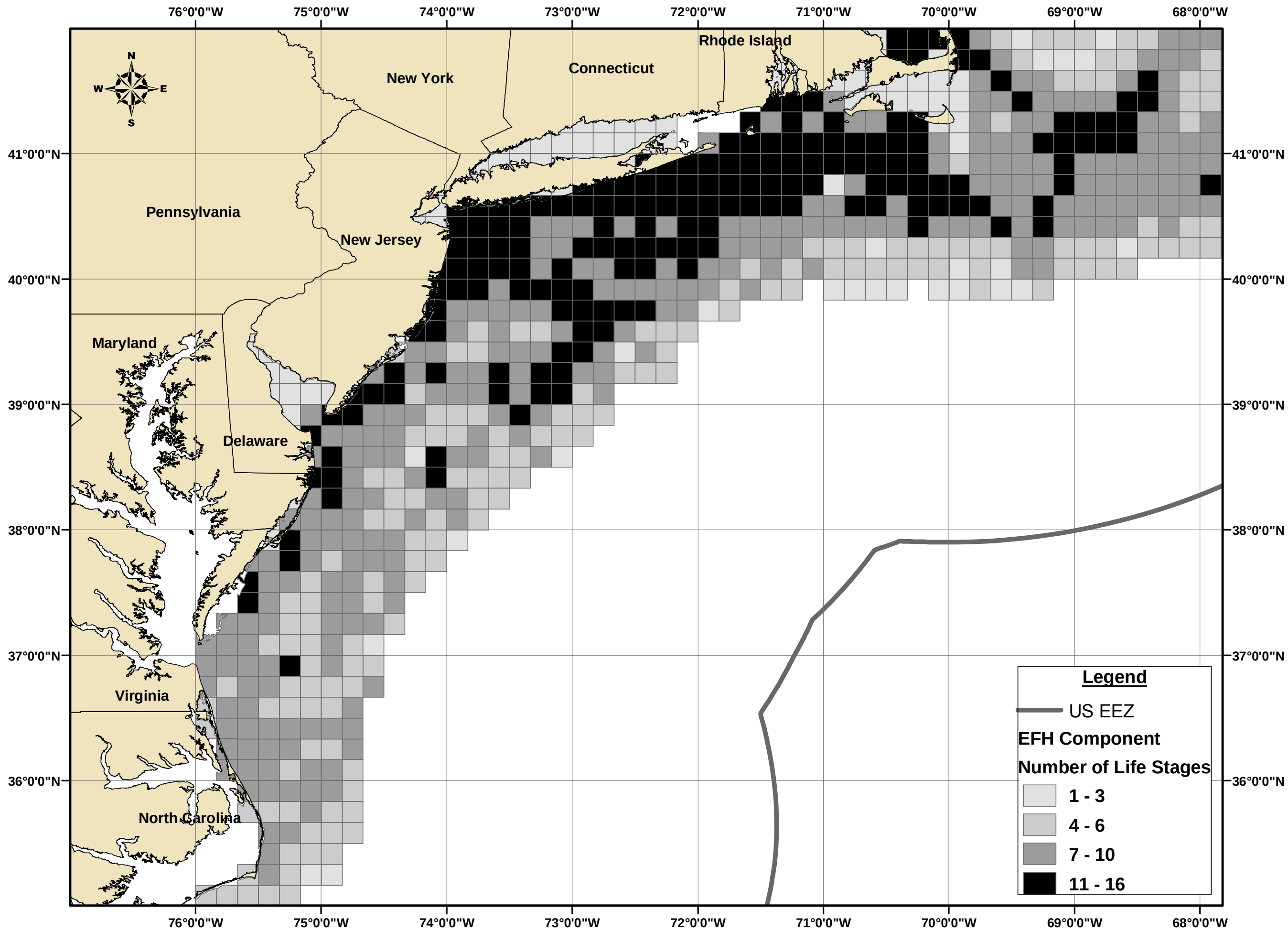


Figure 54. EFH overlap component, defined as the total number of EFH life stages designated by ten minute squares, that overlap with the Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries, and have at least one life stage greater than minimally vulnerable.

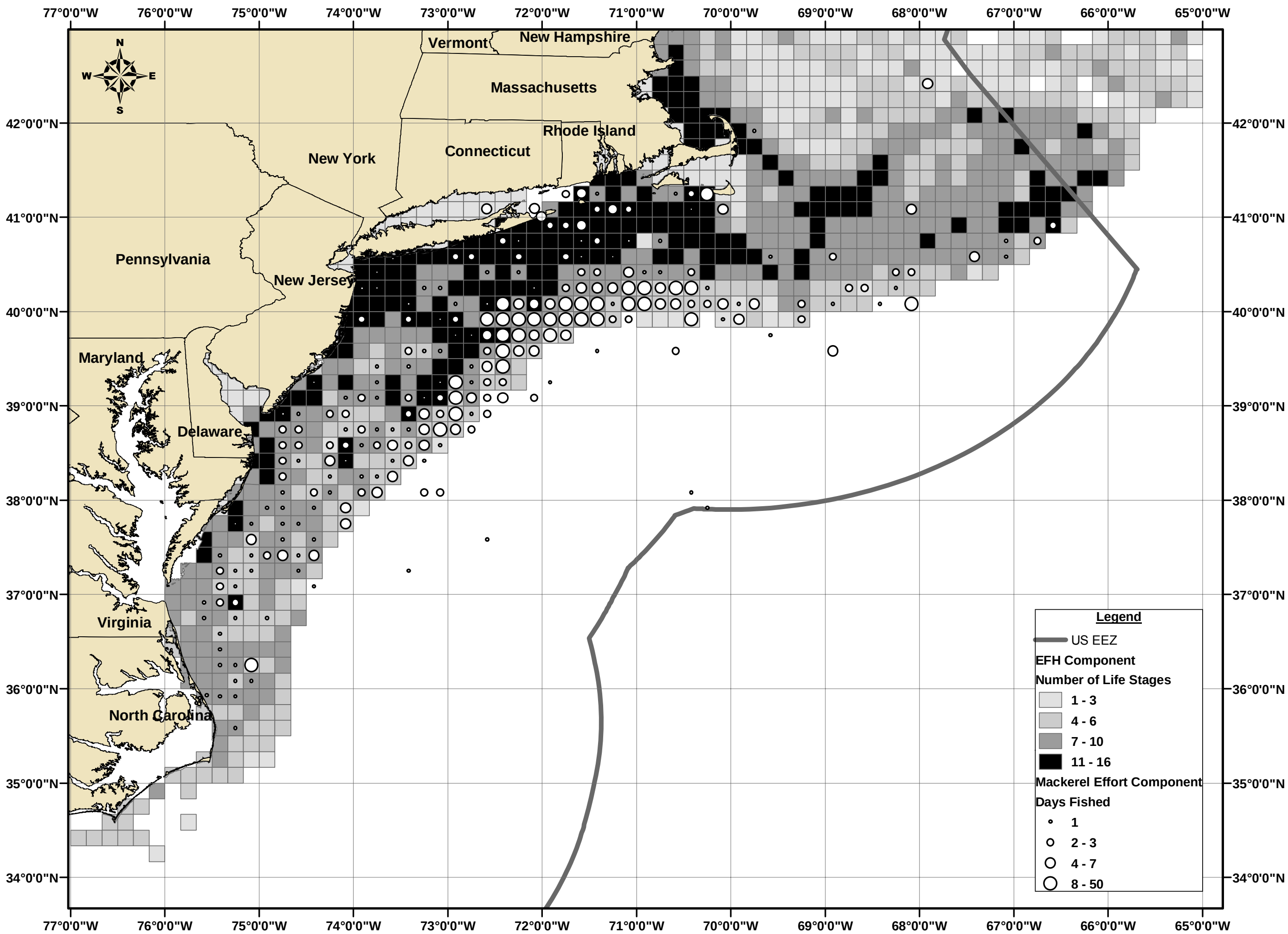


Figure 55. Comparison of the EFH overlap component and the Atlantic mackerel effort overlap component.

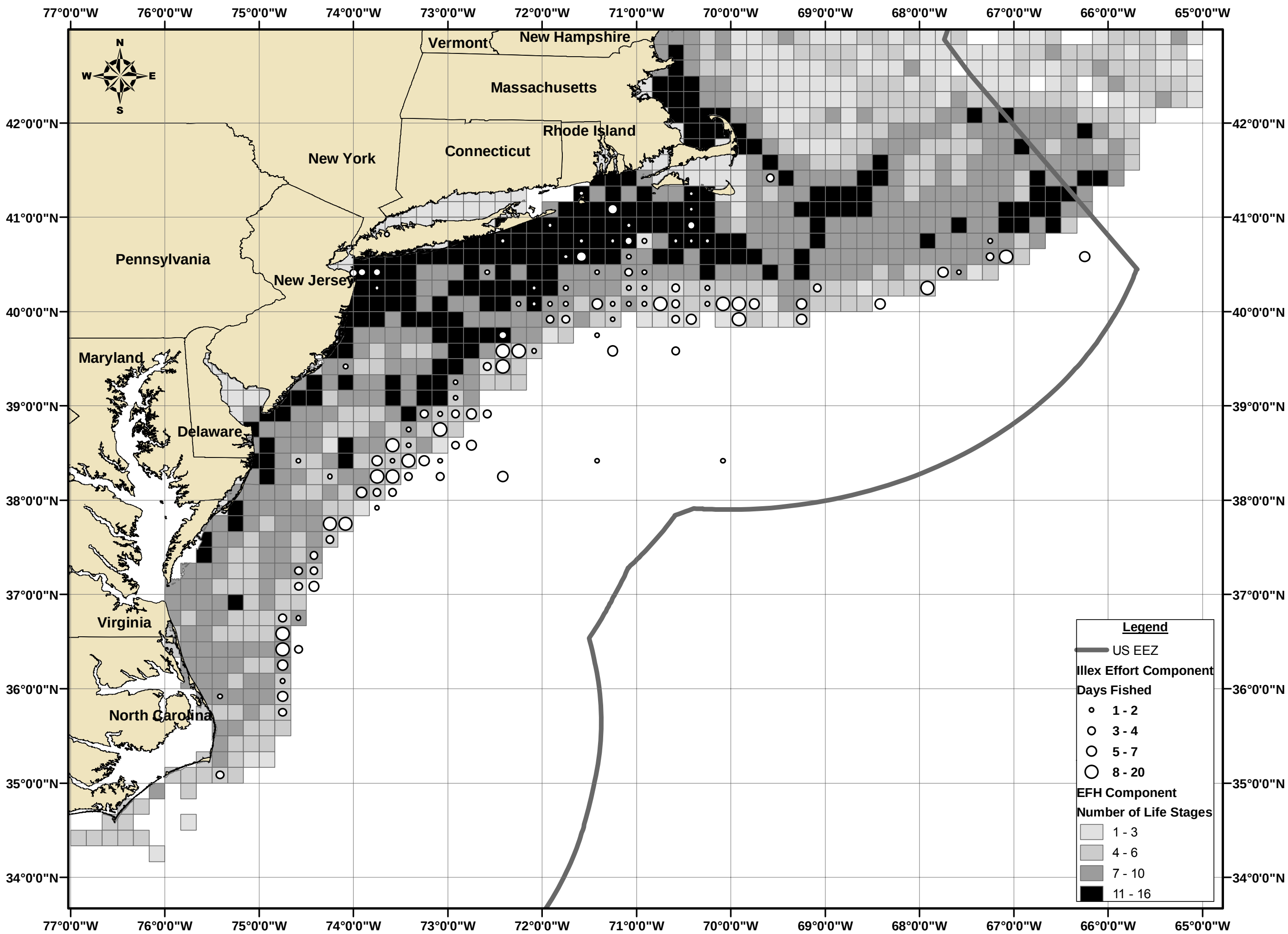


Figure 56. Comparison of the EFH overlap component and the *Illex* effort overlap component.

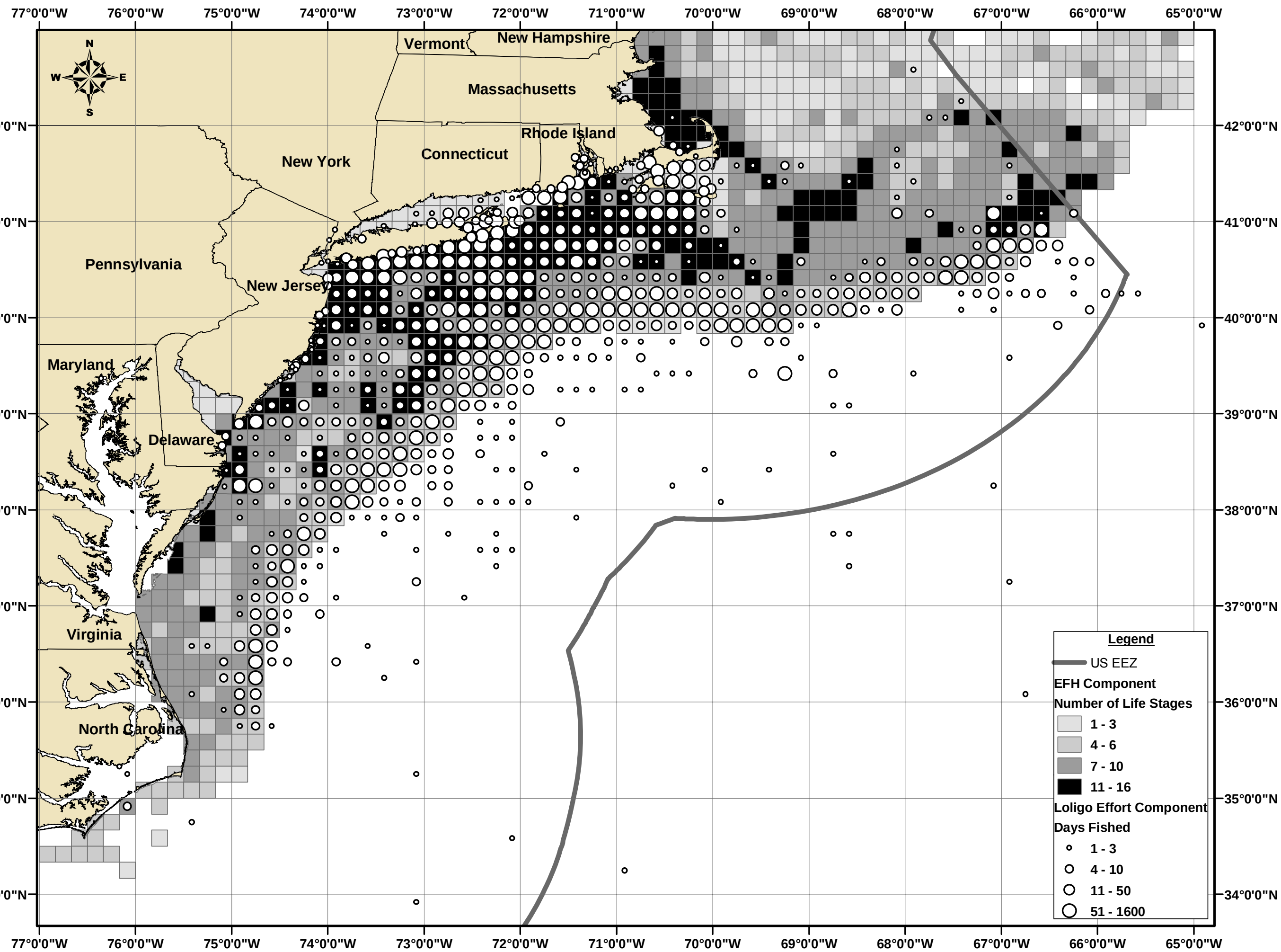


Figure 57. Comparison of the EFH overlap component and the *Loligo* effort overlap component.

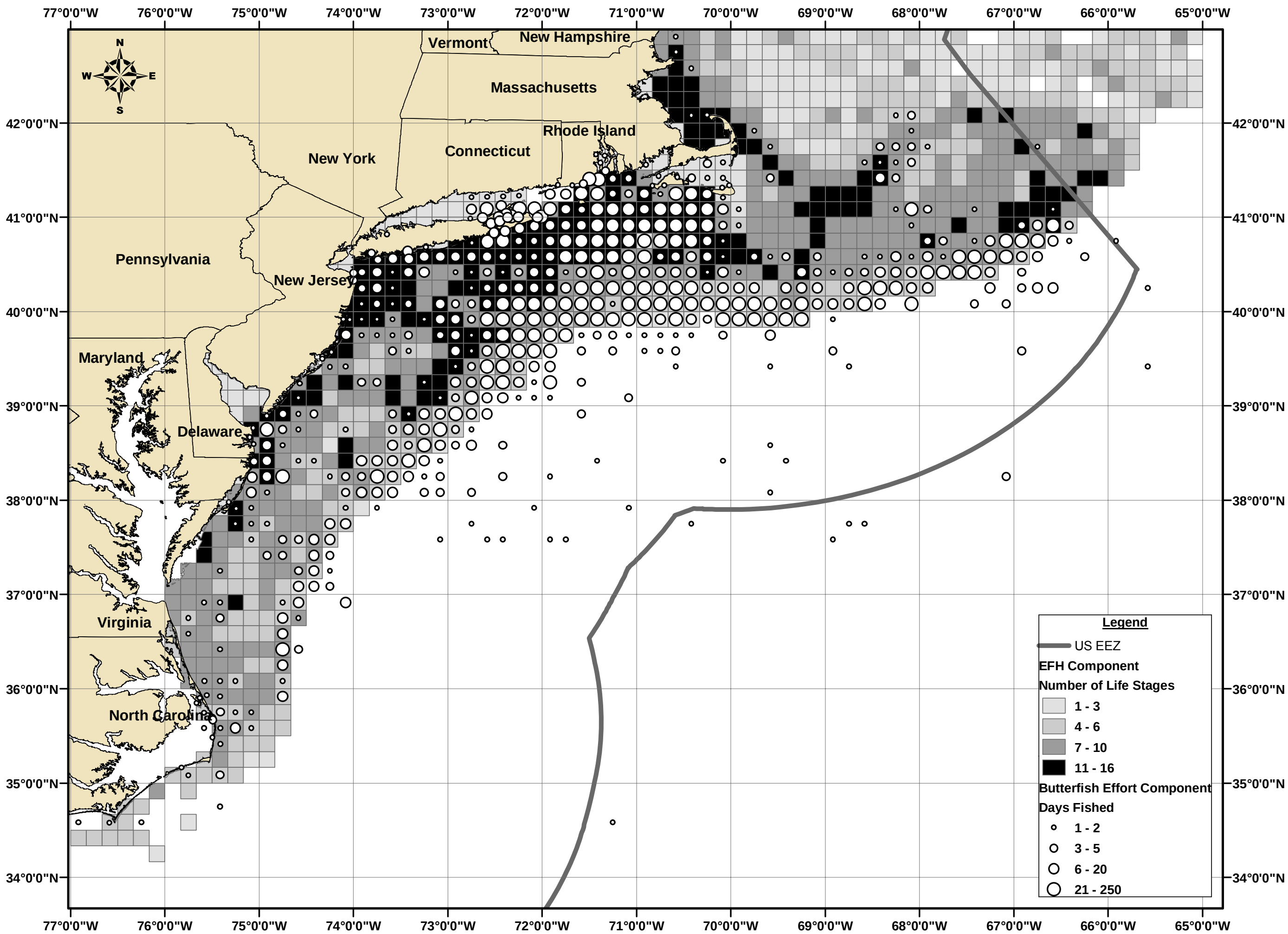


Figure 58. Comparison of the EFH overlap component and the butterfish effort overlap component.

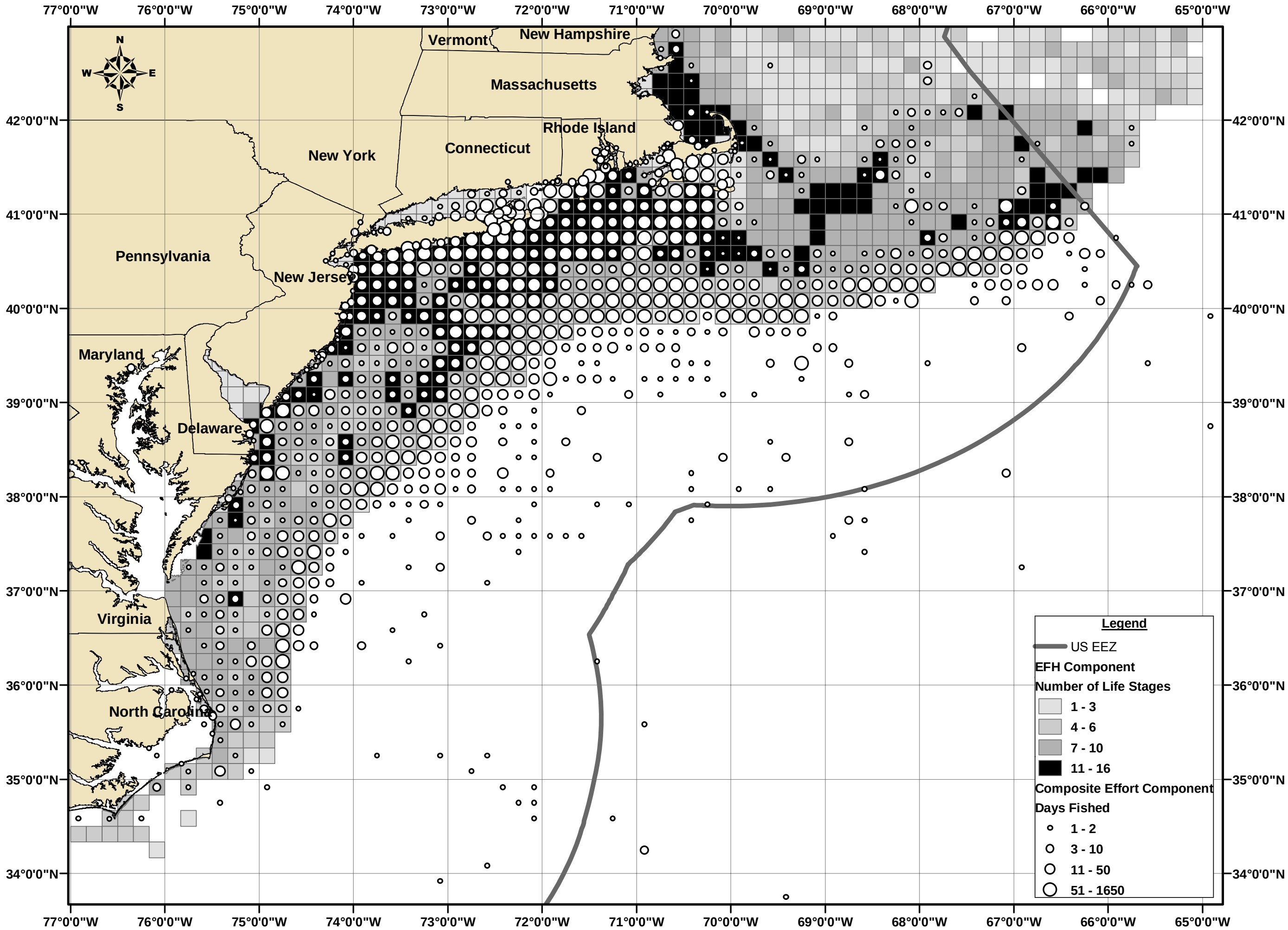


Figure 59. Comparison of the EFH overlap component and the composite effort overlap component.

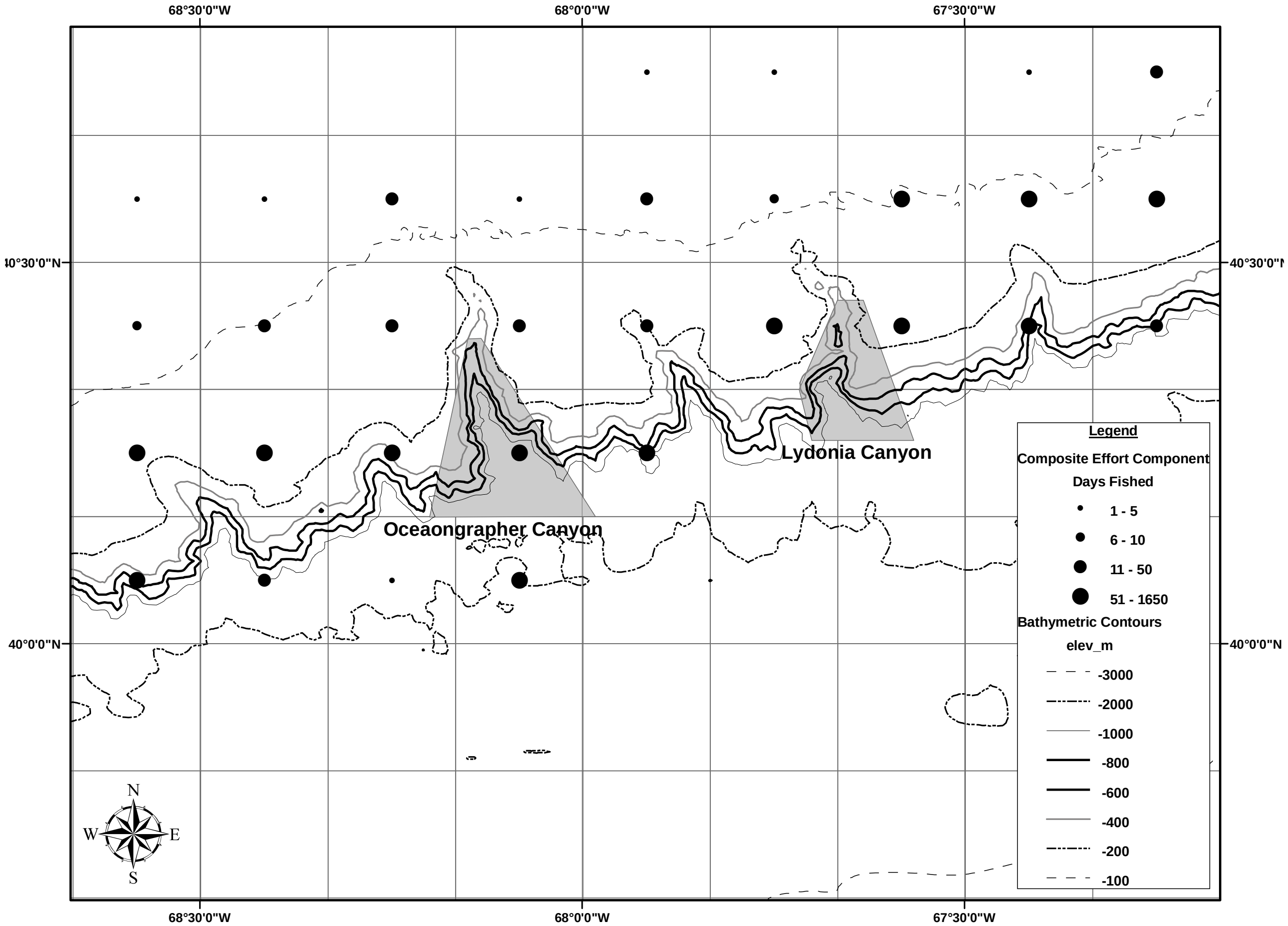


Figure 60. Distribution of the composite effort component relative to Lydonia and Oceanographer Canyons proposed alternative 5D GRAs.

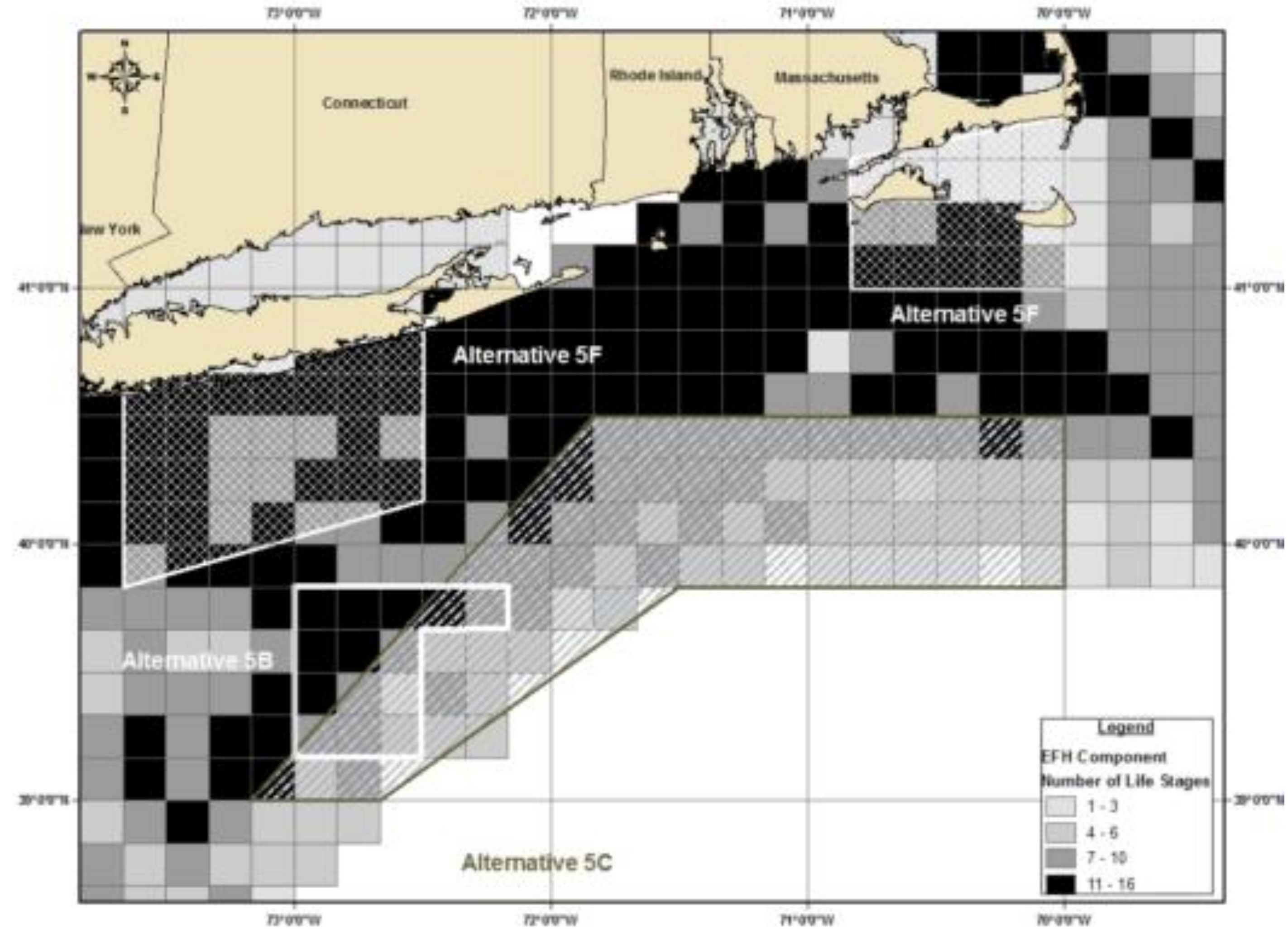


Figure 61. The EFH overlap component (as defined in section 6.4.4.1) and three of the proposed bottom otter trawl GRAs for the Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries associated with alternative 5B, 5C, and 5F.

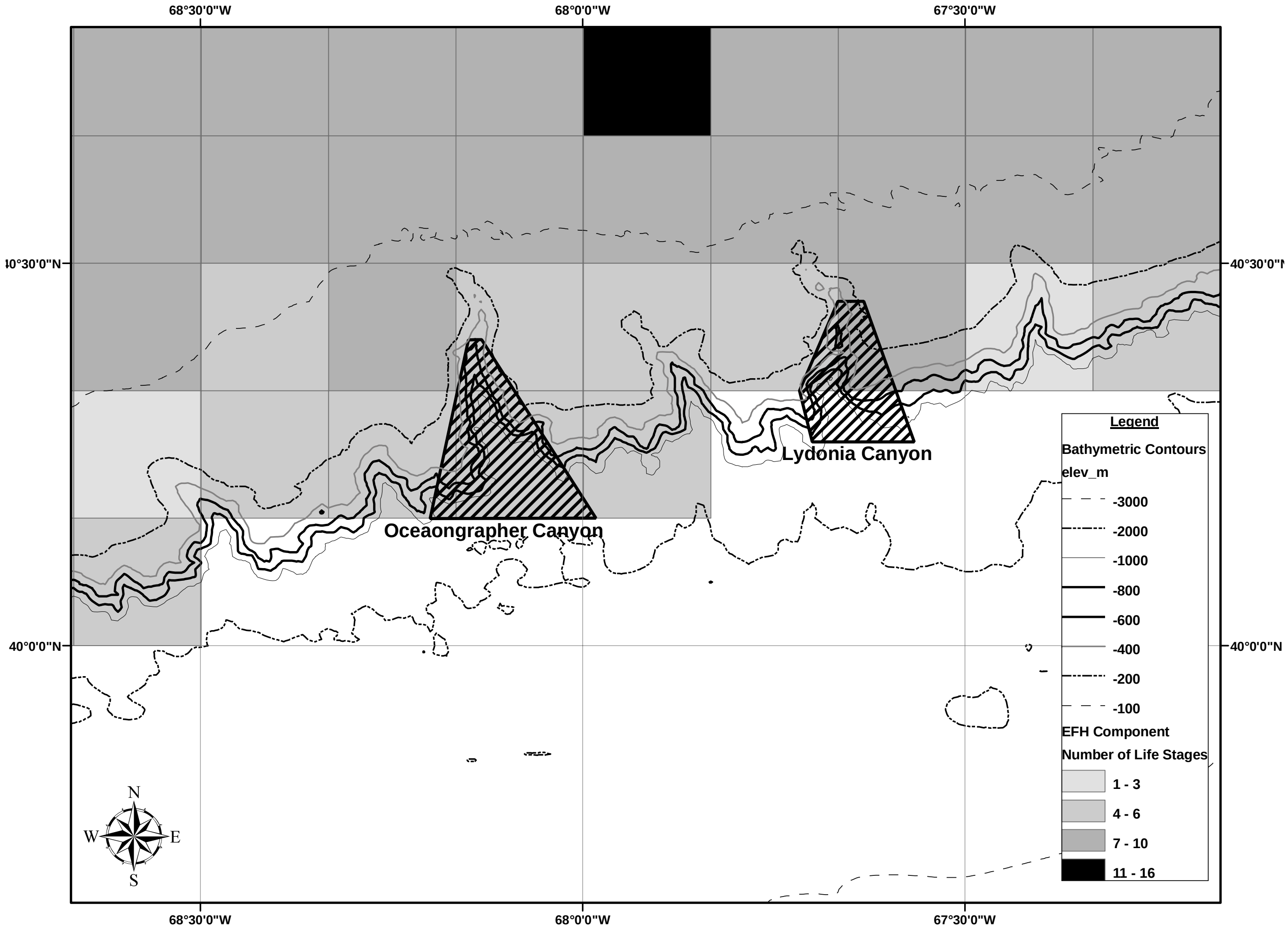


Figure 62. The EFH overlap component and proposed bottom otter trawl GRAs for the Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries associated with alternative 5D.

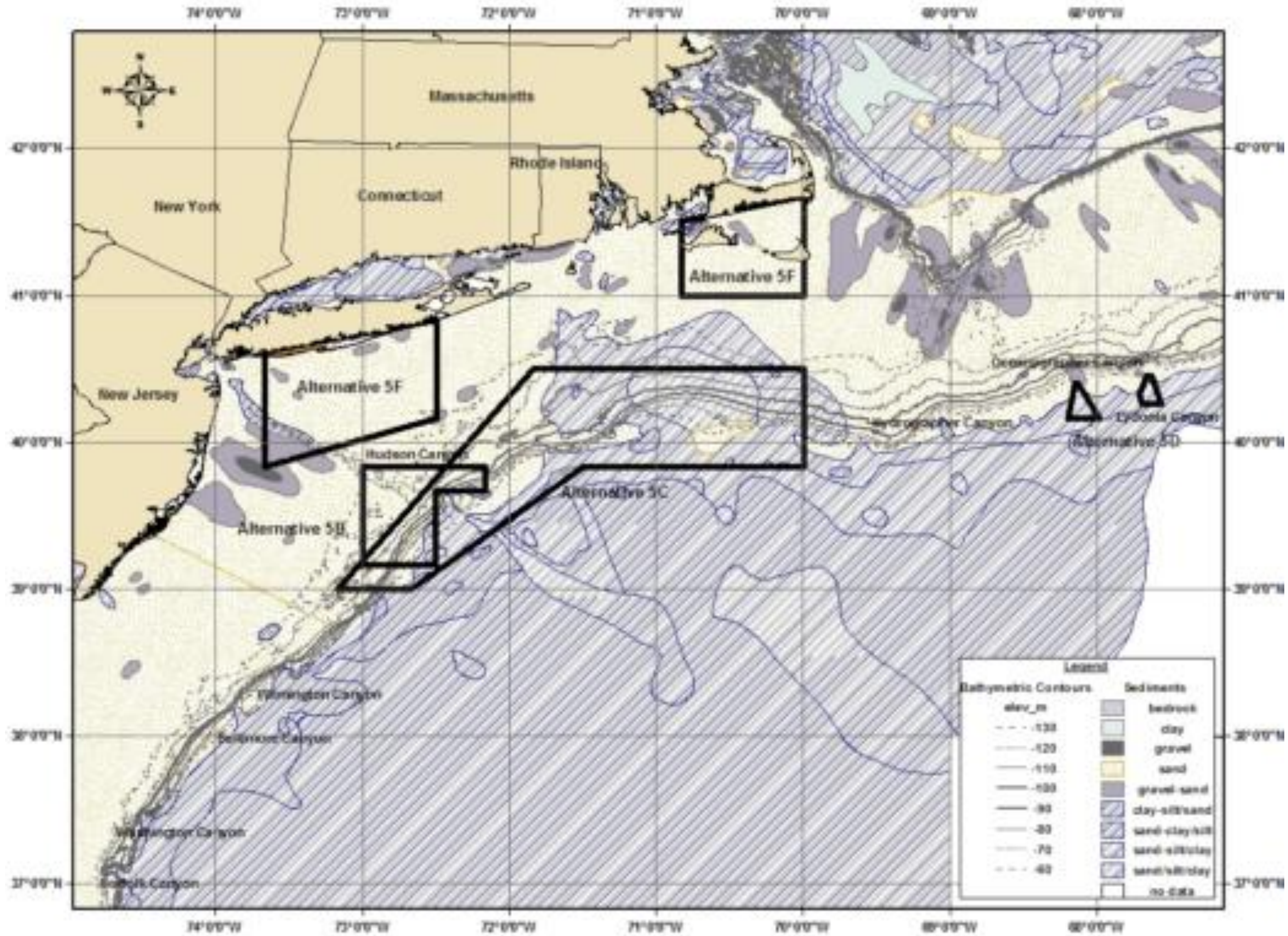


Figure 63. Distribution of sediment types for Alternatives 5B to 5F, based on sediment data that was interpolated by Poppe and Polloni (2000).

6.4 Endangered and Protected Species

There are numerous species which inhabit the environment within the management unit of this FMP that are afforded protection under the Endangered Species Act (ESA) of 1973 (i.e., for those designated as threatened or endangered) and/or the Marine Mammal Protection Act of 1972 (MMPA). Eleven are classified as endangered or threatened under the ESA, while the rest are protected by the provisions of the MMPA. The subset of these species that are known to have interacted with the SMB fisheries is provided in this document section. The Council has determined that the following list of species protected either by the Endangered Species Act of 1973 (ESA), the Marine Mammal Protection Act of 1972 (MMPA), or the Migratory Bird Act of 1918 may be found in the environment utilized by Atlantic mackerel, squid and butterfish fisheries:

* = Known to have interacted with SMB fisheries

Cetaceans

Species	Status
Northern right whale (*Eubalaena glacialis*)	Endangered
Humpback whale (*Megaptera novaeangliae*)	Endangered
Fin whale (*Balaenoptera physalus*)	Endangered
Blue whale (*Balaenoptera musculus*)	Endangered
Sei whale (*Balaenoptera borealis*)	Endangered
Sperm whale (*Physeter macrocephalus*	Endangered
Minke whale (*Balaenoptera acutorostrata*)	Protected
Beaked whales (*Ziphius and Mesoplodon spp*.)	Protected
Risso's dolphin (*Grampus griseus*)	Protected
*Pilot whale (*Globicephala spp*.)	Protected
*White-sided dolphin (*Lagenorhynchus acutus*)	Protected
*Common dolphin (*Delphinus delphis*)	Protected
Spotted and striped dolphins (*Stenella spp*.)	Protected
Bottlenose dolphin (*Tursiops truncatus*)	Protected

Sea Turtles

Species	Status
*Leatherback sea turtle (*Dermochelys coriacea*)	Endangered
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered
Green sea turtle (*Chelonia mydas*)	Endangered
Hawksbill sea turtle (*Eretmochelys imbricata*)	Endangered
*Loggerhead sea turtle (*Caretta caretta*)	Threatened

Fish

Species	Status
Shortnose sturgeon (*Acipenser brevirostrum*)	Endangered
Atlantic salmon (*Salmo salar*)	Endangered
Smalltooth sawfish (*Pristis pectinata*)	Endangered

Birds

Species	Status
Roseate tern (*Sterna dougallii dougallii*)	Endangered
Piping plover (*Charadrius melodus*)	Endangered

Critical Habitat Designations

Species	Area
Right whale	Cape Cod Bay

Protected Species Interactions with the Managed Resources – Includes Fishery Classification under Section 118 of Marine Mammal Protection Act

Species	Status
Common dolphin (*Delphinus delphis*)	Protected
White-sided dolphin (*Lagenorhynchus acutus*)	Protected
Pilot whale (*Globicephala spp.*)	Protected
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered
Loggerhead sea turtle (*Caretta caretta*)	Threatened

Under section 118 of the MMPA, the NMFS must publish and annually update the List of Fisheries (LOF), which places all US commercial fisheries in one of three categories based on the level of incidental serious injury and mortality of marine mammals in each fishery (arranging them according to a two tiered classification system). The categorization of a fishery in the LOF determines whether participants in that fishery may be required to comply with certain provisions of the MMPA, such as registration, observer coverage, and take reduction plan requirements. The classification criteria consists of a two tiered, stock-specific approach that first addresses the total impact of all fisheries on each marine mammal stock (Tier 1) and then addresses the impact of the individual fisheries on each stock (Tier 2). If the total annual mortality and serious injury of all fisheries that interact with a stock is less than 10% of the Potential Biological Removal (PBR) for the stock then the stock is designated as Tier 1 and all fisheries interacting with this stock would be placed in Category III. Otherwise, these fisheries are subject to categorization under Tier 2. PBR is the product of minimum population size, one-half the maximum productivity rate, and a “recovery” factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997).

Under Tier 2, individual fisheries are subject to the following categorization:

Category I. Annual mortality and serious injury of a stock in a given fishery is greater than or equal to 50% of the PBR level;

Category II. Annual mortality and serious injury of a stock in a given fishery is greater than one percent and less than 50% of the PBR level; or

Category III. Annual mortality and serious injury of a stock in a given fishery is less than one percent of the PBR level.

In Category I, there is documented information indicating a "frequent" incidental mortality and injury of marine mammals in the fishery. In Category II, there is documented information indicating an "occasional" incidental mortality and injury of marine mammals in the fishery. In Category III, there is information indicating no more than a "remote likelihood" of an incidental taking of a marine mammal in the fishery or, in the absence of information indicating the frequency of incidental taking of marine mammals, other factors such as fishing techniques, gear used, methods used to deter marine mammals, target species, seasons and areas fished, and species and distribution of marine mammals in the area suggest there is no more than a remote likelihood of an incidental take in the fishery. "Remote likelihood" means that annual mortality and serious injury of a stock in a given fishery is less than or equal to 10% of the PBR level or, that it is highly unlikely that any marine mammal will be incidentally taken by a randomly selected vessel in the fishery during a 20-day period or, in the absence of reliable information it is at the discretion of the Assistant Administrator (AA) for Fisheries to determine whether the incidental injury or mortality qualifies (or not) for a specific category.

For the 2005 List of Fisheries, NMFS has modified the name of the ‘‘Atlantic squid, mackerel, and butterfish trawl fishery’’ to the ‘‘Mid-Atlantic mid-water trawl fishery.’’ Trawl fisheries targeting squid occur mainly in southern New England and Mid-Atlantic waters and typically use small mesh otter trawls throughout the water column. Trawl fisheries targeting mackerel occur mainly in southern New England and Mid-Atlantic waters and generally operate in mid-water. Butterfish are predominately caught incidental to directed squid and mackerel trawl fisheries. There have been frequent interactions documented between this fishery and several species/stocks of marine mammals and, thus, the fishery is currently classified as a Category I fishery. NMFS is proposing to modify the name of this fishery in order to appropriately classify all similar mid-water trawl fisheries operating in the Mid-Atlantic region, with home ports between New York and North Carolina that may be interacting with marine mammals.

Additionally, in the 2005 List of Fisheries, NMFS added the WNA offshore stock of bottlenose dolphins to the list of marine mammal species and stocks incidentally injured or killed by the “Mid-Atlantic mid-water trawl fishery”. Interactions between this marine mammal stock and this fishery have been documented in recent SARs. Importantly, however, this species would be added by analogy, meaning that if the ‘‘Atlantic squid, mackerel, and butterfish trawl fishery’’ is renamed to the ‘‘Mid-Atlantic mid-water trawl fishery'' it will be grouped with other midwater trawl fisheries that have documented interactions. No interactions between the WNA offshore stock of bottlenose dolphins and the directed SMB fisheries have been observed.

NMFS elevated the SMB fishery to Category I in the 2001 LOF and it has remained a Category I fishery since then. Because this fishery is a Category I fishery, it will receive a high priority with respect to observer coverage and consideration for measures under future Take Reduction Plans for any of the species listed above.

Based on data presented in the draft 2005 Stock Assessment Report (SAR), annual serious injury and mortality across all fisheries for common dolphin, white sided dolphin, and pilot whale exceeds 10% of each species PBR. PBR is 899, 364, and 247 for these "species", respectively, and the average annual mortality from all fisheries is 119, 38 and 201, respectively. With respect to the SMB fisheries, the draft 2005 SAR estimated an average annual mortality of 90 common dolphins, 0 white-sided dolphins and 21 pilot whales.

6.4.1 Description of species of concern which are protected under MMPA

The following is a description of species of concern because they are protected under MMPA and, as discussed above, have had documented interactions with fishing gears used to harvest species managed under this FMP. This following species of cetaceans are known to interact with the Atlantic Mackerel Squid and Butterfish fisheries:

Common dolphin

The common dolphin may be one of the most widely distributed species of cetaceans, as it is found worldwide in temperate, tropical, and subtropical seas. In the North Atlantic, common dolphins appear to be present along the coast over the continental shelf along the 200-2000m isobaths or over prominent underwater topography from 50° N to 40°S latitude (Evans 1994). The species is less common south of Cape Hatteras, although schools have been reported as far south as eastern Florida (Gaskin 1992). They are widespread from Cape Hatteras northeast to Georges Bank (35 to 42 North latitude) in outer continental shelf waters from mid-January to May (Hain et al. 1981; CETAP 1982; Payne et al. 1984). Common dolphins move northward onto Georges Bank and the Scotian Shelf from mid-summer to autumn (Palka et al. Unpubl. Ms.). Selzer and Payne (1988) reported very large aggregations (greater than 3,000 animals) on Georges Bank in autumn. Common dolphins are occasionally found in the Gulf of Maine, where temperature and salinity regimes are lower than on the continental slope of the Georges Bank/mid-Atlantic region (Selzer and Payne 1988). Migration onto the Scotian Shelf and continental shelf off Newfoundland occurs during summer and autumn when water temperatures exceed 11°C (Sergeant et al. 1970; Gowans and Whitehead 1995).

Total numbers of common dolphins off the USA or Canadian Atlantic coast are unknown, although several estimates from selected regions of the habitat do exist for selected time periods. As recommended in the GAMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable, therefore should not be used for PBR determinations. Further, due to changes in survey methodology these data should not be used to make comparisons to more current estimates (Waring *et al.* 2002). The best 2004 abundance estimate for common dolphins is the sum of the estimates from the two 2004 U.S. Atlantic surveys, 116,005 (CV = 0.258), where the estimate from the northern U.S. Atlantic is 85,809 (CV =0.294), and from the southern U.S. Atlantic is 30,196 (CV =0.537). This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat. The minimum population size is 93,663. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.48 because the CV of the average mortality estimate is between 0.3 and 0.6 (Wade and Angliss 1997), and because this stock is of unknown status. PBR for the western North Atlantic common dolphin is 899.

Fishery Interactions

Illex Squid No incidental takes of common dolphins have been observed in the *Illex* fishery.

Loligo Squid All incidental takes attributed to this fishery were observed during the first quarter of the year (Jan-Mar), exclusively in the offshore fishery. The estimated fishery-related mortality of common dolphins attributable to the fall/winter offshore fishery was 0 between 1997-1998, 49 in 1999 (CV=0.97), 273 in 2000 (CV=0.57), 126 in 2001 (CV=1.09) and 0 in 2002-2003. The average annual mortality between 1999-2003 was 90 common dolphins (CV=0.47). However, these estimates should be viewed with caution due to the extremely low (<1%) observer coverage.

Atlantic Mackerel The estimated fishery-related mortality attributed to this fishery was 161 (CV=0.49) animals in 1997 and 0 between 1999-2003. The average annual mortality between 1999-2003 was 0 (zero). A U.S. joint venture (JV) fishery was conducted in the mid-Atlantic region from February-May 1998. NMFS maintained 100% observer coverage on the foreign JV vessels where 152 transfers from the U.S. vessels were observed. Seventeen incidental takes of common dolphin were observed in the 1998 JV mackerel fishery. This fishery did not operate in 1999-2003.

White-sided dolphin (*Lagenorhynchus acutus*)

White-sided dolphins are found in temperate and sub-polar waters of the North Atlantic, primarily in continental shelf waters to the 100m depth contour. The species inhabits waters from central West Greenland to North Carolina (about 35° N) and perhaps as far east as 43° W (Evans 1987). Distribution of sightings, strandings and incidental takes suggest the possible existence of three stocks units: Gulf of Maine, Gulf of St. Lawrence and Labrador Sea stocks (Palka et al. 1997). Evidence for a separation between the well documented unit in the southern Gulf of Maine and a Gulf of St. Lawrence population comes from a hiatus of summer sightings along the Atlantic side of Nova Scotia. This has been reported in Gaskin (1992), is evident in Smithsonian stranding records, and was seen during abundance surveys conducted in the summers of 1995 and 1999 that covered waters from Virginia to the entrance of the Gulf of St. Lawrence. White-sided dolphins were seen frequently in Gulf of Maine waters and in waters at the mouth of the Gulf of

St. Lawrence, but only a few sightings were recorded between these two regions. The Gulf of Maine stock of white sided dolphins is most common in continental shelf waters from Hudson Canyon (approximately 39°N) north through Georges Bank, and in the Gulf of Maine to the lower Bay of Fundy. Sightings data indicate seasonal shifts in distribution (Northridge et al. 1997). During January to May, low numbers of white-sided dolphins are found from Georges Bank to Jeffreys Ledge (off New Hampshire), and even lower numbers are south of Georges Bank, as documented by a few strandings collected on beaches of Virginia and North Carolina. From June through September, large numbers of white-sided dolphins are found from Georges Bank to lower Bay of Fundy. From October to December, white-sided dolphins occur at intermediate densities from southern Georges Bank to southern Gulf of Maine (Payne and Heinemann 1990). Sightings south of Georges Bank, particularly around Hudson Canyon, have been seen at all times of the year but at low densities. The Virginia and North Carolina observations appear to represent the southern extent of the species range. Prior to the 1970's, white-sided dolphins in U.S. waters were found primarily offshore on the continental slope, while whitebeaked dolphins (L. albirostris) were found on the continental shelf. During the 1970's, there was an apparent switch in habitat use between these two species. This shift may have been a result of the decrease in herring and increase in sand lance in the continental shelf waters (Katona et al. 1993; Kenney et al. 1996).

The total number of white-sided dolphins along the eastern USA and Canadian Atlantic coast is unknown, although the best available current abundance estimate for white-sided dolphins in the Gulf of Maine stock is 51,640 (CV=0.38) as estimated from the July to August 1999 line transect survey because this survey is recent and provided the most complete coverage of the known habitat. The minimum population size is 37,904. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for endangered, depleted, threatened, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.48 because this stock is of unknown status and the CV of the mortality estimate is between 0.3 and 0.6. PBR for the Gulf of Maine stock of the western North Atlantic white-sided dolphin is 364.

Fishery Interactions

<u>*Illex* squid</u> No white-sided dolphin takes have been observed taken incidental to *Illex* squid fishing operations since 1996.

<u>*Loligo* squid</u> No white-sided dolphin takes have been observed taken incidental to *Loligo* squid fishing operations since 1996.

<u>Atlantic mackerel</u> NMFS observers in the Atlantic foreign mackerel fishery reported 44 takes of Atlantic white-sided dolphins incidental to fishing activities in the continental shelf and continental slope waters between March 1977 and December 1991 (Waring et al. 1990; NMFS unpublished data). This total includes 9 documented takes by U.S. vessels involved in joint-venture fishing operations in which U.S. captains transfer their catches to foreign processing vessels. No incidental takes of white-sided dolphin were observed in the Atlantic mackerel JV fishery when it was observed in 1998. One white-sided dolphin incidental take was observed in 1997 and none since then.

Long-finned (*Globicephala melas*) and short-finned (*Globicephala macrorhynchus*) pilot whales

There are two species of pilot whales in the Western Atlantic - the Atlantic (or long-finned) pilot whale, *Globicephala melas*, and the short-finned pilot whale, *G. macrorhynchus*. These species are difficult to identify to the species level at sea; therefore, the descriptive material below refers to *Globicephala* sp., and is identified as such. The species boundary is considered to be in the New Jersey to Cape Hatteras area. Sightings north of this are likely *G. melas*. Pilot whales (*Globicephala* sp.) are distributed principally along the continental shelf edge in the winter and early spring off the northeast USA coast, (CETAP 1982; Payne and Heinemann 1993). In late spring, pilot whales move onto Georges Bank and into the Gulf of Maine and more northern waters, and remain in these areas through late autumn (CETAP 1982; Payne and Heinemann 1993). In general, pilot whales occupy areas of high relief or submerged banks. They are also associated with the Gulf Stream north wall and thermal fronts along the continental shelf edge (Waring *et al.* 1992; Waring *et al.* 2002).

The long-finned pilot whale is distributed from North Carolina to North Africa (and the Mediterranean) and north to Iceland, Greenland and the Barents Sea (Leatherwood *et al.* 1976; Abend 1993; Buckland *et al.* 1993). The stock structure of the North Atlantic population is uncertain (Fullard *et al.* 2000). Recent morphometrics and genetics (Siemann 1994; Fullard *et al.* 2000) studies have provided little support for stock structure across the Atlantic (Fullard *et al.* 2000). However, Fullard *et al.* (2000) have proposed a stock structure that is correlated to sea surface temperature: 1) a cold-water population west of the Labrador/North Atlantic current and 2) a warm-water population that extends across the Atlantic in the Gulf Stream (Waring *et al.* 2002).

The short-finned pilot whale is distributed worldwide in tropical to warm temperate water (Leatherwood and Reeves 1983). The northern extent of the range of this species within the USA Atlantic Exclusive Economic Zone (EEZ) is generally thought to be Cape Hatteras, North Carolina (Leatherwood and Reeves 1983). Sightings of these animals in US Atlantic EEZ occur primarily within the Gulf Stream [Southeast Fisheries Science Center (SEFSC) unpublished data], and along the continental shelf and continental slope in the northern Gulf of Mexico. There is no information on stock differentiation for the Atlantic population (Waring *et al.* 2002).

The total number of pilot whales off the eastern USA and Canadian Atlantic coast is unknown, although the best 2004 abundance estimate for *Globicephala sp.* is the sum of the estimates from the two 2004 U.S. Atlantic surveys, 30,847 (CV =0.269), where the estimate from the northern U.S. Atlantic is 15,436 (CV =0.325) , and from the southern U.S. Atlantic is 15,411 (CV =0.428). This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat. The minimum population size for *Globicephala sp.* is 24,697. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.50 because the CV of the average mortality estimate is less than 0.3 (Wade and Angliss 1997) and because this stock is of unknown status. PBR for the western North Atlantic *Globicephala sp.* is 247.

Fishery Interactions

Illex Squid Since 1996, 45% of all pilot whale takes observed were caught incidental to *Illex* squid fishing operations; 1 in 1996, 1 in 1998 and 2 in 2000. Annual observer coverage of this fishery has varied widely and reflects only the months when the fishery is active. The estimated fishery-related mortality of pilot whales attributable to this fishery was: 45 in 1996 (CV=1.27), 0 in 1997, 85 in 1998 (CV=0.65), 0 in 1999, 34 in 2000 (CV=0.65), unknown in 2001-2002 due to no observer coverage, and 0 in 2003. The average annual mortality between 1999-2003 was 11 pilot whales (CV=0.65).

Loligo Squid Only one pilot whale incidental take has been observed in *Loligo* squid fishing operations since 1996. The one take was observed in 1999 in the offshore fishery. No pilot whale takes have been observed in the inshore fishery. The estimated fishery-related mortality of pilot whales attributable to the fall/winter offshore fishery was 0 between 1996 and 1998, 49 in 1999 (CV=0.97) and 0 between 2000 and 2003. The average annual mortality between 1999-2003 was 10 pilot whales (CV=0.97). However, these estimates should be viewed with caution due to the extremely low (<1%) observer coverage.

Atlantic Mackerel No incidental takes of pilot whales have been observed in the mackerel fishery. The former distant water fleet fishery has been non-existent since 1977. There is also a mackerel trawl fishery in the Gulf of Maine that generally occurs during the summer and fall months (May-December) (Clark ed. 1998). There have been no observed incidental takes of pilot whales reported for the Gulf of Maine fishery.

6.4.2 Description of Turtle Species with Documented Interactions with the SMB Fisheries

Leatherback sea turtles (*Dermochelys coriacea*)

Leatherback turtles are widely distributed throughout the oceans of the world, and are found in waters of the Atlantic, Pacific, Caribbean, and the Gulf of Mexico (Ernst and Barbour 1972). The leatherback sea turtle is the largest living turtle and ranges farther than any other sea turtle species, exhibiting broad thermal tolerances (NMFS and USFWS, 1995). Evidence from tag returns and strandings in the western Atlantic suggests that adults engage in routine migrations between boreal, temperate and tropical waters (NMFS and USFWS, 1992). In the U.S., leatherback turtles are found throughout the action area of this amendment. Located in the northeastern waters during the warmer months, this species is found in coastal waters of the continental shelf and near the Gulf Stream edge, but rarely in the inshore areas. However, leatherbacks may migrate close to shore, as a leatherback was satellite tracked along the mid-Atlantic coast, thought to be foraging in these waters. A 1979 aerial survey of the outer Continental Shelf from Cape Hatteras , North Carolina to Cape Sable, Nova Scotia showed leatherbacks to be present throughout the area with the most numerous sightings made from the Gulf of Maine south to Long Island. Shoop and Kenney (1992) also observed concentrations of leatherbacks during the summer off the south shore of Long Island and off New Jersey. Leatherbacks in these waters are thought to be following their preferred jellyfish prey. This aerial survey estimated the leatherback population for the northeastern U.S. at approximately 300-600 animals (from near Nova Scotia, Canada to Cape Hatteras, North Carolina).

Compared to the current knowledge regarding loggerhead populations, the genetic distinctness of leatherback populations is less clear. However, genetic analyses of leatherbacks to date indicate female turtles nesting in St. Croix/Puerto Rico and those nesting in Trinidad differ from each other and from turtles nesting in Florida, French Guiana/Suriname and along the South African Indian Ocean coast. Much of the genetic diversity is contained in the relatively small insular subpopulations. Although populations or subpopulations of leatherback sea turtles have not been formally recognized, based on the most recent reviews of the analysis of population trends of leatherback sea turtles, and due to our limited understanding of the genetic structure of the entire species, the most conservative approach would be to treat leatherback nesting populations as distinct populations whose survival and recovery is critical to the survival and recovery of the species. Further, any action that appreciably reduced the likelihood for one or more of these nesting populations to survive and recover in the wild, would appreciably reduce the species' likelihood of survival and recovery in the wild.

Leatherbacks are predominantly a pelagic species and feed on jellyfish (i.e., *Stomolophus, Chryaora*, and *Aurelia* (Rebel 1974)), cnidarians (medusae, siphonophores) and tunicates (salps, pyrosomas). Time-Depth-Recorder data recorded by Eckert *et al.* (1998b) indicate that leatherbacks are night feeders and are deep divers, with recorded dives to depths in excess of 1000 meters. However, leatherbacks may come into shallow waters if there is an abundance of jellyfish nearshore.

Although leatherbacks are a long lived species (> 30 years), they are slightly faster to mature than loggerheads, with an estimated age at sexual maturity reported as about 13-14 years for females, and an estimated minimum age at sexual maturity of 5-6 years, with 9 years reported as a likely minimum (Zug and Parham 1996) and 19 years as a likely maximum (NMFS 2001). In the U.S. and Caribbean, female leatherbacks nest from March through July. They nest frequently (up to 7 nests per year) during a nesting season and nest about every 2-3 years. During each nesting, they produce 100 eggs or more in each clutch and thus, can produce 700 eggs or more per nesting season (Schultz 1975). The eggs will incubate for 55-75 days before hatching. The habitat requirements for post-hatchling leatherbacks are virtually unknown (NMFS and USFWS 1992).

Anthropogenic impacts to the leatherback population include fishery interactions as well as intense exploitation of the eggs (Ross 1979). Eckert (1996) and Spotila *et al.* (1996) record that adult mortality has also increased significantly, particularly as a result of driftnet and longline fisheries. Zug and Parham (1996) attribute the sharp decline in leatherback populations to the combination of the loss of long-lived adults in fishery related mortality, and the lack of recruitment stemming from elimination of annual influxes of hatchlings because of intense egg harvesting.

Poaching is not known to be a problem for U.S. nesting populations. However, numerous fisheries that occur in State and Federal waters are known to interact with juvenile and adult leatherback sea turtles. These include incidental take in several commercial and recreational fisheries. Fisheries known or suspected to incidentally capture leatherbacks include those deploying bottom trawls, off-bottom trawls, purse seines, bottom longlines, hook and line, gill nets, drift nets, traps, haul seines, pound nets, beach seines, and surface longlines (NMFS and USFWS 1992). At a workshop held in the Northeast in 1998 to develop a management plan for leatherbacks, experts expressed the opinion that incidental takes in fisheries were likely higher than is being reported.

Leatherback interactions with the southeast shrimp fishery are also common. Turtle Excluder Devices (TEDs), typically used in the southeast shrimp fishery to minimize sea turtle/fishery interactions, are less effective for the large-sized leatherbacks. Therefore, the NMFS has used several alternative measures to protect leatherback sea turtles from lethal interactions with the shrimp fishery. These include establishment of a Leatherback Conservation Zone (60 FR 25260). NMFS established the zone to restrict, when necessary, shrimp trawl activities from off the coast of Cape Canaveral, Florida to the Virginia/North Carolina Border. Leatherbacks are also susceptible to entanglement in lobster and crab pot gear, possibly as a result of attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface, attraction to the buoys which could appear as prey, or the gear configuration which may be more likely to wrap around flippers.

Spotila *et al.* (1996) recommended not only reducing mortalities resulting from fishery interactions, but also advocated protection of eggs during the incubation period and of hatchlings during their first day, and indicated that such practices could potentially double the chance for survival and help counteract population effects resulting from adult mortality. They conclude, "stable leatherback populations could not withstand an increase in adult mortality above natural background levels without decreasing . . . the Atlantic population is the most robust, but it is being exploited at a rate that cannot be sustained and if this rate of mortality continues, these populations will also decline."

Nest counts are currently the only reliable indicator of population status available for leatherback turtles. The status of the leatherback population in the Atlantic is difficult to assess since major nesting beaches occur over broad areas within tropical waters outside the United States.

Spotila et al. (1996) provided the most recent summary of the status of total population of nesting leatherback turtles in the Atlantic Ocean. The largest nesting colonies of leatherbacks occur on the coasts of French Guiana (4,500-7,500 females per year) and Suriname, South America (600-2,000 females per year) and Gabon, West Africa (1,276-2,553 females per year. Smaller colonies occur among the Caribbean Islands, but constitute a significant aggregation when considered collectively (1,437-1,780 females per year). For the Suriname nesting colony, Hilterman and Goverse (2004) estimated that the minimum annual number of nesting females is likely between 1,545 and 5,500.

Fishery Interactions

A single leatherback sea turtle capture has been documented on observed SMB fishing trips according to the NMFS Observer Database. The animal was caught in a bottom otter trawl net in October 2001 on a trip for which *Loligo* was recorded as the target species. The animal was alive when captured and was released. No information is available on the subsequent survival of the turtle. There are no mortality estimates for leatherback turtles that are attributed to the *Loligo* fishery.

Loggerhead sea turtle (*Caretta caretta*)

The loggerhead sea turtle occurs throughout the temperate and tropical regions of the Atlantic, Pacific and Indian Oceans (Dodd 1998). The loggerhead turtle was listed as "threatened" under the ESA on July 28, 1978, but is considered endangered by the World Conservation Union (IUCN) and under the Convention on International Trade in Endangered Species of Flora and Fauna (CITES). Loggerhead sea turtles are found in a wide range of habitats throughout the temperate and tropical regions of the Atlantic. These include open ocean, continental shelves, bays, lagoons, and estuaries (NMFS& FWS 1995).

Since they are limited by water temperatures, sea turtles do not usually appear on the summer foraging grounds in the Gulf of Maine until June, but are found in Virginia as early as April. They remain in these areas until as late as November and December in some cases, but the large majority leaves the Gulf of Maine by mid-September. Loggerheads are primarily benthic feeders, opportunistically foraging on crustaceans and mollusks (NMFS & FWS 1995). Under certain conditions they also feed on finfish, particularly if they are easy to catch *(e.g.,* caught in gillnets or inside pound nets where the fish are accessible to turtles).

A Turtle Expert Working Group (TEWG 2000), conducting an assessment of the status of the loggerhead sea turtle population in the Western North Atlantic (WNA), concluded that there are at least four loggerhead subpopulations separated at the nesting beach in the WNA. However, the group concluded that additional research is necessary to fully address the stock definition question. The four nesting subpopulations include the following areas: northern North Carolina to northeast Florida, south Florida, the Florida Panhandle, and the Yucatan Peninsula. Genetic evidence indicates that loggerheads from Chesapeake Bay southward to Georgia appear nearly equally divided in origin between South Florida and northern subpopulations. Additional research is needed to determine the origin of turtles found north of the Chesapeake Bay.

The TEWG (1998) analysis also indicated the northern subpopulation of loggerheads is stable or declining. A recovery goal of 12,800 nests has been assumed for the Northern Subpopulation, but TEWG (1998) reported nest number at around 6,200 (TEWG 1998). More recently, the addition of nesting data from the years 1996, 1997 and 1998, did not change the assessment of the TEWG that the number of loggerhead nests in the Northern Subpopulation is stable or declining (TEWG 2000). Since the number of nests has declined in the 1980's, the TEWG concluded that it is unlikely that this subpopulation will reach this goal given this apparent decline and the lack of information on the subpopulation from which loggerheads in the WNA originate. Continued efforts to reduce the adverse effects of fishing and other human-induced mortality on this population are necessary.

A 2003 report on surveys of loggerhead turtle nests in the Mexican state of Quintana Roo (Zurila et al. 2003) suggested that the number of nests has fluctuated between 903 (1987) and 2,331 (1995) and was approximately 1,897 in 2001.

The most recent 5-year ESA sea turtle status review (NMFS & USFWS 1995) highlights the difficulty of assessing sea turtle population sizes and trends. Most long-term data comes from nesting beaches, many of which occur extensively in areas outside U.S. waters. Because of this lack of information, the TEWG was unable to determine acceptable levels of mortality. This status review supports the conclusion of the TEWG that the northern subpopulation may be experiencing a decline and that inadequate information is available to assess whether its status has changed since the initial listing as threatened in 1978. NMFS & USFWS (1995) concluded that loggerhead turtles should remain designated threatened but noted that additional research will be necessary before the next status review can be conducted.

Fishery Interactions

Illex Fishery A single capture of a loggerhead turtle on an *Illex* trip was documented in 1995 according to the NMFS Observer Database. The animal was alive when captured, and was subsequently tagged. No information on the survival of this individual is available at present. There are no mortality estimates for loggerhead turtles that are attributed to the *Illex* fishery.

Loligo Fishery A loggerhead capture was observed once in each year of 1995, 1996, and 1997 on *Loligo* trips. In every case the animal was alive when captured and no injuries were reported. In 2002, a loggerhead mortality that was likely the result of capture during a *Loligo* haul was observed. In 2004, a loggerhead was resuscitated after capture on an observed *Loligo* haul, and was tagged and released alive. There are no mortality estimates for loggerhead turtles that are attributed to the *Loligo* fishery.

6.5 Human Communities

The following excerpts were provided through interviews or written contributions by participants (processors and fishermen) in the SMB fisheries. They are included here in order to give an idea of the lives and day to day operations involved in making a living that depends largely on the harvest of the managed resources. A more formal description of the Ports and Communities and Economic Environment are provided in subsequent sections (6.5.1 and 6.5.2, respectively).

Overview of SMB Fishing

Information in the following three paragraphs was compiled from interviews carried out in June, 2005 with MAFMC advisors: James Ruhle, Lars Axelson, and Geir Monsen.

Approximately 90-95% of *Loligo, Illex*, Atlantic mackerel, and butterfish fishermen prosecute the fishery with otter trawls. The remaining 5% of the fishermen utilize sea pound nets or traps; no structured recreational or pot fishery exists for these species. Sea pound nets, a type of lead net, are set inshore at the end of April through June or July. These nets harvest a variety of other species besides squid, mackerel, and butterfish, including herring and scup. Sea pound nets soak for 24 hours a day and are checked once per day by a crew of approximately 8-10 fishermen. This fishery occurs solely off the coast of Rhode Island and Massachusetts.

The extensive otter trawl fishery for *Loligo, Illex,* Atlantic mackerel, and butterfish ranges from Massachusetts to Maryland. Due to the diversity in fishing vessels and strategies for prosecuting the fisheries it is difficult to describe a "typical" squid, mackerel, or butterfish fishing experience. However, vessels generally fall into one of two class sizes: 30-45 feet or 50-160 feet. The smaller vessels account for approximately 10-15% of the otter trawl vessels targeting squid, mackerel, and butterfish. These vessels are known as "day boats" and fish inshore waters from early May through July. Typically a day boat carries a crew of one to three fishermen and the boat returns to the dock each night.

Larger vessels ranging from 50 to 160 feet carry three to four fishermen on average, however, vessels that freeze and process fish at sea may carry up to 10-12 crewmen. These larger vessels run from 1-18 day trips depending upon the vessel's capability to store catch and meet quota. Vessels that do not freeze and process at sea are known as "wet boats"; these vessels either ice their catch or store it in refrigerator sea water for up to seven days. Vessels that freeze at sea have the ability to make longer trips averaging 12-14 days and extending as long as 18 days at sea.

Sea Freeze, Ltd. – a Large Scale Combined Harvesting/Processing Operation

The information presented below was compiled by Patricia Pinto da Silva of the NEFSC. She was obtained the information from personnel at Sea Freeze, Ltd located in North Kingston, RI during a site visit and follow up phone calls. Some additional information was obtained from the company website. The site visit was carried out in May 2004.

Sea Freeze is the largest producer of sea-frozen fish on the east coast of the United States. It supplies sea-frozen and land-frozen fish to domestic and international markets including bait products to long-line fleets. Sea Freeze's dedicated trawlers are some of the largest freezer trawlers on the east coast. At-sea freezing produces a very high quality product as the product is not damaged during loading and unloading. Sea Freeze owns two freezer trawlers that provide all of the catch that is stored at Sea Freeze facilities. Catch is then marketed nationally and world-wide. Fishing operations target *Illex* and *Loligo* squid, mackerel, herring and to a lesser degree, butterfish. The vessels are approximately 140 ft in length with a holding capacity of approximately 280 mt and a daily freezing capacity of 50 mt per day.

Domestic sales account for approximately 30% of total sales and 70% are international. Internationally, Eastern Europe and Asia are two important regions that purchase from Sea Freeze. In both locations imports are largely used for human consumption. Atlantic mackerel is sold to companies in Canada as baitfish and *Illex* squid is sold nationally as baitfish for the groundfish, swordfish and tuna fisheries as well as for crab and lobster bait. Zoos and aquariums also purchase Sea Freeze products as feed for other species. *Illex* squid and mackerel are the mainstay of the business accounting for approximately 80% of revenue.

Sea Freeze began its operations in 1985 when it was initially a fishing operation with just a few employees. This company operated one of the first successful US freezer trawlers in the region and over time, cold storage facilities were added and later enlarged (current capacity 7,000 mt). The plant does not include any processing facilities, nor is it invested in the distribution of product. Operations are limited to catching, cold storing and marketing whole fish. The cold storage is used primarily for catch from the dedicated freezer trawlers though from time to time, other vessels unload and store here. Currently, the plant employs approximately 60 people including 10 administrative and managerial staff, 20 crew working rotating shifts, and 15 individuals that work in the storage facility (packing, loading etc.). These employees work full time and employment is generally stable year round. Employee turnover is generally low and when it occurs it is often due to crew seeking land based positions for personal reasons (family time etc.).

Seasonal round for the plant is as follows:

Illex squid – May to October,
Mackerel January – May
Loligo squid – September to May

Product supply is lowest during the spring and fall. As a result, these months are dedicated to vessel repairs and maintenance. Sales and distribution occur year round.

Plant location was selected because of its access to transport mechanisms. The plant is accessible by deep-water port and rail access. Rail access is slower than other forms of distribution but it is significantly cheaper. The plant exists largely independent of the surrounding community (North Kingston). Employees live regionally, though not necessarily locally. Some local distribution of bait occurs in summer months and vessel fuel is purchased locally along with food for the crew. Some of the gear used on the trawlers is produced and repaired on site by a company that rents space from Sea Freeze.

Representatives stated that more and more time is being dedicated to involvement in the management of the species each year. In the past, a small percentage of time was spent on management concerns (attending meetings, etc.), now as much as 50% of key staff time is spent investing in this aspect of the business. Representatives stated that this is one of the new costs of doing business in an increasingly regulated environment.

Regulations in the *Loligo* fishery were cited as having impacts on the business. Tighter regulations in this fishery has meant that Sea Freeze has had to replace this product with other fish as current restrictions make this fishery less attractive for larger vessels. Also, regulations in other fisheries (such as groundfish) have meant that shifts are occurring between fisheries that also impact on business. Sea Freeze representatives suggested that it is important in this regulatory environment to diversify where possible and not be too dependent on any one species.

FUTURE PLANS - Sea Freeze is considering expanding its existing cold storage facilities to accommodate other products in addition to whole fish.

SUMMARY INFORMATION

Operations: Sea frozen fish and cold storage facilities
Plant capacity: 7,000 mt of cold storage space.
Current operations (approximate numbers per year)

- *Illex* – 6,000 mt
- Mackerel – 6,000 mt
- *Loligo* – 1,000 mt

Employment: 60 full time employees total; 20 fishermen – on rotating shifts, others divided between storage facility and administrative functions.

F/V Flicka – A Large Capacity Harvester

The text below was written in large part by the owner of F/V Flicka, H. Axelsson, with edits by Council and NMFS staff.

Summer Fishery (June - September)

The Flicka is a 140' x 35" freezer trawler. It can deposit fish in frozen blocks or in refrigerated sea water (RSW) tanks. We can carry about 200 tons of frozen product, and roughly the same amount of RSW product.

During the summer season *Illex* Squid are generally frozen. Given the draft of the vessel, the Flicka can only dock in Cape May, NJ during high tide. . The Flicka steams approximately 7 hours to reach its closest fishing areas (between the Baltimore and Wilmington Canyons) and can steam as long as 24 hours to reach farther ones (canyons off North Carolina).

The trawl net is set at dawn and hauled back one to three hours later. This process is repeated throughout the day until evening. The goal of the Flicka is to catch 30 to 40 tons per day. Because *Illex* squid disperse at night, fishing occurs during the day. When the squid are hauled back, they are put immediately into the six vertical plate freezers. If we have more than the freezers can hold, the rest is placed into the RSW tanks until the next cycle.

It takes about one and half hours to empty and reload the freezers. The frozen, forty pound blocks, are boxed and transported down into the storage hold, which is kept at –10 degrees F or colder. The squid take about three and half hours to freeze. Then, the whole cycle begins again. This process occurs approximately six times per day. Life on the Flicka revolves around this cycle. The crew eats, sleeps and sets or hauls nets while fish is being frozen.

At the end of 5 days, the storage hold is usually full and the Flicka steams back to Cape May, NJ, to unload. While fish are unloaded, the crew re-provisions the vessel, repairs worn or broken items and otherwise readies the vessel to return to sea. Generally, the vessel returns to sea about 24 hours after it arrives.

Winter Fishery (November through April)

The winter fishery is primarily for *Loligo* Squid or Boston Mackerel. Due to the GRA (Gear Restricted Area – requires use of 4.5 inch or greater codend mesh Nov 1 – Dec 31) between the Hudson Canyon down to the Washington Canyon, and the quota being caught so quickly, we opted to fish for "Mackerel".

Like the *Illex*, fish is either frozen or stored in RSW tanks. For the past few winter seasons we have opted to "Wet Fish." The shore side facilities have increased their freezing and handling capacity to handle our "carrying capacity" per trip in one day. When the catch is stored in RSW (as opposed to being frozen) the harvest capacity is greater.

Unlike the *Loligo* squid fishery that is prosecuted by the Flicka using otter trawl gear, *Illex* squid is prosecuted using single mid water trawl gear or by working in partnership with another vessel and pair trawling (putting a net that runs between the two vessels). When the Flicka pair trawls it does so with the vessel Dyrsten.

During the winter fishery, the Flicka uses a smaller crew (5 men in total). The fishing grounds for *Illex* are anywhere from Nantucket, MA to Oregon Inlet, NC, and anywhere from 10 miles to 70 miles off the coast.

The crew begins searching for mackerel almost as soon as the vessel leaves port and will continue to do so for several days. Water temperature, fathometers, and sonar are all utilized to locate schools. When *Illex* schools are found, large amounts can be caught very quickly. If squid is plentiful, the vessel can be completely filled in one day. Once the vessel is loaded, the Flicka unloads at Cape May, NJ. Once the vessel is unloaded, it leaves port at the next high tide.

6.5.1 Key Ports and Communities

Eight locations were identified as key ports or communities prosecuting the *Loligo, Illex*, Atlantic mackerel, and butterfish fisheries managed by the Mid-Atlantic Fishery Management Council (Figure 64). These key ports and communities were selected based on NMFS landings data from 2000-2003 (Table 22).

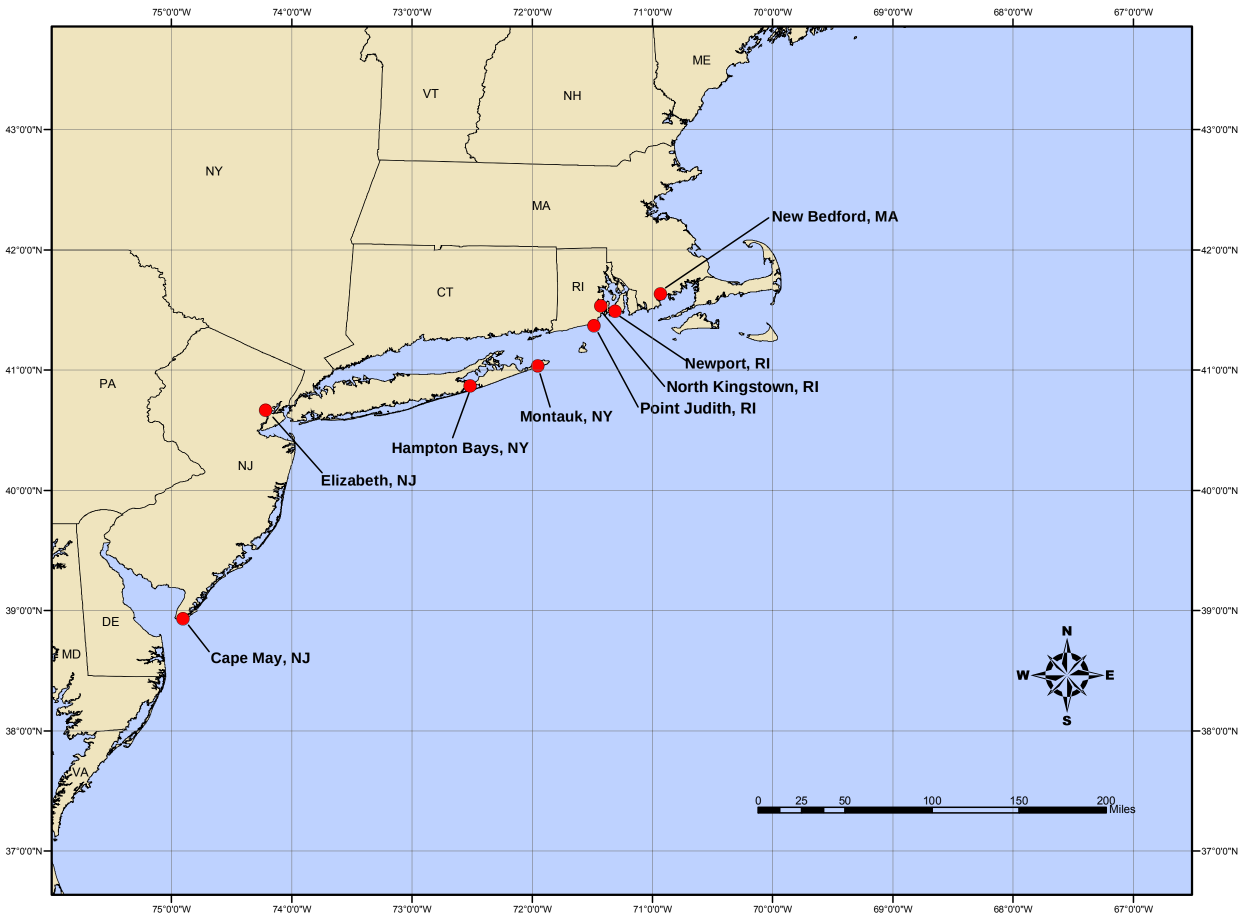


Figure 64. Key ports and communities for the Atlantic mackerel, squid, and butterfish fisheries based on NMFS landings data from 2000-2003.

Table 22. Ranking of total landings value, SMB landings value, and relative SMB value (SMB value/total value) for major SMB fishing ports.
Major SMB fishing ports are defined as those ports where the value of SMB landings comprised > $2 million from 2000-2003 (average $500,000 per year).

PORT	Total Value	SMB Value	Relative SMB Value (SMB Value/Total Value)	Rank: Total Value	Rank: SMB Value	Rank: Relative SMB Value
POINT JUDITH, RI	$138,158,323	$31,565,376	22.8%	2	1	5
NORTH KINGSTOWN, RI	$33,157,821	$22,128,446	66.7%	5	2	2
CAPE MAY, NJ	$115,467,650	$16,208,573	14.0%	3	3	7
HAMPTON BAY, NY	$32,946,146	$12,226,324	37.1%	6	4	3
MONTAUK, NY	$47,666,017	$11,154,448	23.4%	4	5	4
NEWPORT, RI	$32,412,745	$5,959,634	18.4%	7	6	6
NEW BEDFORD, MA	$635,241,252	$3,402,389	0.5%	1	7	8
ELIZABETH, NJ	$2,450,182	$2,270,367	92.7%	8	8	1

Source: NMFS Dealer Weighout Data 2000-2003

The eight key ports and communities with the largest squid, Atlantic mackerel, butterfish values (SMB Value) were identified by averaging NMFS dealer weighout data from 2000-2003. These communities are listed in order of their SMB Value in Table 22; the SMB Value corresponds to the combined monetary value of all *Loligo, Illex*, Atlantic Mackerel and Butterfish landings for each respective port.

This section offers pertinent information on the eight key communities with the greatest SMB Values from 2000-2003: Point Judith, Rhode Island, North Kingstown, Rhode Island, Cape May, New Jersey, Hampton Bay, New York, Montauk, New York, Newport, Rhode Island, New Bedford Massachusetts, and Elizabeth, New Jersey. Specifically this section discusses the role of squid, Atlantic mackerel, and butterfish in these locations. This section provides a detailed description of the location, historical background, issues and processes, involvement in Northeast commercial fisheries, and interactions with squid, mackerel, and butterfish fisheries for the top four key communities followed by a brief review of the interactions with the squid, mackerel, and butterfish fisheries for the four communities ranking 5th through 8th in SMB value. The information included in this section was excerpted from a report prepared for the Mid-Atlantic Council and submitted by Bonnie J. McCay *et.* al on behalf of the Fisheries Project, Rutgers University and reports prepared by Patricia Pinto da Silva, Northeast Fisheries Science Center, and Bryan Oles, MPA Center, National Oceanic and Atmospheric Administration. More detailed information in the form of complete port and community profiles for these locations and others is available in Appendix 9a and 9b.

Point Judith, Rhode Island

Location

Narragansett (41.45°N, 71.45°W) is located in Washington County 30 miles south of Providence.[1] Point Judith is located in Washington County 4 miles south of Narragansett along Highway 108 near Galilee State Beach, located at the western side of the mouth of Rhode Island Sound.[2]

Figure 65. Map of Point Judith's location within Rhode Island Sound

Historical/Background

The land now called Narragansett was originally inhabited by the Algonquin Indians until 1659 when a group of Connecticut colonists purchased it. Over the next half-century, the Rhode Island, Connecticut and Massachusetts colonies all vied for control of Narragansett until the British crown placed the area under the control of Rhode Island.

By the 1660s, settlers put the fertile soil to use by developing agriculture in the area. Soon the area's economy depended on the export of agricultural products to markets such

[1] http://www.ohwy.com/ri/n/narragan.htm
[2] http://www.ohwy.com/ri/p/pointjud.htm

as Boston, Providence, and Newport. At this time, Point Judith was connected to the sea by a deep, wide breachway, which was used to ship the agricultural goods to market.

In the early 1800's Narragansett, like the rest of the country, experienced rapid industrial growth, particularly in the textile industry. By the mid 1800's the resort tourism industry developed in Narragansett including the once popular Narragansett Casino. However, most of the tourism resorts were destroyed in a fire in the early 1900s.[3]

By the 1800's many farmers began to supplement their income by fishing for bass and alewife, or digging oysters. Eventually, the Port of Galilee was established in the mid 1800's as a small fishing village. By the early 1900's Point Judith's Port of Galilee became one of the largest fishing ports on the east coast. This was largely due to a series of construction projects that included dredging the present breachway and stabilizing it with stone jetties and the construction of three miles of breakwater that provided refuge from the full force of the ocean.[4] By the 1930's wharves were constructed to facilitate large ocean-going fishing vessels.

Today, Point Judith is not only an active commercial fishing port but supports a thriving tourism industry that includes restaurants, shops, whale watching, recreational fishing, and a ferry to Block Island.[5]

Issues/Processes

Not unlike many fishing communities in the North East, increasingly stringent fishing regulations jeopardize the viability of Point Judith as a fishing port. Specifically, Point Judith processing companies have difficulty handling drastic deviations in the number of landings, commonly due to the lifting or expending of quotas, as well as sudden changes in what species are landed. Additionally, the boom in tourism at Point Judith has had an adverse effect on the commercial fishing industry. Not only do fishermen battle parking issues but shore front rents for fish processing companies and the cost of dockage and wharfage for vessels has increased.

Involvement in Northeast Commercial Fisheries

The number of commercial vessels in port is 224.[6] Vessels range from 45-99 feet, with most being ground trawlers. Of these, 55 are between 45 and 75 feet, and 17 over 75 feet.[7] In 2001, Point Judith was ranked 16th in value of landings by port (fourth on the East Coast).[8] The state's marine fisheries are divided into three major sectors: shellfish, lobster, and finfish. The shellfish sector includes oysters, soft shell clams, and most importantly, quahogs. The lobster sector is primarily comprised of the highly valued

[3] http://www.geocities.com/Heartland/Hills/6365/narhist.html

[4] History of Galilee *available at* http://www.woonsocket.org/galhist.html.
[5] *Available at* http://officialcitysites.org/county.php3?st=RI&countyname=Washington
[6] Department of Environmental Management, Current Boat listings by location 12/01/03.
[7] Hall-Arber et al. 2001. New England Fishing Communities. Available at: http://web.mit.edu/seagrant/aqua/cmss/marfin/index.html
[8] http://seagrant.gso.uri.edu/fa/commrec.html

American lobster with some crabs as well. The finfish sector targets a variety of species including winter, yellowtail and summer flounder, tautog, striped bass, black sea bass, scup, bluefish, butterfish, squid, whiting, skate, and dogfish. A wide range of gear including otter trawl nets, floating fish traps, lobster traps, gill nets, fish pots, rod and reel, and clam rakes are used to harvest these species. The state currently issues about 4,500 commercial fishing licenses (Lazar and Lake 2001).

Squid/Mackerel/Butterfish

Squid and butterfish have long been primary targets of fishermen from Rhode Island, together with whiting and scup--the diversified "small mesh" fishery of the Mid-Atlantic--and with the decline of groundfish in the northeast, these species have become even more important. According to the 2000 weigh-out data, 90 boats landed *Loligo* in Point Judith, or about 40% of all the boats that landed fish in Point Judith that year. Pt. Judith lands high volumes of *Illex*, *Loligo*, mackerel and butterfish, especially as groundfish landings in the area have declined. *Loligo* accounted for between 12 and 16% of the value of total landings in Point Judith. However, butterfish played a very small role in Point Judith less than 2% of the total landings value.

Most fish processing in Pt. Judith is done in a large industrial area, the location of six processing plants, including Town Dock, the former Point Judith Cooperative (now the Pt. Judith Fishermen's Company), South Pier Fish, and Sea Fresh Corporation (Hall-Arber et al. 2002: 79). In recent years the processors have shifted their focus away from groundfish (fluke, yellowtail flounder, cod, whiting, and other species) and toward squid, herring, and mackerel (Ibid). A processor from Pt. Judith interviewed in 2002 noted that their busy season is during the winter and slow season is in the summer with *Loligo* being his primary product for processing. He used to process a lot of butterfish, but because of the down turn in the Japanese market, there is less demand for butterfish. He derives 50% of his revenue from *Loligo*. He buys product from 20-22 boats. Most of the boats have landed at his dock for many years; only a few move around to other docks. Another Pt. Judith processor indicated that *Loligo* and butterfish are important to his business, but not *Illex* and mackerel. If he could obtain more volume of butterfish he could sell it. Thirteen boats land at his facility. He has bought product from the same boats for 20 years.

North Kingstown, Rhode Island

Location

North Kingstown (41.55°N, 71.466°W) is located in Narragansett Bay in Washington County in the state of Rhode Island. The city is located 8.2 miles from Narragansett Pier, RI, 22.85 miles from Providence, RI, 72.54 miles from Boston, MA, and 169.8 miles from New York City, NY.

Figure 66. Map of North Kingstown's location in Rhode Island.

Historical/Background information

North Kingstown is a small town on the west side of Narragansett Bay. It is comprised of nine villages, with Wickford as the center of town and the seat of the local government. The city is best known as Rhode Island's sea town. Kingstown was incorporated in 1674, and included the vast area of Narragansett County. Before 1722-23, North Kingstown and South Kingstown was the same town. North Kingstown's mill villages, farms and summer colonies changed significantly with the onset of World War II. In 1938, the point of land north of Wickford village was identified as a favorable site for the protection of the Northeast coast during the war. The development of the Quonset Naval Air Station and the Davisville Construction Training Center in North Kingstown changed the character of North Kingstown from an historic seaside village to a key naval station during World War II.

Today, North Kingstown is home to Rhode Island's largest economic growth potential featuring a deep-water port, rail lines and the state's longest runway, and because of its location and natural harbor and beaches, it is also famous as a summer resort.[9]

Issues/Processes

The predominant issue right now for the fishermen in North Kingstown is the transformation of the Quonset Naval Base into a large commercial shipping port. In 1991, the Navy requested that a local "base reuse committee" be created to turn the existing Navy base to civilian use. In 1994, the Navy base was officially closed. In July 1998, a group of developers created the Quonset Port Partners (QPP) and contracted with the state to develop a containerized cargo terminal at Quonset Point.[10] Concern from fishermen is considerable. These concerns include: pollution from the port, noise from the ships, increased erosion from the wake of increased number of ships, greater potential for oil spills, and the introduction of invasive species from ballast water.[11] Most significantly, fishermen are concerned about a decline in fisheries that may be the result of any number of the previously mentioned effects. Additionally, many of the vessels that use this port are large vessels and require large amounts of dock space.[12] This has the possibility of depleting waterfront access to the commercial fishermen.

<u>Involvement in Northeast Commercial Fisheries</u>

In 2002 recorded annual landings for Rhode Island totaled 103.6 million pounds with a landing value of $64.2 million.[13] North Kingstown's annual landing value for 2002 was $7.1 million including an annual herring landing value of $1.2 million, and an annual lobster landing value of 744,757. In 2002, the value of landings at dealer-reported port was of $7.1 million.

The South of Cape Cod midwater trawl fleet (pair and single) consists of eight vessels with principal ports of New Bedford MA, Newport RI, North Kingstown RI, and Point Judith RI. This sector made 181 trips and landed 17,189 mt of herring in 2003. Maine had the highest reported landings (46%) in 2003, followed by Massachusetts (38%), New Hampshire (8%), and Rhode Island (7%).[14]

Squid/Mackerel/Butterfish

North Kingstown lands high volumes of *Illex*, *Loligo*, mackerel and butterfish, especially as groundfish landings in the area have declined. Seven boats landed *Loligo* in North Kingstown in the year 2000, 20% of all the boats that year. *Loligo* accounted for between

[9] http://www.villageprofile.com/rhodeisland/nkingstown/04his/

[10] http://omp.gso.uri.edu/doee/policy/dev2.htm
[11] Personal communication, Capt. John O'Leary 1/14/05.
[12] Personal communication, Capt. John O'Leary 1/14/05.
[13] http://www.st.nmfs.gov/st1/fus/current/02_commercial2002.pdf
[14] http://www.nefmc.org/herring/final_2005_herring_specs.pdf

12 and 16% of the value of total landings in North Kingstown in 2000. Butterfish accounted for over 17% of the total value of landings in North Kingstown.

Illex is also important in North Kingstown, where three vessels landed *Illex* in 2000; their catches accounted for 22% of the value of total landings in 2000. In North Kingstown a processor reported that 95% of his business is from *Loligo*, *Illex*, mackerel and butterfish and some percentage from Atlantic herring. This processor unpacks frozen fish and squid from the boats. Seven boats pack out at his facility; these boats have been unpacking at his facility for about 17 years. The dependency of North Kingston processing on these species has already been shown by the Gear Restricted Areas which went into effect in 2001. According to one processor, the GRAs reduced his business by 20-30%: "There are no other species to target if we can't catch these fish."

Cape May, New Jersey

Location

The city of Cape May, New Jersey (38.935°N, 74.9064°W), is located in Cape May County. It is 48 miles from Atlantic City, NJ, 87 miles from Philadelphia, PA, and 169 miles from New York City.

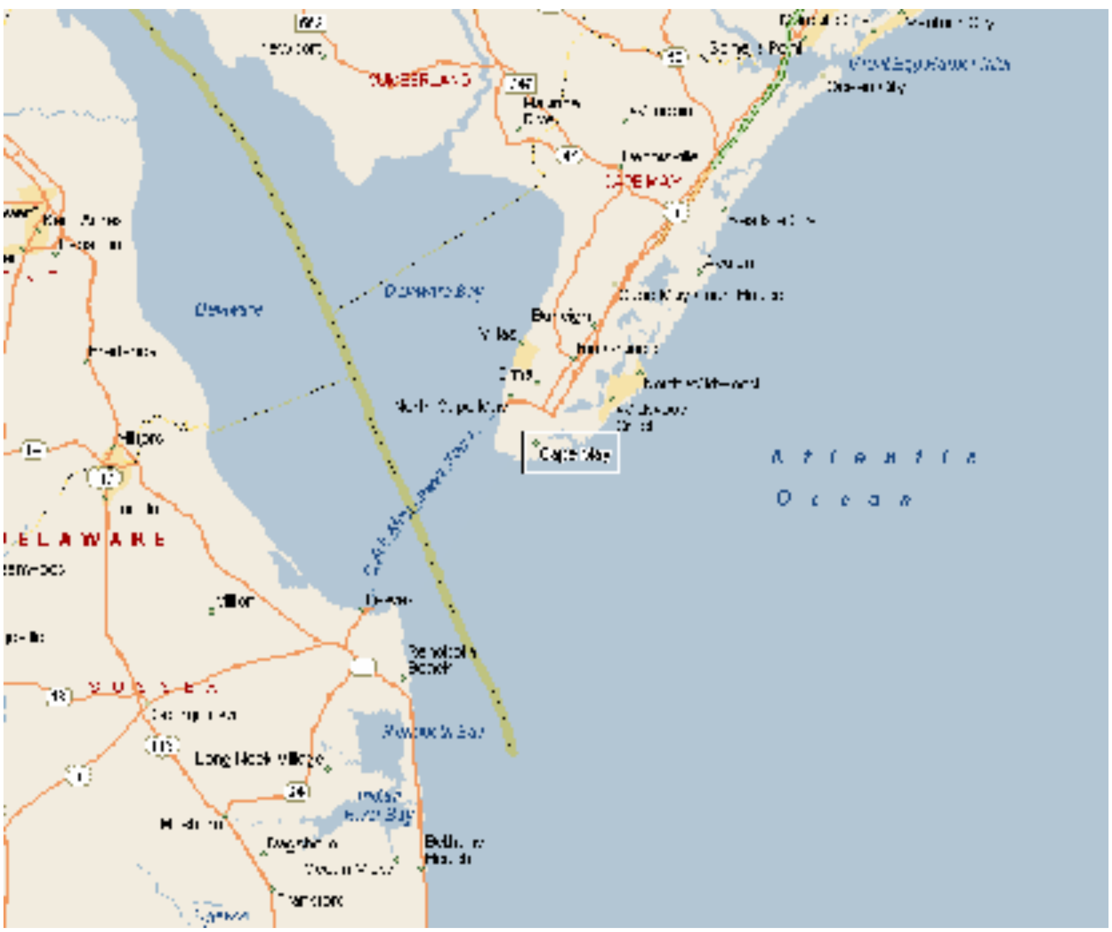


Figure 67. Map of Cape May's location in New Jersey.

Historical/Background information

Farming and fishing have been the lifeblood of the county since the early 1600's. Today commercial fishing is still the backbone of the county and is the second largest industry in Cape May County. The port of Cape May is considered one of the largest and busiest seaports along the eastern seaboard and generates more than $500 million annually.
In an effort to maintain a healthy and safe fishing industry the Board of Chosen Freeholders along with the State of New Jersey developed the Cape May County Revolving Fishing Loan Program. This program was instituted in 1984 and is designed to help commercial, charter and party boat fishermen with low interest loans for safety and maintenance of fishing vessels. More than $2.5 million has been loaned out to help strengthen the local fishing industry.[15]

Issues/Processes

Information has not yet been obtained regarding issues/processes in Cape May.

Involvement in Northeast Commercial Fisheries

At the Southernmost tip of New Jersey - and almost as far South as Washington, DC - the combined port of Cape May/Wildwood is the largest in New Jersey and one of the largest on the East Coast. The center of fish processing and freezing in New Jersey, Cape May/Wildwood is the home port to some of the largest vessels fishing on the Atlantic coast and has led the way in developing new fisheries and new domestic and international markets for New Jersey seafood. Major Cape May fisheries focus on squid, mackerel, fluke, sea bass, porgies, lobsters and menhaden. In addition to these, Wildwood boats are also in the surf clam/ocean quahog fisheries. Like many Jersey Shore communities, much of Cape May's and Wildwood's economies are dependent on seasonal tourism - which is dependent both on the weather and the overall state of the economy. The year-round character of commercial fishing is a major factor in keeping these communities going in the off-season.[16]

In 2002 recorded annual landings for New Jersey totaled 162.2 million pounds with a landing value of $112.7 million.[17] Cape May annual landing value for 2002 was $28.2 million including an annual scallop landing value of $19.8 million. The herring landing value in 2002 represented 6% of the 1997-2003 average. In 2002, the value of landings at dealer-reported port was of $28.3 million, and the landed value of homeported vessels was of $34.5 million. Between 1997 and 2003 homeported vessels number increased from 109 to 129.[18]

[15] http://www.co.cape-may.nj.us/Cit-e-Access/webpage.cfm?TID=5&TPID=452&Print=1
[16] http://www.fishingnj.org/portcm.htm; http://www.panynj.gov/
[17] http://www.st.nmfs.gov/st1/fus/current/02_commercial2002.pdf
[18] NMFS Landings and Permit databases

Squid/Mackerel/Butterfish

Squid, Atlantic mackerel, and butterfish are important products for the first commercial packing and processing facility mentioned above, which is the only year-round industry in Cape May. Their primary business is with these "underutilized" species, and they handle large volumes. Decline in stocks of groundfish, whiting and summer flounder over the years has increased the importance of squid and mackerel to this business. The plant workers are primarily Hispanic and live in nearby Wildwood as well as the inland towns of Bridgeton and Vineland, and the office staff live within 20 mile radius of the facility. Many of the plant workers come through a labor contractor; the others are long-standing employees. The only competition for workers is from the tourist industry during the summer. He stated that seafood is the number two employer in Cape May. He derives all of his business from *Loligo, Illex*, mackerel and butterfish with *Loligo* and *Illex* comprising about 50% of his business. The only species that is important is Atlantic herring and is not part of this plan. He handles both fresh and frozen product from fishing boats and processes squid. About 90% of his product comes from the port of Cape May. A total of 15 boats land fish at his facility and the boats have been selling to his facility for generations.

In 2000, 51 boats landed *Loligo* in Cape May, which was 36.2% of all the boats that landed catch in Cape May in that year. *Loligo* accounted for 6.1% of the value of total landings in Cape May in 2000. However, Cape May lands scallops that are a high value product. *Loligo* is an important fishery during the winter months for Cape May draggers. As a result of the GRAs particularly the southern GRA (January-March 15 closure), fishermen and processor reported losing from 10-30% of their income. Fishermen were forced to fish for less valuable species such as scup or spend more time searching and steaming for *Loligo* in non-traditional grounds.

Ten boats landed *Illex* in Cape May during the 2000 fishing season and these were 7% of all the boats that landed catch in Cape May. According to the fishermen, 2000 was not a good fishing season for *Illex.* The *Illex* remained further east and were unavailable for capture in their gear. As a result, fewer boats participated in the 2000 fishery. *Illex* is primarily a June through September fishery for Cape May vessels. In Cape May in 2000, 15 boats landed mackerel out of 141 boats. Mackerel are not a high value product, but this fish did account for 7% of the value of total landings in Cape May in 2000. Fishermen stated that only larger vessels with the capacity to land high volume of mackerel participate in the fishery because they are only the boats who can make money on this species.

Hampton Bays, New York

Location

Southampton is located approximately 80 miles from New York City along Route 27, Sunrise Highway. The town is bordered on the west by the town of Brookhaven and on the east by the town of East Hampton. The Great and Little Peconic Bays are located to the north, along with the town of Riverhead which lies at the junction of the North and South Forks. A series of coastal bays, including Moriches, Shinnecock, and Mecox, separate the mainland Town of Southampton from a barrier island along the Atlantic Ocean. The north side of the barrier island just south of Shinnecock Bay is the harbor for the commercial fishing fleet. The commercial properties, clustered along Dune Road, are surrounded by Suffolk County park land. The island is reached via the Route 32 Ponquogue Bridge. This fleet has access to the Atlantic via the Shinnecock Inlet, which is less than half a mile from the docks.

Figure 68. Map of Hampton Bay's Location in New York

Historical/Background information

Shinnecock Indians were the original inhabitants of the Hampton Bays area. They planted crops, fished the coastal bays, hunted whales along the shore and are known to have passed their knowledge of whaling to early European settlers. Settlers established the Town of Southampton in 1640 after having purchased land from the area Indians. The Dongan Patent was granted by King James II of England through his General Governor, Thomas Dongan in 1686. This patent granted citizens access and rights to over 25,000 acres of common underwater land, marshland, and common areas, as well as Rights of Ways to the water, and it established the Board of Trustees of the Freeholders and Commonalty of the Town of Southampton to act as stewards of these areas.

Hampton Bays is home to the second largest commercial fishing fleet in New York and the location of significant recreational fishing activity. The commercial fleet landed over

9.7 million pounds of seafood, valued at just over $9.2 million in 2001, according to National Marine Fisheries Service (NMFS) weighout data. Hampton Bays is known as "the boat ways of the Hamptons" due to the area's access to numerous waterways (http://www.hamptonbayschamber.com/). The Shinnecock Canal allows boats to move between the Peconic Bay system to the north and the coastal bays, including Shinnecock and Tiana Bays, to the south. The Shinnecock Inlet provides access to the Atlantic Ocean. Hampton Bays is bordered by a number of other hamlets in Southampton Town including East Quogue to the west, and Southampton Village and Shinnecock Hills to the east. Great Peconic Bay lies to the north, and Shinnecock Bay separates the mainland area of the hamlet from the barrier island that borders the Atlantic to the south.

Issues/Processes

Involvement in Northeast Commercial Fisheries

Today, there are approximately thirty full-time baymen in the entire Town of Southampton, a dozen or so of who live in the Hampton Bays area. These baymen harvest fish with a variety of gear types including pound nets, fyke nets, and gillnets. Many also harvest shellfish such as clams, oysters, mussels and scallops. As many as 200 residents may also engage in shellfish harvest on a part-time basis (Southampton Town 1999).

Commercial fishing in the Atlantic did not become a significant business in Hampton Bays until after the creation of the Shinnecock Inlet in the late 1930s. Prior to this, Atlantic fisheries were limited to those men who launched boats from the surf further east on the South Fork in communities like Amagansett. Hook and line cod fishing, whaling, and ocean haul seining were once practiced in the area. Weighout data show that less than one percent of the total catch value landed in Hampton Bays is attributed to ocean haul seining, indicating that the practice is still in existence.

Hampton Bays is the principal port of New York's second largest commercial fishing fleet. The fleet, which numbers approximately 40 vessels, is characterized by a diversity of gear types. One long time resident and participant in the fishing industry assisted in identifying boats from a 2002 National Marine Fisheries Service (NMFS) permit list. Of the 63 boats registered with a principal port of Hampton Bays or Shinnecock, 35 were identified as draggers, five as gill-netters, one as a lobster boat, and one as a clammer. The remaining boats were unknown (17), sport fishing boats (1), or non-operational commercial craft (3). A separate informant provided a list of local boats, and assisted in identifying the gear types for each boat. The list of 35 boats includes: 12 inshore draggers; 11 offshore draggers; four gill-netters; three transient draggers; two longliners; one scalloper; one clammer; and one baymen. There are additional baymen who work in the area as noted above.

Vessel Trip Report (VTR) data indicate that sixty one federally-permitted commercial boats landed 2,706 trips in Hampton Bays in 2001.[19] Thirty seven of these boats claim either Hampton Bays or Shinnecock as their principal port of landing. These boats landed 2,441 trips in Hampton Bays in 2001, or 90% of all trips landed in Hampton Bays by federally permitted boats. The reported gear types among these boats in 2001 included otter trawl, handline, gillnet, lobster pot, bottom longline, pelagic longline, scallop dredge, and fish pot. There were twenty four boats from a variety of other ports that landed catch in Hampton Bays in 2001 including five from Montauk, four from Point Judith, RI, four from Greenport, NY, three with a principal port of New York, NY, two from New Bedford, and one each from Barnegat Light, NJ, Boston, MA, Bremen, ME, Lowland, NC, Mattituck, NY, and Point Lookout, NY.

The fleet in Hampton Bays is largely owner-operated. An analysis of 2001 VTR data on federally permitted boats that designate Hampton Bays or Shinnecock as their principal port indicate that these boats (n=38) average 48 feet in length, 43 gross tons and 359 horsepower. The average year built is 1982. These boats reported a total of 2,511 trips. Of these trips, 97% were landed in Hampton Bays/Shinnecock. Other ports of landing included Brooklyn, NY, Elizabeth, NJ, Mattituck, NY, New Bedford, MA, New London, CT, and Point Judith, RI.

Squid/Mackerel/Butterfish

Since 1994, *Loligo* squid has accounted for at least 17% (1995) and as much as 43% (2000) of the total value landed. The 1995 figure is low as a result of the high value of ocean quahogs landed at that time. The percentage of value contributed by whiting landings has dipped from a high of 27% in 1996 to 11% in 2001. From the mid-1980s to the mid-1990s, whiting landings ranged from over 1 million pounds and a value of $0.5 million (1986) to a high of 4.7 million pounds with a value exceeding $2 million in 1993 (Gall 1996). According to local fishermen, even though whiting was a low value fish, the allowable by-catch of species like fluke, porgy, and sea bass made it profitable. Once the by-catch was reduced, whiting was no longer worth pursuing. Prices dropped from $0.60/pound to $0.10/pound for whiting. Over the years, squid fishing has become a necessity for Shinnecock trawlers due to the restrictions on other Mid-Atlantic species. The control exercised by processors over the squid market is said to have kept prices as low today as they were 20 years ago (approximately $0.35/pound).

Loligo and butterfish are important to the trawler fishing fleet that operates out of Shinnecock/Hampton Bays. There were approximately 30 draggers working out of Shinnecock/Hampton Bays in 1999: 10 in the 45' to 60' range; 16 in the 60' to 65' range; 4 boats between 80' and 90'; and, 4 boats over 90' in length (McCay and Cieri 2000). In 2000, 64 boats (many from other ports) landed *Loligo*, which was 66% of all the boats that landed catch in Shinnecock/Hampton Bays in that year. Forty-nine boats, or 50.5% of all boats that packed in Shinnecock/Hampton Bays, landed butterfish in 2000. Mackerel, though less important in overall value, was landed by 35 boats, or 36% of the

[19] This analysis of VTR data includes trips reported for both Hampton Bays and Shinnecock, as these names refer to the same port of landing.

boats that landed catch in Shinnecock/Hampton Bays in 2000. *Illex* is infrequently landed at this port due to the highly perishable nature of *Illex* and the need to transport it in boats set up for RSW (refrigerated sea water). The commercial draggers that land *Loligo* and butterfish at the three packing facilities engage in a mixed-trawl fishery. Like the draggers in Montauk, the fishermen target a diversity of species depending on the boat size, season, and regulations. A number of the draggers that land here also engage in the groundfish fishery during the summer months.

Loligo makes up a large part of the catch that is landed in Shinnecock. *Loligo* accounted for 39.2% of the value of the total landings in Shinnecock/Hampton Bays in 2000. During the summer of 2000, *Loligo* was being caught in unusually large numbers just off the beach of Shinnecock. Fishermen from Montauk and Rhode Island landed their catch in Shinnecock rather than steaming home. The local packing facilities did very well as did the fishermen. Compared to the lucrative summer of 2000, squid fishing in the summer of 2001 was not profitable. One local fisherman explained that his operation took a serious financial hit when the 2500 lb trip limit was instated. This fisherman lost his crew members due to the drop in income. He explained that it is difficult to find good crew, especially when the boat is not making money. He retained only one original crew member and the rest went “to bang nails," or work in construction, a common alternative to fishing.

Montauk, New York

Squid/Mackerel/Butterfish

In 2000, 42 boats landed *Loligo* in Montauk, which was 21.6% of all the boats that landed catch in Montauk in that year. *Loligo* accounted for 18.9% of the value of total landings in Montauk in 2000. Thirty-eight boats, equivalent to 19.6% of all boats that packed in Montauk, landed butterfish in 2000.

Most of the fish and squid included in the plan are landed at one commercial packing facility in Montauk. Of the four species, *Loligo* has been the most significant for this facility. Six fishermen own this business, each of whom has been fishing for over 30 years. This packing facility is one of the only year-round labor employers in Montauk with the exception of a few resorts. During the winter when most other businesses are shut down, the dockworkers at this facility are putting in long hours to handle the large landings of *Loligo* and whiting. The business employs between six and 10 dockworkers, a secretary, and a manager. Ninety percent of the dockworkers are Hispanic. All of the employees live in Montauk or East Hampton.

According to the manager, 13 trawlers pack with the facility. In addition, 20 to 30 "pinhookers", or hand line boats, use the dock. The activity at the dock slows in the summer for the trawlers, but picks up for the small pinhookers. The business also relies on the charter boat businesses for buying fuel, bait, and ice. The majority of the business's revenue is generated through the packing and shipping of fish to dealers at Fulton Market, and processing plants in New Jersey and New York.

The commercial draggers that land *Loligo* and butterfish at this dock engage in a mixed-trawl fishery. In other words, the fishermen target a diversity of species that include *Loligo*, whiting, butterfish, mackerel, scup, flounder, and fluke, among others, depending on the boat size, season, and regulations. A number of the draggers that land here also engage in the groundfish fishery during the summer months. Diversification and adaptability are considered essential among those engaged in Montauk's mixed trawl fishing. One boat owner said that he maintains 17 permits on his vessel to allow him the option of moving into different fisheries as circumstances demand. *Loligo* are harvested all year long, but the winter months and early spring (December - April) are often the most productive times. *Loligo* are often harvested between 80 and 120 fathoms when they are offshore, but are also caught in shallow inshore water when they are spawning (Georgianna et al. 2001).

A number of the boat owners who pack *Loligo* at this dock explained the history of their involvement in the fishery. About fifteen years ago, management began to encourage fishermen who engaged in groundfish fishing to focus more of their fishing effort on the abundant stocks of underutilized, low value fish like *Loligo*, butterfish, mackerel, and whiting. Low interest government loans were provided for the purchase of the necessary boats and equipment.

Fishermen who took advantage of this opportunity were subsequently allotted fewer days at sea (DAS) in the multi-species groundfish plan of the New England Fishery Management Council. They now feel vulnerable to further cutbacks in DAS that have resulted from the May 2002 settlement of a lawsuit brought by environmental groups against the NMFS. The fishermen interviewed also expressed grave concern about the possibility that the new ruling will force fishermen from New England to move into their mixed-trawl fishery. They noted that current regulations are already limiting profitability of their operations. In 2000, the packing facility experienced a 66% decline in income between November and December due to the closure of area 6A, the Gear Restricted Area (GRA) designated to protect scup. The company had to let 2 employees go because of this decline, and the manager believes that it had an even greater impact on fishermen. Other regulations have limited the profitability of *Loligo* fishing including the 2500-pound trip limit that is triggered when 80% of the quota has been landed. One captain who had just returned from a trip that netted approximately 60,000 pounds of *Loligo* said that the 2500-pound trip limit does not allow him to even consider going out for *Loligo*. *Loligo* fishermen in Montauk feel especially frustrated by the fact that management decisions for an animal with a one-year lifespan are being based on 3-year-old data. Most expressed support for "real time management" of *Loligo*.

Newport, Rhode Island

Squid/Mackerel/Butterfish

Newport lands high volumes of *Loligo* and this species has become increasingly important as groundfish landings in the area have declined. Forty-two boats (47%) landed *Loligo* in Newport in the year 2000 which accounted for between 12 and 16% of the value of total landings in Newport in the year 2000. Comparatively, butterfish played a very small role in Newport, less than 2% of the total landings value. Mackerel and *Illex* play larger roles in other Rhode Island communities which the fishery in Newport is directed primarily toward *Loligo*. Additional information on this port is available in Appendix 9b.

New Bedford, Massachusetts

Squid/Mackerel/Butterfish

New Bedford ranks 9th in terms of the value of squid, Atlantic mackerel, and butterfish landings, and 12th in terms of the proportion of total landings from these species (Table 22). They are part of a large suite of species caught by the draggers of New Bedford. The fishing grounds used are generally northeast of the areas considered as Essential Fish Habitat in this amendment to the FMP, with the consequence that there are few if any direct impacts of potential closures of EFH areas in the Mid-Atlantic, although this may change as groundfish regulations are stricter and more stringently applied. This port was not visited for the SIA but discussions with people in the industry indicate that there is currently little or no processing of these species in New Bedford; most facilities are just packing them. The 2000 weighout data indicate that 64 boats landed *Loligo* squid, 15% of the total boats landing in New Bedford that year. Additional information on this port is available in Appendix 9b.

Elizabeth, New Jersey

Squid/Mackerel/Butterfish

A major Squid, Atlantic Mackerel, and butterfish processing facility is located in the city of Newark, NJ, Essex County, and some of the raw materials processed there are landed in the nearby port town of Elizabeth, NJ, Union County. Although the quantities landed in Elizabeth are small relative to landings at other ports, the processing facility is an important part of the industry and heavily dependent on the species covered by this FMP. Additional information on this port is available in Appendix 9b.

6.5.2 Economic Environment

Characteristics of the top SMB ports are identified and described in the preceding section (6.5.1). The focus in this section is on participation, fleet characteristics, and economic trends in the fisheries.

6.5.2.1 Atlantic Mackerel Fishery

Commercial Atlantic Mackerel Fishery

Access to the Commercial Fishery

Prior to 1985, possession of a Federal Atlantic mackerel permit allowed for permanent participation in the fishery. With the implementation of Amendment 2, however, a requirement for annual renewal of Federal commercial fishing permits for all SMB species was established.

There are currently two Federal permits that pertain to the harvest of Atlantic mackerel by commercial fishing vessels. In accordance with 50 CFR §648.4,

Vessels with a Federal *party/charter permit* (SMB2) may "fish for or retain in or from the EEZ mackerel, squid, or butterfish while carrying passengers for hire."

Vessels with a Federal *Atlantic mackerel permit* (SMB4) may "fish for or retain Atlantic mackerel in or from the EEZ, except for vessels that exceed either 165 feet in length overall (LOA) and 750 gross registered tons, or a shaft horsepower of 3,000 shp. Vessels that exceed the size or horsepower restrictions may seek to obtain an at-sea processing permit specified under §648.6(a)(2)."

The contribution to total Atlantic mackerel landings from party/charter vessels in any given year is negligible (annual average 1998 - 2004 ≈ 100 mt) in comparison to landings from vessels in possession of open access mackerel permits. The activity of the recreational sector of the fishery is described briefly under a separate heading below.

The *Atlantic mackerel permit* is currently an open access permit. Vessels that are currently in possession of an SMB4 permit may land unlimited quantities of Atlantic mackerel on any trip throughout the year. The vast majority of total annual Atlantic mackerel landings come from these vessels. The total number of mackerel-permitted vessels increased from 1,845 in 1998 to 2,481 in 2002 and declined slightly to 2,414 in 2004. Despite the large number of permitted vessels, the vast majority of landings (95%) from 1998 to 2004 has come from only 30 vessels. In 2004, the year with the greatest level of U.S. commercial landings on record, 18 vessels landed more than 1 million pounds (454 mt) of mackerel and landings from these vessels comprised 98% of the total 2004 landings, while five vessels landed more than 10 million pounds (4,536 mt) and their landings comprised more than 50% of the 2004 landings.

Market for Atlantic Mackerel

The disposition of the vast majority of the U.S. commercial harvest of Atlantic mackerel is in the food/unknown category (average = 98.2% from 2001-2004), while a small amount is reported to be sold as bait (average = 1.8% from 2001-2004) according to NMFS dealer reports. As with other SMB landings, nearly all of the Atlantic mackerel harvest is exported. In 2003 and 2004, exports were sold as frozen product (59.8%), prepared/preserved product (26.0%), and fresh product (14.2%) according to the NOAA Fisheries Office of Science and Technology (http://www.st.nmfs.gov/st1/index.html).

U.S. exports of all mackerel products totaled 25,332 mt valued at $18.3 million in 2003. The leading markets for U.S. exports of mackerel in 2003 were Nigeria (9,023 mt), Bulgaria (3,519 mt), Romania (3,482 mt) and Canada (2,405 mt). In 2004, U.S. exports of all mackerel products totaled 24,874 mt valued at $22.1 million (it is unclear why reported exports of Atlantic mackerel are lower in 2004 than in 2003, while landings increased by 75% from 2003 to 2004). The leading markets for U.S. exports of mackerel in 2004 were reported as Nigeria (8,639 mt), Romania (3,768 mt), Bulgaria (2,091 mt), Canada (1,260 mt) and Egypt (1,034 mt).

Fleet Characteristics

The home ports indicated in the NMFS permit data for the 1998-2004 top 30 Atlantic mackerel vessels are primarily in New Jersey, Massachusetts, Maine, and New Hampshire (Table 23). These vessels range in size from 115 to 476 gross tons (Table 24), and are between 76 and 150 feet in length (Table 25). Crew size for these vessels ranges between 3 and 14 (Table 26).

New Jersey, Massachusetts, and Rhode Island are the primary states where Atlantic mackerel are landed commercially (Table 27, 28). Landings were historically highest in New Jersey, and Rhode Island. Landings in Massachusetts increased dramatically in 2003 and 2004 compared to previous years, and in 2004 were greater than the combined New Jersey and Rhode Island landings.

With regard to specific ports, the majority of Atlantic mackerel revenues in recent years (2002-2004) came from landings Cape May, NJ, North Kingston, RI, Gloucester, MA and New Bedford, MA (Table 29). As a percentage of the total annual revenue for these ports, Atlantic mackerel is consistently more important in Cape May, NJ where revenues from Atlantic mackerel landings ranged from 61% to 95% of the port's gross revenues. Although mackerel revenues increased markedly in Gloucester and New Bedford, MA in 2004, the relative value of mackerel for these ports was still much less than for the Cape May and North Kingston (Table 29).

Among the 19 vessels whose combined 2002 – 2004 Atlantic mackerel revenues comprised ≥ 1% of the total 2002 – 2004 Atlantic mackerel revenues for all vessels, the majority collected less than 50% of their total revenues through the landing of Atlantic mackerel. For those vessels whose total revenues were ≥ 50% mackerel revenue, the average annual mackerel revenues more than doubled in 2004 (Table 30).

Table 23. Distribution of top Atlantic mackerel vessel home ports. These vessels landed 95% of the combined 1998-2004 commercial landings.

Home Port	N Vessels
Cape May, NJ	10
Boston, MA	4
Gloucester, MA	4
New Bedford, MA	3
Portland, ME	3
Portsmouth, NH	3
All Others	3
Total	30

Table 24. Distribution of vessel gross tonnage by home port state for major mackerel vessels.
Data source: Unpublished NMFS Permit Data

Gross Tonnage	MA	NJ	ME	NH	Other	Total
< 115	0	0	0	0	0	0
115-150	0	5	0	0	1	6
150-200	10	5	2	3	2	22
200-250	0	0	0	0	0	0
250-300	0	0	0	0	0	0
300-350	0	0	0	0	0	0
350 -400	1	0	0	0	0	1
400-450	0	0	0	0	0	0
450-500	0	0	1	0	0	1
>500	0	0	0	0	0	0
Total	11	10	3	3	3	30

Table 25. Distribution of vessel length (ft) by home port state for major mackerel vessels.
Data source: Unpublished NMFS Permit Data a

Length (ft)	MA	NJ	ME	NH	Other	Total
<74	0	0	0	0	0	0
74 - 79	3	3	0	0	1	7
80 - 89	0	2	1	1	1	5
90 - 99	4	2	0	0	0	6
100 - 109	0	2	1	0	0	3
110 - 119	0	0	0	1	0	1
120 - 129	2	1	1	0	0	4
130 - 139	0	0	0	1	1	2
140 - 150	2	0	0	0	0	2
>150	0	0	0	0	0	0
Total	11	10	3	3	3	30

Table 26. Distribution of vessel crew size by home port state for major mackerel vessels.
Data source: Unpublished NMFS Permit Data

Crew Size	MA	NJ	ME	NH	Other	Total
<3	0	0	0	0	0	0
3-5	5	5	1	0	1	12
6-10	5	4	2	2	1	14
10 -14	1	1	0	1	1	4
>14	0	0	0	0	0	0
Total	11	10	3	3	3	30

Table 27. Atlantic mackerel commercial landings (mt) by state.
Data source: Unpublished NMFS dealer weighout data.

YEAR	NJ	RI	MA	All Others	Total
1998	8,270	2,618	1,056	666	12,610
1999	9,088	1,967	590	387	12,031
2000	4,375	879	217	177	5,649
2001	11,442	513	176	178	12,308
2002	9,293	9,494	2,517	171	21,475
2003	14,994	4,884	10,637	223	30,738
2004	16,124	4,562	32,971	124	53,781

Table 28. Atlantic mackerel commercial landings (pct) by state.
Data source: Unpublished NMFS dealer weighout data.

YEAR	NJ	RI	MA	All Others	Total
1998	66%	21%	8%	5%	100%
1999	76%	16%	5%	3%	100%
2000	77%	16%	4%	3%	100%
2001	93%	4%	1%	1%	100%
2002	43%	44%	12%	1%	100%
2003	49%	16%	35%	1%	100%
2004	30%	8%	61%	0%	100%

Table 29. Atlantic mackerel revenue and total port revenue (unadj. $1,000s) for major mackerel ports in 2002 - 2004.
Data source: Unpublished NMFS Dealer Weighout Data

	2002			2003			2004		
Port	Mackerel revenue	Total revenue	Pct mackerel	Mackerel revenue	Total revenue	Pct mackerel	Mackerel revenue	Total revenue	Pct mackerel
Cape May, NJ	1,693	2,762	61%	2,792	3,936	71%	3,302	3,484	95%
North Kingstown, RI	1,676	3,833	44%	2,042	3,971	51%	2,206	4,414	50%
Gloucester, MA	583	16,721	3%	938	12,651	7%	3,222	14,722	22%
New Bedford, MA	35	39,059	0%	912	39,101	2%	3,266	39,926	8%

Table 30. Relative importance of Atlantic mackerel revenue for major Atlantic mackerel vessels from 2002 – 2004 (N = 13). Revenues are unadjusted gross $1,000s.
Data source: Unpublished NMFS Dealer Weighout Data

	2002			2003			2004		
Pct of annual revenue from *Illex*	Vessels (N)	Mean Mackerel revenue	Mean total revenue	Vessels (N)	Mean Mackerel revenue	Mean total revenue	Vessels (N)	Mean Mackerel revenue	Mean total revenue
< 5%	3	>1	1,076	0			0		
5%-10%	0			0			0		
10%-25%	2	209	1,085	3	176	1,203	4	767	3,666
25%-50%	3	751	2,183	3	862	2,619	2	662	1,594
50%-75%	3	539	786	3	442	701	5	1,108	1,728
75%-90%	1	614	711	2	448	516	0		
≥ 90%	1	495	504	2	599	602	2	697	730

Trends in Atlantic Mackerel Revenues

The annual value of U.S. commercial Atlantic mackerel landings has grown from around $1 million in the 1980s to $12.5 million in 2004. Unadjusted gross revenues from the fishery have tracked landings fairly consistently over this time period with a notable exception in 1997 when a spike occurred in the price of Atlantic mackerel (Figure 69). In light of the six-fold increase in Atlantic mackerel landings between 2000 and 2004, the catch efficiency of the mackerel fleet appears to have increased. Figure 70 suggests that this is likely due to the transition of landings from bottom otter trawls to paired mid-water trawls. In other words, for the bottom otter trawl sector, trip-level landings and landings per trip have remained relatively steady from 2000-2004. However, both trip-level landings and number of trips have increased substantially in the paired mid-water trawl sector. Note that the VTR data indicate that there were no paired mid-water trawl landings reported in 2001.

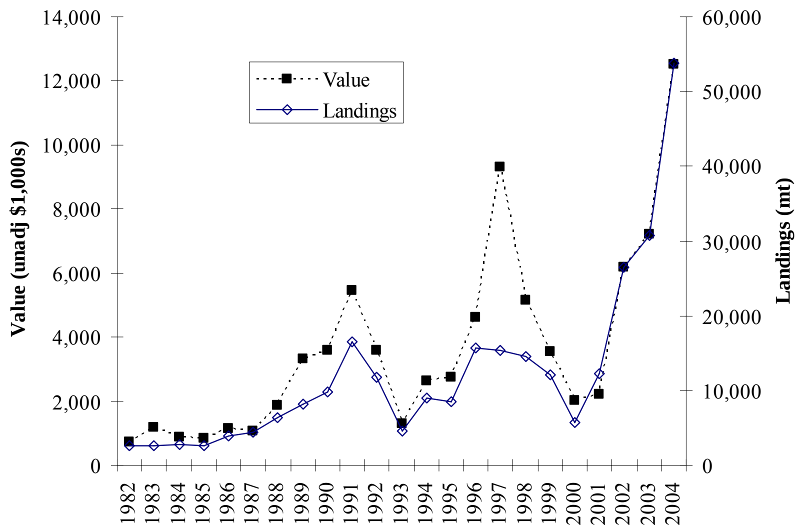
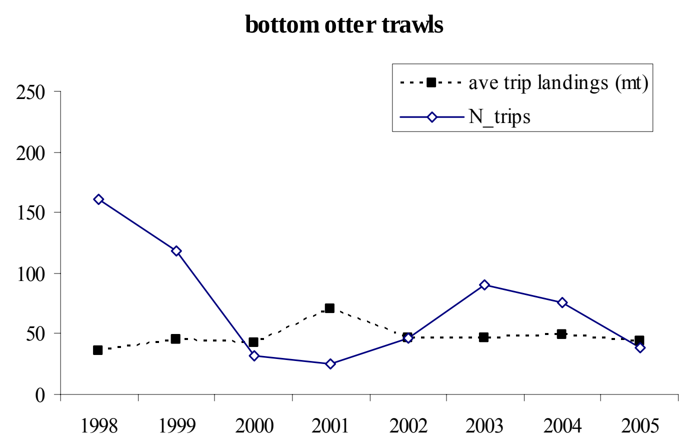


Figure 69. Atlantic mackerel landings (mt) and value (unadjusted $1,000s) from 1982 – 2004).
Data source: Unpublished NMFS dealer weighout data.



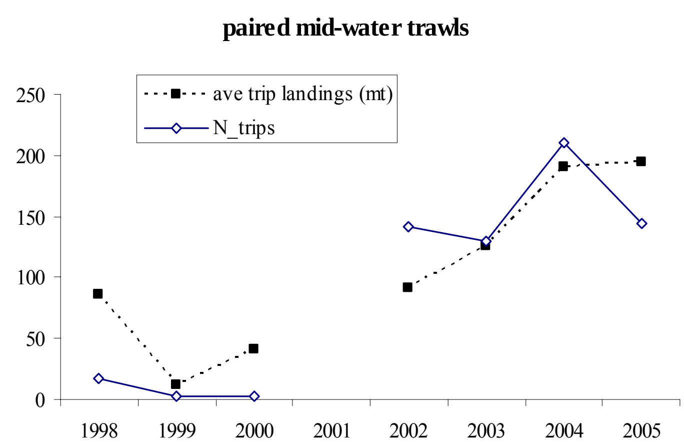


Figure 70. U.S. commercial Atlantic mackerel trips (N) and trip level landings (mt) for bottom otter trawls (top) and paired mid-water trawls (bottom) from 1998 - 2004.
Data source: Unpublished NMFS dealer weighout data.

The Atlantic mackerel fishery has historically been dominated by landings in December through May, with revenue peaking in March. Figure 71 provides an illustration of the combined 1998-2004 gross revenues by month. The historic monthly revenue pattern is reflected in recent years (2002-2004) by the major states that harvest Atlantic mackerel (Figure 72). During the peak fishery months the price of Atlantic mackerel appears to have remained stable in recent years (2002-2004; Figure 73).

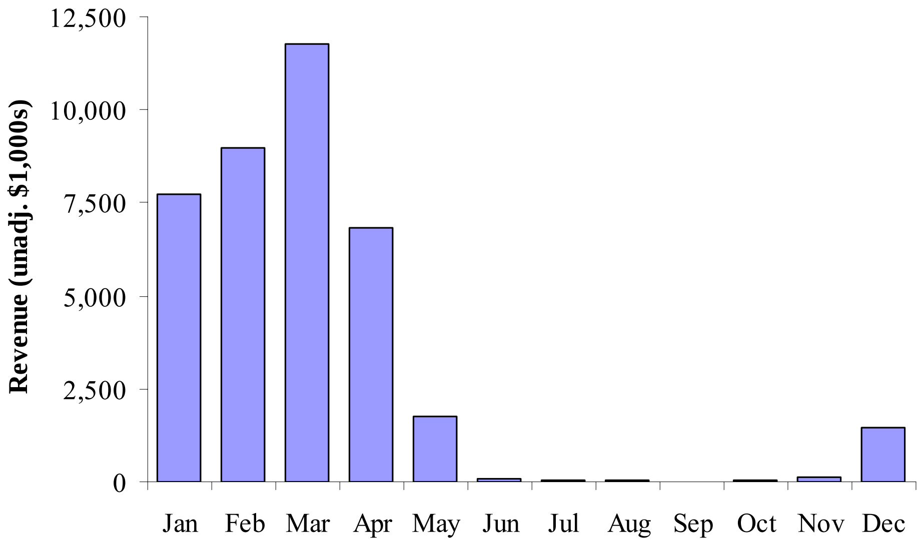


Figure 71. U.S. commercial revenue (unadjusted $1,000s) from Atlantic mackerel landings by month from 1998 - 2004.
Data source: Unpublished NMFS dealer weighout data.

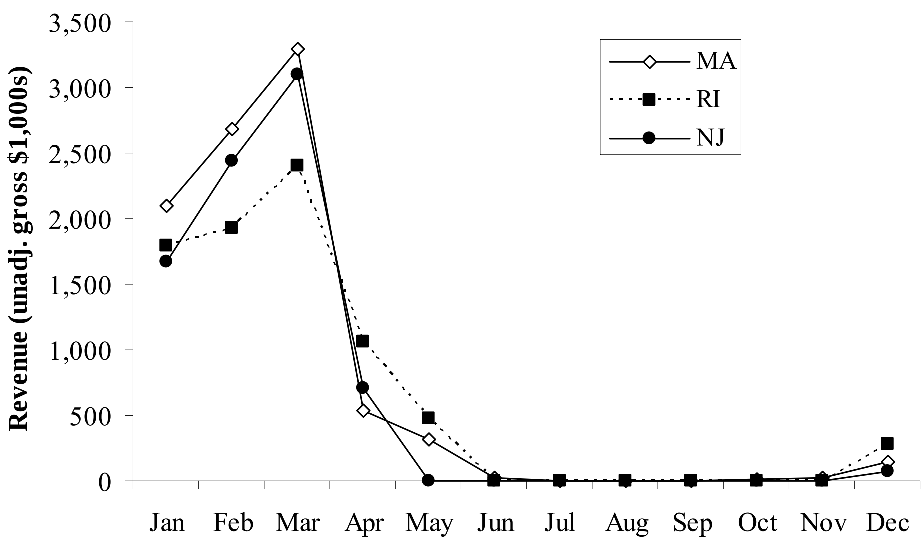


Figure 72. Combined 2002 – 2004 Atlantic mackerel landings revenue (unadjusted $1,000s) by month and state.
Data source: Unpublished NMFS dealer weighout data

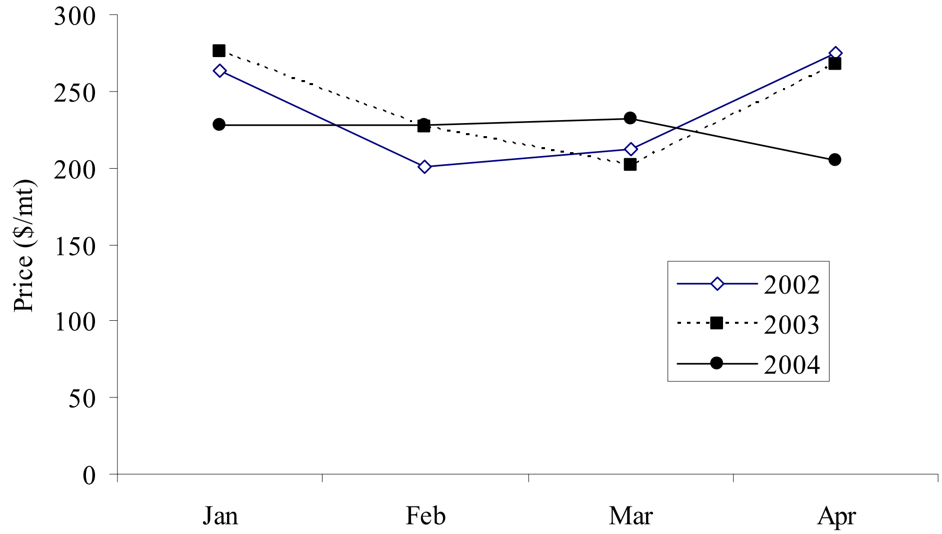


Figure 73. Atlantic mackerel price ($/mt) by month from 2002 - 2004.
Data source: Unpublished NMFS dealer weighout data.

Commercial Gear

Tables 31-33 provide revenue data by gear for the top Atlantic mackerel vessels in 2002-2004 (N = 13). According to the 2002-2004 dealer weighout data, mid-water otter trawls are the primary gear used in the commercial harvest of Atlantic mackerel , and bottom otter trawls are secondary (Table 31). In 2004, revenue from paired mid-water trawls was roughly double the revenue from the previous years. Unpaired midwater trawls have increased in importance from 2002 – 2004. There does not appear to be a season for which the relative importance of gear types shifts within the fishing year (Table 32). Nevertheless a significant revenue pulse from gillnet landings of Atlantic mackerel occurred in January of 2004 (see Tables 32 and 33). Commercial revenues peak in December – April for all gears used in the fishery. Table 33 indicates that revenue from paired mid-water trawls is greatest in New Jersey, unpaired mid-water trawls in Massachusetts, and bottom otter trawls in Rhode Island.

Table 31. Mackerel revenue (unadj. $1,000s) by gear according to 2002-2004 dealer weighout data.

GEAR	2002	2003	2004
TRAWL,OTTER,MIDWATER PAIRED	2,153	2,150	4,107
TRAWL,OTTER,MIDWATER	1,567	2,185	3,903
TRAWL,OTTER,BOTTOM,FISH	1,676	2,202	2,442
GILL NET,SINK, OTHER			870
UNKNOWN			5

Table 32. Commercial mackerel revenue (unadj. $1,000s) by gear and month landed (combined 2002-2004).
Data source: Unpublished NMFS dealer weighout data

GEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TRAWL,OTTER,MIDWATER PAIRED	1,985	2,930	2,836	563								95
TRAWL,OTTER,MIDWATER	827	2,384	3,765	580	1						3	96
TRAWL,OTTER,BOTTOM,FISH	1,685	1,425	1,915	770	339							186
GILL NET,SINK, OTHER	870											
UNKNOWN	5	<1										

Table 33. Commercial mackerel revenue (unadj. $1,000s) by gear and state landed (combined 2002-2004).
Data source: Unpublished NMFS dealer weighout data

GEAR	MA	RI	NJ	All Others
TRAWL,OTTER,MIDWATER PAIRED	2,267	1,152	4,979	12
TRAWL,OTTER,MIDWATER	5,159	93	2,143	260
TRAWL,OTTER,BOTTOM,FISH	9	6,311		
GILL NET,SINK, OTHER	870			
UNKNOWN			5	

Recreational Fishery

Approximately 600 vessels per year have been in possession of SMB2 (party/charter) permits from 1997-2004. The majority of Atlantic mackerel party/charter vessel activity occurs in New Jersey, New Hampshire and Massachusetts. A significant recreational fishery occurs in Maine, but is dominated by privately owned recreational boats. In general, the recreational fishery for Atlantic mackerel occurs from March through December, with the bulk of the catch occurring in New England during May and June (Table 34).

Table 34. Recreational catch of Atlantic mackerel by state and two-month wave (combined N, 1997-2004).
Source: MRFSS database

State	Jan-Feb	Mar-Apr	May-Jun	Jul-Aug	Sep-Oct	Nov-Dec
Maine			2,159	4,383	2,890	
New Hampshire			2,616	1,062	364	
Massachusetts		1	6,980	1,775	693	2,981
Rhode Island		98	81	138	89	154
Connecticut		1				
New York		119	13	1		
New Jersey		1,923	6	74		245
Delaware		105	1	0		
Maryland		176		12		
Virginia		144	1			
North Carolina				8		

6.5.2.2 Commercial *Illex* Fishery

<u>Access to the Commercial Fishery</u>

There are three types of Federal commercial fishing permits that apply to the harvest of *Illex* under 50 CFR §648.4:

The party/charter permit (SMB2): see description under Atlantic mackerel heading (above)

The squid/butterfish incidental catch permit (SMB3): "Any vessel of the United States may obtain a permit to fish for or retain up to … 10,000 lb (4.54 mt) of *Illex* squid, as an incidental catch in another directed fishery. The incidental catch allowance may be revised by the Regional Administrator based upon a recommendation by the Council following the procedure set forth in §648.21."

The *Illex* moratorium permit (SMB5 - in effect until July 1, 2009 according to current FMP): "To be eligible to apply for a moratorium permit to fish for and retain … *Illex* squid in excess of the incidental catch allowance … in the EEZ, a vessel must have been issued [an] … *Illex* squid moratorium permit …, for the preceding year, be replacing a vessel that was issued a moratorium permit for the preceding year, or be replacing a vessel that was issued a confirmation of permit history."

The moratorium permit was established through Amendment 5 and went into effect in 1997, but is not reflected in the permit data until 1998. In any given year since then, the vast majority of *Illex* landings come from vessels in possession of the *Illex* moratorium permit (99.3% on average from the 1998-2004 dealer weighout data). At any one time since implementation, there have been no more than 77 vessels in possession of the moratorium permit. Although landings per individual moratorium-permitted vessel have fluctuated from 1998 to 2004, the majority of *Illex* combined landings (>98%) during this timeframe has come from only 35 distinct vessels. Within this group, greater than 56% of the combined 1998-2004 landings came from four vessels.

<u>Market for *Illex*</u>

The disposition of the majority of the U.S. commercial harvest of *Illex* is typically in the food/unknown category (average = 99.7% from 2001-2003) according to NMFS dealer reports. However, in 2004, a significant shift in the reported catch disposition occurred with only 63.7% in the food/unknown category and 36.3% in the bait category. Unlike other SMB species, export data for *Illex* is lacking.

<u>Fleet Characteristics</u>

The home ports indicated in the NMFS permit data for the top 35 *Illex* vessels are Cape May, NJ, Boston, MA, Wanchese, NC and Point Judith, RI (Table 35). These vessels range in size from 112 to 288 gross tons (Table 36), and are between 72 and 138 feet in length (Table 37). Crew size for these vessels ranges between 3 and 14 (Table 38).

New Jersey, Rhode Island, North Carolina and Virginia are the primary states where *Illex* are landed commercially (Tables 39, 40). Landings were highest in New Jersey in 1998 and 2004, the two highest landings years on record, however, from 1999 – 2003, Rhode Island dominated the landings.

With regard to specific ports, the majority of *Illex* revenues in recent years (2002-2004) came from landings North Kingston, RI and Cape May, NJ (Table 41). As a percentage of the total annual revenue for these ports, *Illex* is consistently more important in North Kingston, RI where revenues from Atlantic mackerel landings ranged from 22% to 87% of the port's gross revenues. In 2004, the relative value of *Illex* in Wanchese, NC increased greatly to 50% compared to 8% in 2003 (Table 41).

Among the 12 vessels whose combined 2002 – 2004 *Illex* revenues comprised ≥ 1% of the total 2002 – 2004 *Illex* revenues for all vessels, the majority saw marked increases in revenue in 2004, when the relative contribution of *Illex* revenue to total vessel revenue increased dramatically (Table 42).

Table 35. Distribution of home ports and principle ports for the major *Illex* vessels. The major (35) *Illex* vessels landed >98% of the combined 1998-2004 commercial landings.
Data source: Unpublished NMFS Permit Data

Home Port	**Vessels (N)**
Cape May, NJ	15
Boston, MA	4
Wanchese, NC	4
Point Judith, RI	3
All Others	9
Total	35

Table 36. Distribution of vessel gross tonnage by home port state for major *Illex* vessels.
Data source: Unpublished NMFS Permit Data

Gross tonnage	**NJ**	**RI**	**MA**	**NC**	**All Others**	**Total**
< 112	0	0	0	0	0	0
112 - 149	7	3	0	3	0	13
150 - 199	8	3	4	1	3	19
200 - 249	0	1	0	0	0	1
250 - 299	1	0	0	0	1	2
≥300	0	0	0	0	0	0
Total	16	7	4	4	4	35

Table 37. Distribution of vessel length (ft) by home port state for major *Illex* vessels.
Data source: Unpublished NMFS Permit Data

Length (ft)	**NJ**	**RI**	**MA**	**NC**	**All Others**	**Total**
< 72	0	0	0	0	0	0
72 - 79	6	2	1	2	0	11
80 - 89	5	2	2	2	0	11
90 - 99	2	1	0	0	2	5
100 - 109	2	0	0	0	1	3
110 - 119	0	1	0	0	0	1
120 - 129	1	0	1	0	0	2
130 - 139	0	1	0	0	1	2
≥140	0	0	0	0	0	0
Total	16	7	4	4	4	35

Table 38. Distribution of vessel crew size by home port state for major *Illex* vessels.
Data source: Unpublished NMFS Permit Data

Crew Size	**NJ**	**RI**	**MA**	**NC**	**All Others**	**Total**
<3	0	0	0	0	0	0
3-5	8	4	2	4	1	19
6-9	7	2	1	0	0	10
10 -14	1	1	1	0	3	6
>14	0	0	0	0	0	0
Total	16	7	4	4	4	35

Table 39. *Illex* commercial landings (mt) by state.
Data source: Unpublished NMFS dealer weighout data.

YEAR	**NJ**	**RI**	**VA**	**NC**	**All Others**	**Total**
1998	13,696	8,149	460	351	913	23,568
1999	2,625	3,998	219	79	468	7,389
2000	3,950	4,112	165	39	45	8,312
2001	588	3,240	77	0	103	4,009
2002	222	2,388	94	42	4	2,750
2003	1,502	4,609	35	242	0	6,389
2004	14,050	9,317	579	1,100	14	25,059

Table 40. *Illex* commercial landings (pct) by state.
Data source: Unpublished NMFS dealer weighout data.

YEAR	**NJ**	**RI**	**VA**	**NC**	**All Others**	**Total**
1998	58%	35%	2%	1%	4%	100%
1999	36%	54%	3%	1%	6%	100%
2000	48%	49%	2%	0%	1%	100%
2001	15%	81%	2%	0%	3%	100%
2002	8%	87%	3%	2%	0%	100%
2003	24%	72%	1%	4%	0%	100%
2004	56%	37%	2%	4%	0%	100%

Table 41. *Illex* revenue and total port revenue (unadj. $1,000s) for ports where *Illex* was landed in 2002 - 2004.
Data source: Unpublished NMFS Dealer Weighout Data

	2002			**2003**			**2004**		
Port	***Illex* revenue**	**Total revenue**	**Pct *Illex***	***Illex* revenue**	**Total revenue**	**Pct *Illex***	***Illex* revenue**	**Total revenue**	**Pct *Illex***
North Kingstown, RI	1,034	4,619	22%	2,761	3,158	87%	7,721	10,557	73%
Cape May, NJ	61	503	12%	650	1,778	37%	6,743	16,302	41%
Point Judith, RI	220	5,269	4%	18	5,817	0%	962	9,793	10%
Wanchese, NC	15	1,580	1%	107	1,304	8%	483	957	50%
Newport, RI	2	218	1%	428	614	70%	23	567	4%
Hampton, VA	30	128	23%	16	281	6%	215	3,665	6%

Table 42. Relative importance of *Illex* revenue for major *Illex* vessels from 2002 – 2004 (N=12). Revenues are unadjusted gross $1,000s.
Data source: Unpublished NMFS Dealer Weighout Data

	2002			2003			2004		
Pct of annual revenue from *Illex*	Vessels (N)	Mean *Illex* revenue	Mean total revenue	Vessels (N)	Mean *Illex* revenue	Mean total revenue	Vessels (N)	Mean *Illex* revenue	Mean total revenue
< 5%	9	>1	726	6	1	622	0		
5%-10%	1	430	1,802	0			0		
10%-25%	1	624	2,453	3	143	815	0		
25%-50%	1	624	2,453	3	1,097	2,402	3	562	1,569
50%-75%	0			0			8	1,256	2,009
75%-90%	0			0			1	2,077	2,525
≥ 90%	0			0			0		

Trends in *Illex* Revenues

Annual gross revenues from U.S. commercial *Illex* landings were relatively low (between $0.5 and $3 million) in the 1980s, increased to around $10 million in the 1990s and then dropped to about $1 to $3 million in 2000-2003. In 2004, revenues increased to a record high of over $16 million. Revenues have tracked landings fairly consistently over the entire time period (Figure 74). The number of trips that landed *Illex* was around 800 in 1998 and less than 100 in 2002. Trips have tracked landings fairly consistently between 1997 -2004 suggesting that the catch efficiency of the *Illex* fleet has not changed remarkably during this time period (Figure 75).

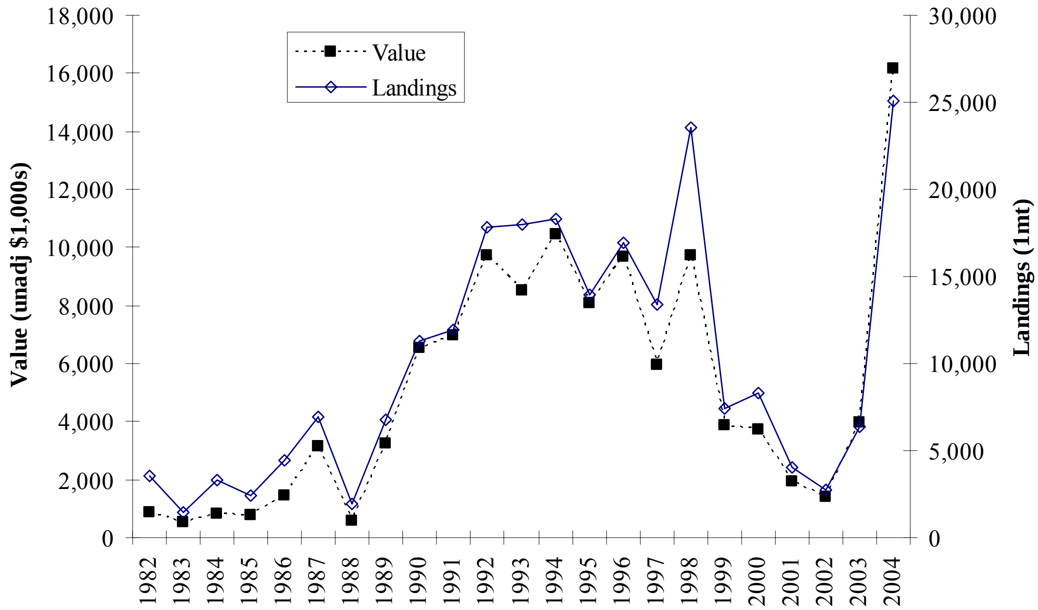


Figure 74. U.S. Commercial *Illex* landings (mt) and value (unadjusted $1,000s) from 1982 – 2004).
Data source: Unpublished NMFS dealer weighout data.

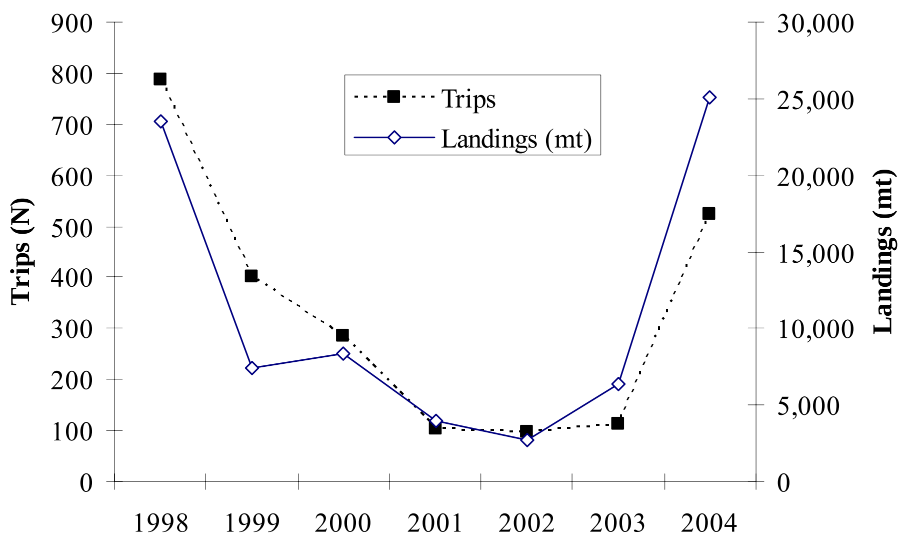


Figure 75. U.S. commercial *Illex* trips (N) and landings (mt) from 1998 - 2004.
Data source: Unpublished NMFS dealer weighout data

Within years, the *Illex* fishery has historically been dominated by landings in May through October. Figure 76 provides an illustration of the combined 1998-2004 gross revenues by month. The monthly revenue pattern is reflected by the major states that harvest *Illex* with revenues peaking in August (Figure 77). Combined 2002-2004 gross revenues indicate New Jersey revenues exceeding Rhode Island revenues in May only. This is may be related to the greater availability of *Illex* to vessels fishing out of New Jersey during that time of year. Over the past three years (2002-2004), the price of *Illex* during the height of the fishery has ranged from about $450/mt to $650/mt. The price of *Illex* in 2004 was greater than in the previous two years (Figure 78). No price is indicated for October 2004 because the fishery was closed Sept 21, 2004 when 95% of the quota was reached.

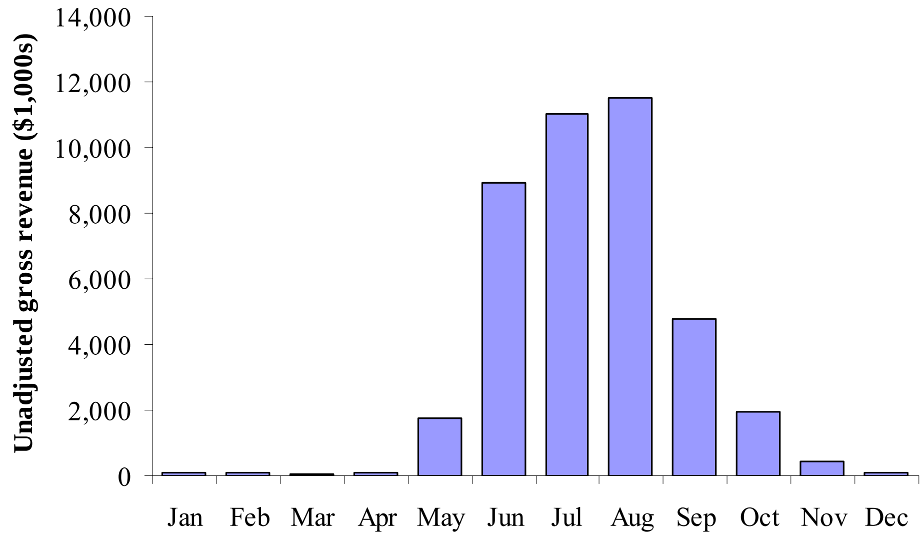


Figure 76. *Illex* value (unadjusted $1,000s) by month from 1998 – 2004.
Data source: Unpublished NMFS dealer weighout data

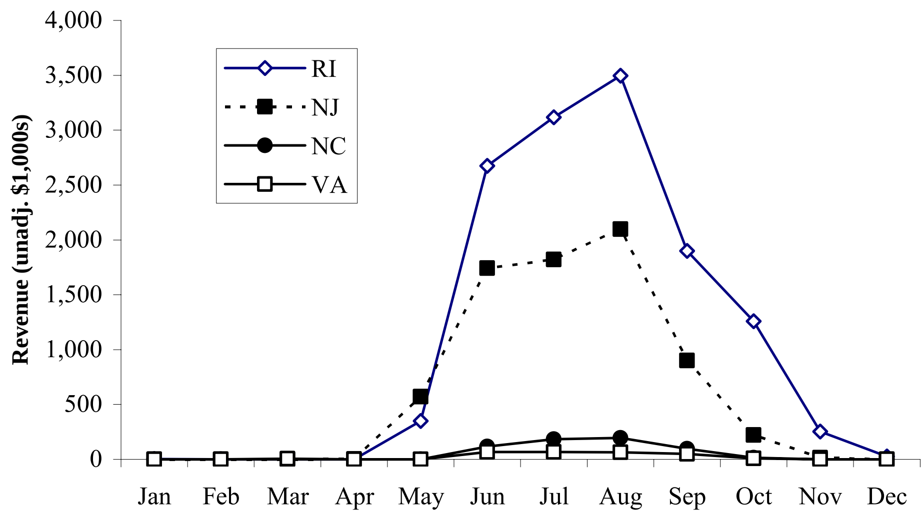


Figure 77. Combined 2002 – 2004 *Illex* landings revenue (unadjusted $1,000s) by month and state.
Data source: Unpublished NMFS dealer weighout data

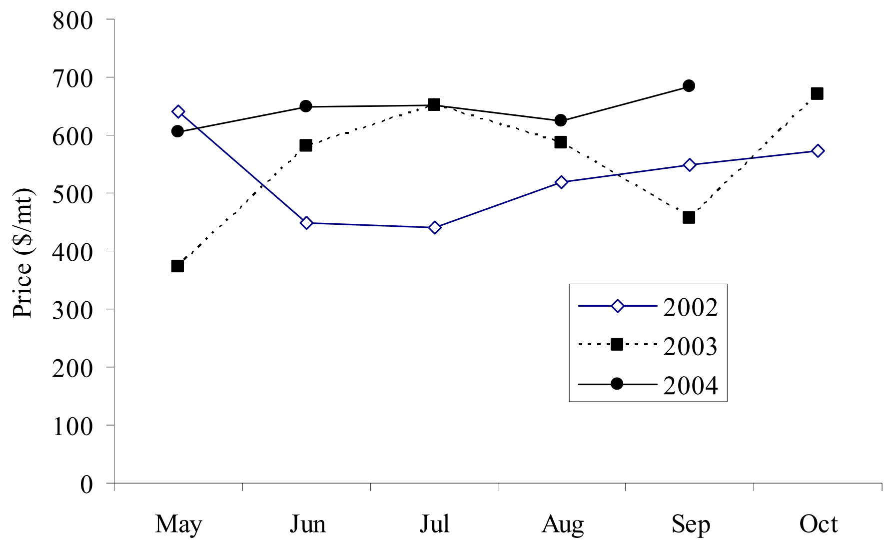


Figure 78. *Illex* price ($/mt) by month in 2002 – 2004.
Data source: Unpublished NMFS dealer weighout data

Commercial Gear

Tables 43-45 provide revenue data by gear for the top *Illex* vessels in 2002-2004 (N = 12). According to the 2002-2004 dealer weighout data, bottom otter trawls are the primary gear used in the commercial harvest of *Illex* (Table 43). In 2004, the record high year for *Illex* landings, 99.9% of the *Illex* revenue landings came from bottom otter trawls in 2004 (discounting the "unknown" gear category).

Within years, commercial revenues peak in May – October for all gears used in the fishery. There does not appear to be a season for which the relative importance of gear types shifts within the fishing year (Table 44). Additionally, the distribution of commercial gear by state (Table 45) reflects the predominance of bottom otter trawls in the harvest of *Illex*.

Table 43. *Illex* revenue (unadj. $1,000s) by gear for the top according to 2002-2004 dealer weighout data.

GEAR	2002	2003	2004
TRAWL,OTTER,BOTTOM,FISH	1,292	3,707	13,399
TRAWL,OTTER,MIDWATER PAIRED		12	
TRAWL,OTTER,MIDWATER		4	
TRAWL,OTTER,BOTTOM,OTHER		2	
UNKNOWN			416
ALL OTHERS			<1

Table 44. Commercial *Illex* revenue (unadj. $1,000s) by gear and month (combined 2002-2004).
Data source: Unpublished NMFS dealer weighout data

GEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TRAWL,OTTER,BOTTOM,FISH	2	<1		4	785	3,950	4,328	5,199	2,379	1,455	268	27
TRAWL,OTTER,MIDWATER PAIRED									12			
TRAWL,OTTER,MIDWATER						4						
TRAWL,OTTER,BOTTOM,OTHER							2					
UNKNOWN					38	105	111	<1	163			
ALL OTHERS												<1

Table 45. Commercial *Illex* revenue (unadj. $1,000s) by gear and state (combined 2002-2004).
Data source: Unpublished NMFS dealer weighout data

GEAR	RI	NJ	NC	VA
TRAWL,OTTER,BOTTOM,FISH	12,161	6,237	<1	
TRAWL,OTTER,MIDWATER PAIRED		12		
TRAWL,OTTER,MIDWATER		4		
TRAWL,OTTER,BOTTOM,OTHER			2	
UNKNOWN	416			
ALL OTHERS	<1			

6.5.2.3 Commercial *Loligo* Fishery

Access to the Commercial Fishery

There are three types of Federal commercial fishing permits that apply to the harvest of *Loligo* under 50 CFR §648.4:

The *Loligo*/butterfish moratorium permit (SMB1): "To be eligible to apply for a moratorium permit to fish for and retain … *Loligo* squid in excess of the incidental catch allowance … in the EEZ, a vessel must have been issued [an] … *Loligo* squid moratorium permit …, for the preceding year, be replacing a vessel that was issued a moratorium permit for the preceding year, or be replacing a vessel that was issued a confirmation of permit history."

The party/charter permit (SMB2): see description under Atlantic mackerel heading (above)

The squid/butterfish incidental catch permit (SMB3): "Any vessel of the United States may obtain a permit to fish for or retain up to … 2,500 lb (4.54 mt) of *Loligo* squid, as an incidental catch in another directed fishery. The incidental catch allowance may be revised by the Regional Administrator based upon a recommendation by the Council following the procedure set forth in §648.21."

The moratorium permit was implemented in 1997, but is not reflected in the permit data until 1998. Since implementation there have been approximately 400 vessels in possession of the moratorium permit. According to dealer reports, from 1998 to 2004, 94.5% on average of annual commercial *Loligo* landings came from vessels in possession of the *Loligo* moratorium permit (Table 46). The contribution to annual landings by incidental catch permit holders is approximately 1.3%. The remainder of the landings as reported in the dealer data comes from vessels with no Federal *Loligo* permit (0.7%) or from unknown vessels (3.5%).

Table 46. The landings (mt) of *Loligo* by permit category from 1998 – 2004.
Source: Unpublished NMFS dealer weighout and permit data

	LOLIGO MORATORIUM		INCIDENTAL TAKE		PARTY CHARTER		NO *LOLIGO* PERMIT		UNKNOWN VESSELS		TOTAL	
Year	mt	pct	mt	pct	mt	pct	mt	pct	mt	pct	mt	pct
1998	18,263	95.5%	126	0.7%	0	0.0%	101	0.5%	633	3.3%	19,123	100.0%
1999	18,424	95.4%	215	1.1%	0	0.0%	110	0.6%	570	3.0%	19,319	100.0%
2000	16,057	93.1%	393	2.3%	0	0.0%	146	0.8%	657	3.8%	17,252	100.0%
2001	13,423	94.3%	170	1.2%	6	0.0%	116	0.8%	523	3.7%	14,238	100.0%
2002	15,279	91.5%	408	2.4%	4	0.0%	135	0.8%	881	5.3%	16,707	100.0%
2003	11,299	97.2%	98	0.8%	0	0.0%	98	0.8%	127	1.1%	11,623	100.0%
2004	12,567	94.3%	100	0.7%	1	0.0%	81	0.6%	574	4.3%	13,322	100.0%
Mean pct		94.5%		1.3%		0.0%		0.7%		3.5%		100.0%

Excluding unknown vessels, the bulk (95%) of *Loligo* landings from 1998 to 2004 was harvested by 208 vessels, and 37 vessels landed the top 50% of the combined landings. From 2002 to 2004 148 vessels landed 95% of the combined *Loligo* landings and 30 vessels landed the top 50%.

<u>Market for *Loligo*</u>

The disposition of the vast majority of the U.S. commercial harvest of *Loligo* is in the food/unknown category (average = 99.95% from 2001-2004), while a small amount is reported to be sold as bait (average = 0.05% from 2001-2004) according to NMFS dealer reports. In 2003 and 2004, exports of *Loligo* were sold as prepared/preserved product (48%), live/fresh product (30%), and frozen/dried/salted/brine product (22%) according to the NOAA Fisheries Office of Science and Technology.

U.S. exports of *Loligo* totaled 8,993 mt valued at $13.6 million in 2003. The leading markets for U.S. exports of *Loligo* in 2003 were reported as China (3,077 mt), Japan (2,685 mt), Greece (766 mt), Italy (589 mt) and Spain (566 mt). In 2004, U.S. exports of *Loligo* totaled 14,292 mt valued at $20.1 million. The leading markets for U.S. exports of *Loligo* in 2004 were reported as China (4,621 mt), Japan (2,028 mt), Spain (1,714 mt), Venezuela (1,013 mt), Italy (1,001 mt) and Greece (777 mt).

Fleet Characteristics

The home ports indicated in the NMFS permit data for the top 1998-2004 *Loligo* vessels (N = 208) are primarily in Rhode Island, New York, Massachusetts, New Jersey, Maine, and North Carolina (Table 47). These vessels range in size from 9 to 258 gross tons (Table 48), and are between 27 and 138 feet in length (Table 49). Crew size for these vessels ranges between 1 and 14 (Table 50).

Rhode Island, New York, New Jersey and Massachusetts are the primary states where *Loligo* are landed commercially (Tables 51, 52). Landings have fluctuated in Rhode Island and New York from 1998 and 2004, and have generally declined in New Jersey (Tables 51, 52).

With regard to specific ports, the majority of *Loligo* revenues in recent years (2002-2004) came from landings Point Judith, RI, Montauk, NY, North Kingstown, RI, Hampton Bay, NY, Newport, RI, and Cape May, NJ (Table 53). As a percentage of the total annual revenue for these ports, *Loligo* has been relatively consistent in all of these ports except Cape May, NJ where the relative vale dropped significantly in 2004 (Table 53).

Among the 67 vessels whose combined 2002 – 2004 *Loligo* revenues comprised ≥ 1% of the total 2002 – 2004 *Loligo* revenues for all vessels, the majority collected 25% to 50% of their total revenues through the landings of *Loligo*. Those vessels whose mean total revenues were greatest in 2002 – 2004 had *Loligo* revenues as 10 – 25% of total revenues in each year (Table 54).

Table 47. Top *Loligo* vessel home ports. Top vessels landed 95% of the combined 1998-2004 commercial landings.

Homeport	N Vessels
Point Judith, RI	35
Cape May, NJ	25
New York, NY	20
New Bedford, MA	17
Boston, MA	15
Newport, RI	10
Montauk, NY	9
Point Pleasant, NJ	7
Shinnecock, NY	7
Portland, ME	6
Hampton Bays, NY	5
Greenport, NY	4
Narragansett, RI	4
Wanchese, NC	4
Belford, NJ	3
Gloucester, MA	3
Wakefield, RI	3
All Others	31
Total	208

Table 48. Distribution of vessel gross tonnage by home port state for major *Loligo* vessels.
Data source: Unpublished NMFS Permit Data

Gross Tonnage	RI	NY	MA	NJ	ME	NC	Other	Total
<5								0
5-10			2					2
11-25		4	1		1			6
26-50	4	10	4	1				19
51-100	13	17	12	9				51
101-150	26	9	13	18	1	1	4	72
151-200	11	9	13	13	4	3	3	56
200-250	1							1
250-300				1				1
>300								0
Total	55	49	45	42	6	4	7	208

Table 49. Distribution of vessel length (ft) by home port state for major *Loligo* vessels.
Data source: Unpublished NMFS Permit Data a

Length (ft)	RI	NY	MA	NJ	ME	NC	Other	Total
<25								0
25-50	1	10	4		1			16
51-75	36	27	20	22	1		2	108
76-100	16	11	20	18	4	4	4	77
101-125	1	1		2				4
126-150	1		1				1	3
>150								0
Total	55	49	45	42	6	4	7	208

Table 50. Distribution of vessel crew size by home port state for major *Loligo* vessels.
Data source: Unpublished NMFS Permit Data

CREW	RI	NY	MA	NJ	ME	NC	Other	Total
1		2						2
2		11	4	2				17
3	10	14	7	7	1	1		40
4	30	10	13	7	4		1	65
5	12	7	13	8		1	1	42
6	1	4	3	3			2	13
7	1		3	9	1		1	15
9			1	6		2		9
10		1					1	2
14	1		1				1	3
>14								0
Total	55	49	45	42	6	4	7	208

Table 51. *Loligo* commercial landings (mt) by state.
Data source: Unpublished NMFS dealer weighout data.

YEAR	RI	NY	NJ	MA	All Others	Total
1998	9,342	3,765	4,627	633	757	19,123
1999	9,178	4,835	3,358	1,221	727	19,319
2000	6,952	5,781	2,557	1,207	755	17,252
2001	7,019	3,459	2,558	401	801	14,238
2002	8,227	4,361	2,093	1,068	959	16,707
2003	7,121	2,088	1,075	849	490	11,623
2004	7,944	2,589	1,309	1,053	427	13,322

Table 52. *Loligo* commercial landings (pct) by state.
Data source: Unpublished NMFS dealer weighout data.

YEAR	RI	NY	NJ	MA	All Others	Total
1998	49%	20%	24%	3%	4%	100%
1999	48%	25%	17%	6%	4%	100%
2000	40%	34%	15%	7%	4%	100%
2001	49%	24%	18%	3%	6%	100%
2002	49%	26%	13%	6%	6%	100%
2003	61%	18%	9%	7%	4%	100%
2004	60%	19%	10%	8%	3%	100%

Table 53. *Loligo* revenue and total port revenue (unadj. $1,000s) for major ports where *Loligo* was landed in 2002 - 2004.
Data source: Unpublished NMFS Dealer Weighout Data

	2002			**2003**			**2004**		
Port	***Loligo* revenue**	**Total revenue**	**Pct *Loligo***	***Loligo* revenue**	**Total revenue**	**Pct *Loligo***	***Loligo* revenue**	**Total revenue**	**Pct *Loligo***
Point Judith, RI	8,177	21,007	39%	7,848	22,344	35%	8,588	23,990	36%
Montauk, NY	2,559	6,511	39%	2,354	6,737	35%	2,704	11,125	24%
North Kingstown, RI	2,100	5,575	38%	2,054	7,493	27%	2,562	6,958	37%
Hampton Bay, NY	3,205	6,103	53%	1,732	4,844	36%	1,653	5,345	31%
Newport, RI	1,489	4,256	35%	1,106	5,430	20%	1,322	4,218	31%
Cape May, NJ	1,475	3,353	44%	1,003	3,570	28%	1,391	21,033	7%
New Bedford, MA	733	51,811	1%	684	50,365	1%	989	90,729	1%
New London, CT	651	2,031	32%	278	1,219	23%	132	714	19%
Elizabeth, NJ	960	1,059	91%	90	94	96%			
East Lyme, CT				463	463	100%	382	382	100%
Pt. Pleasant, NJ	260	2,925	9%	240	3,218	7%	225	5,461	4%
Freeport, NY	421	877	48%	188	608	31%	73	273	27%
Stonington, CT	525	1,997	26%	4	15	28%	140	826	17%
Boston, MA	28	1,683	2%	414	3,965	10%	196	3,261	6%

Table 54. Relative importance of *Loligo* revenue for major *Loligo* vessels from 2002 – 2004 (N = 67). Revenues are unadjusted gross $1,000s. Data source: Unpublished NMFS Dealer Weighout Data

	2002			2003			2004		
Pct of annual revenue from *Loligo*	Vessels (N)	Mean *Loligo* revenue	Mean total revenue	Vessels (N)	Mean *Loligo* revenue	Mean total revenue	Vessels (N)	Mean *Loligo* revenue	Mean total revenue
< 5%	3	15	388	0			1	0	0
5%-10%	0			2	70	827	2	53	901
10%-25%	11	149	824	16	150	982	19	183	1,246
25%-50%	33	227	637	33	213	655	31	219	583
50%-75%	14	283	462	12	333	573	12	472	826
75%-90%	4	451	578	3	226	279	2	425	544
≥ 90%	2	491	532	1	90	90	0		

Trends in *Loligo* Revenues

Annual gross revenues from U.S. commercial *Loligo* landings rose significantly in the 1980s from less than $2 million in 1982 to over $22 million in 1989. Since then gross revenues have ranged from $14 million in 1990 to slightly less than $34 million in 1999. Annual revenues have tracked landings fairly consistently over the entire time period (Figure 79). The number of trips that landed *Loligo* declined steadily from 1998 (~10,500) to 2003 (~4,500). Except for a notable jump in trips in 2004, trips have tracked landings fairly consistently between 1998 -2004 suggesting that the catch efficiency of the *Loligo* fleet has not changed remarkably during this time period, (Figure 80).

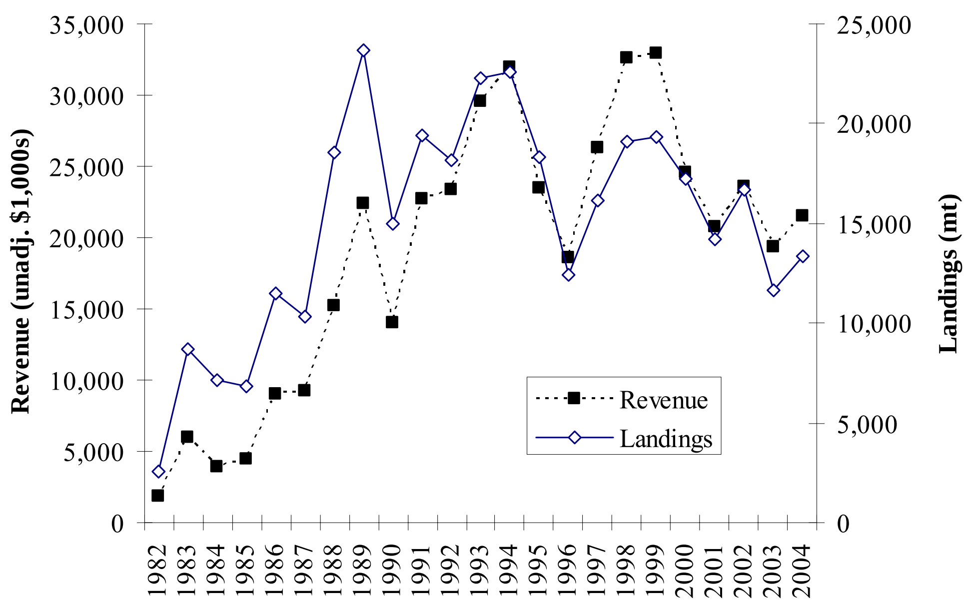


Figure 79. U.S. Commercial *Loligo* landings (mt) and revenue (unadjusted $1,000s) from 1982 – 2004).
Data source: Unpublished NMFS dealer weighout data.

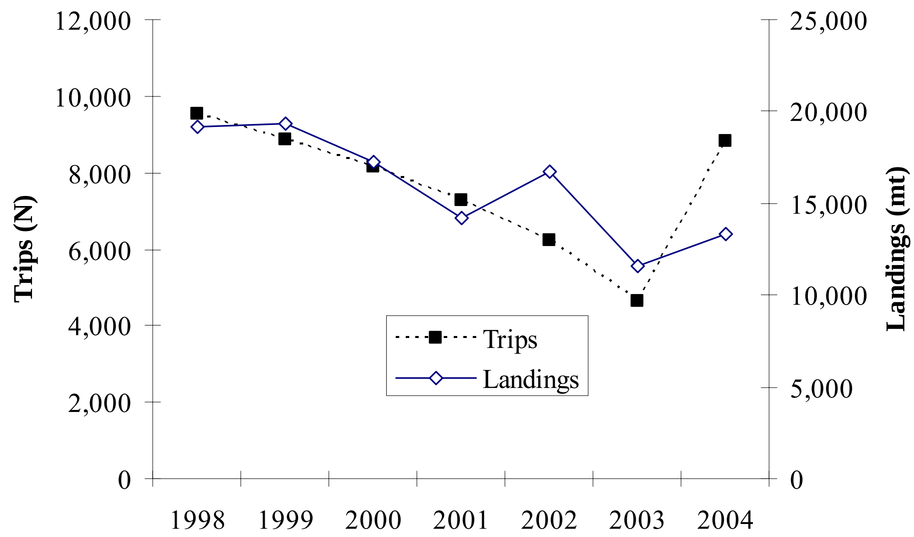


Figure 80. U.S. commercial *Loligo* trips (N) and landings (mt) from 1998 - 2004.
Data source: Unpublished NMFS dealer weighout data

Within years, landings and revenue from the *Loligo* fishery are greater in the fall and winter to early spring than in the summer months (Figure 81).

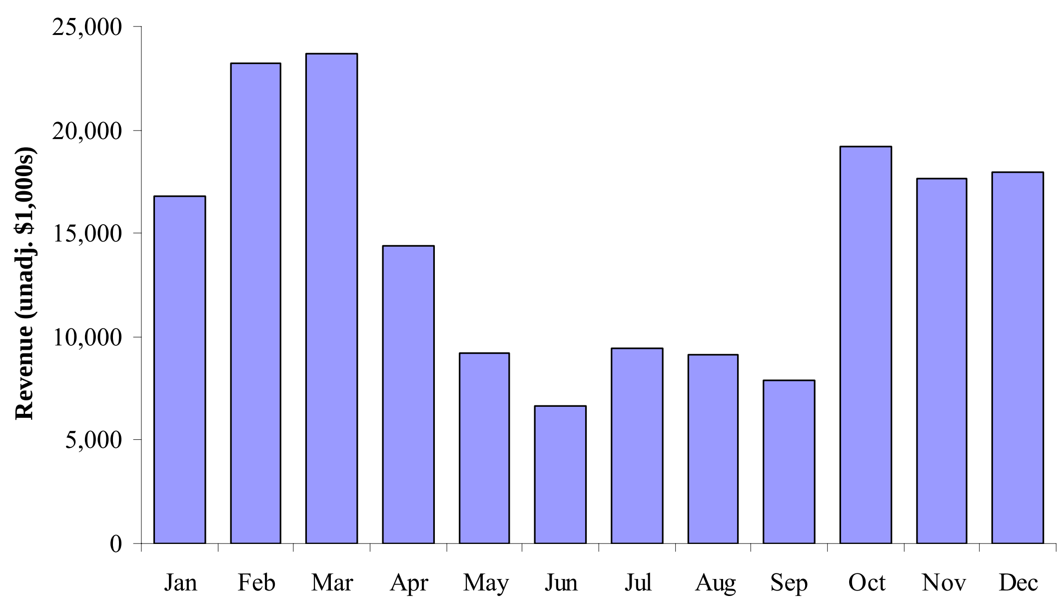


Figure 81. *Loligo* value (unadjusted $1,000s) by month from 1998 – 2004.
Data source: Unpublished NMFS dealer weighout data

Over the past three years (2002-2004), the price of *Loligo* during the height of the fishery (Oct – Apr) has ranged from about $1,200/mt to $2,000/mt. The average monthly price of *Loligo* in 2002 and 2004 was relatively stable throughout the year compared to 2003 when the price peaked in the summer months (June – August; Figure 82).

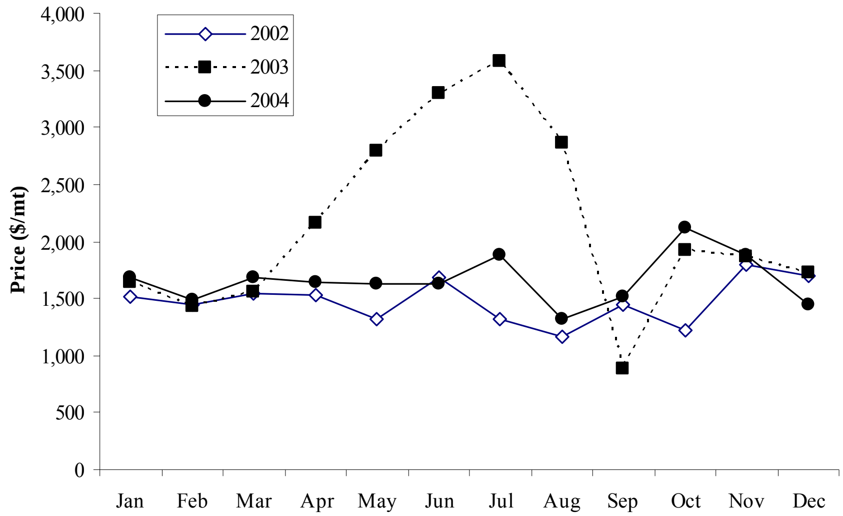


Figure 82. *Loligo* price ($/mt) by month in 2002 – 2004.
Data source: Unpublished NMFS dealer weighout data

Commercial Gear

According to the 2002-2004 dealer reports, bottom otter trawls are the primary gear used in the commercial harvest of *Loligo*, and this is consistent across months and states (Tables 55-57).

Table 55. *Loligo* revenue (unadj. $1,000s) by gear for the top according to 2002-2004 dealer weighout data.

GEAR	2002	2003	2004
Trawl, Otter, Bottom, Fish	16,279	14,603	10,990
Unknown	1	153	4,180
All Others	32	4	1,645

Table 56. Commercial *Loligo* revenue (unadj. $1,000s) by gear and month (combined 2002-2004).
Data source: Unpublished NMFS dealer weighout data

GEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Trawl, Otter, Bottom, Fish	6,083	7,224	5,475	3,726	1,160	429	1,662	1,504	1,254	4,050	4,486	4,816
Unknown	42	114	25	12	148	110	157	130	172	589	1,301	1,532
All Others	<1	2		<1	3	25	11	89	90	87	504	870

Table 57. Commercial *Loligo* revenue (unadj. $1,000s) by gear and state (combined 2002-2004).
Data source: Unpublished NMFS dealer weighout data

GEAR	RI	NY	NJ	MA	All Others
Trawl, Otter, Bottom, Fish	26,354	10,505	3,430	1,371	213
Unknown	3,548	406	48	42	290
All Others	946	353	369	11	2

6.5.2.4 Commercial Butterfish Fishery

Access to the Commercial Fishery

There are three types of Federal commercial fishing permits that apply to the harvest of butterfish under 50 CFR §648.4:

The *Loligo*/butterfish moratorium permit (SMB1): "To be eligible to apply for a moratorium permit to fish for and retain … butterfish in excess of the incidental catch allowance … in the EEZ, a vessel must have been issued a … butterfish moratorium permit …, for the preceding year, be replacing a vessel that was issued a moratorium permit for the preceding year, or be replacing a vessel that was issued a confirmation of permit history."

The party/charter permit (SMB2): see description under Atlantic mackerel heading (above)

The squid/butterfish incidental catch permit (SMB3): "Any vessel of the United States may obtain a permit to fish for or retain up to … 2,500 lb (4.54 mt) of butterfish, as an incidental catch in another directed fishery. The incidental catch allowance may be revised by the Regional Administrator based upon a recommendation by the Council following the procedure set forth in §648.21."

The moratorium permit was implemented in 1997, but is not reflected in the permit data until 1998. Since implementation there have been approximately 400 vessels in possession of the moratorium permit. According to dealer reports, from 1998 to 2004, 83.1%, on average, of annual commercial butterfish landings came from vessels in possession of the butterfish moratorium permit (Table 58). The contribution to annual landings by incidental catch permit holders is approximately 3.1%. The remainder of the landings as reported in the dealer data comes from vessels with no Federal butterfish permit (2.5%) and a significant contribution comes from unknown vessels (11.2%).

Table 58. The landings (mt) of butterfish by permit category from 1998 – 2004.
Source: Unpublished NMFS dealer weighout and permit data

	BUTTERFISH MORATORIUM		INCIDENTAL CATCH PERMIT		PARTY CHARTER		NO BUTTERFISH PERMIT		UNKNOWN VESSELS		TOTAL	
Year	mt	pct	mt	pct	mt	pct	mt	pct	mt	pct	mt	pct
1998	1,711	87.0%	34	1.7%		0.0%	35	1.8%	186	9.5%	1,966	100.0%
1999	1,868	88.5%	33	1.6%		0.0%	28	1.3%	181	8.6%	2,110	100.0%
2000	1,175	81.1%	60	4.1%	0	0.0%	41	2.9%	173	11.9%	1,449	100.0%
2001	3,991	90.6%	52	1.2%	1	0.0%	89	2.0%	271	6.1%	4,404	100.0%
2002	653	74.9%	39	4.5%	0	0.0%	40	4.6%	140	16.0%	872	100.0%
2003	398	84.2%	17	3.7%	0	0.0%	15	3.1%	43	9.1%	473	100.0%
2004	318	75.4%	22	5.3%	0	0.0%	8	2.0%	74	17.4%	422	100.0%
Mean pct		83.1%		3.1%		0.0%		2.5%		11.2%		100.0%

Excluding unknown vessels, the bulk (95%) of butterfish landings from 1998 to 2004 was harvested by 217 vessels, and 20 vessels landed the top 50% of the combined landings. From 2002 to 2004, 95% of the landings came from 194 vessels landed and 33 vessels landed the top 50%.

Market for Butterfish

The disposition of the vast majority of the U.S. commercial harvest of butterfish is in the food/unknown category (average = 97.0% from 2001-2004), while a small amount is reported to be sold as bait (average = 3.0% from 2001-2004) according to NMFS dealer reports. In both 2003 and 2004, exports of butterfish were sold only as frozen product according to the NOAA Fisheries Office of Science and Technology.

U.S. exports of butterfish totaled 112 mt valued at $135 thousand in 2003. U.S. exports of butterfish in 2003 went only to Japan (101 mt) and Singapore (11 mt). In 2004, U.S. exports of butterfish totaled 962 mt valued at $580 thousand. U.S. exports of butterfish in 2004 went to China (748 mt), Hong Kong (96 mt), Japan (71 mt), Singapore (23 mt), South Korea (19 mt), and Taiwan (6 mt).

The dramatic decline in butterfish landings in recent year (see below) is a function of market demand and the condition of the stock. In general, demand in the export market is for large butterfish. Biomass of the butterfish stock, however, has been declining since the early 1980s, and, in particular, the number of large butterfish in the population has declined substantially relative to historic levels.

Fleet Characteristics

The home ports indicated in the NMFS permit data for the top 1998-2004 butterfish vessels (N = 217) are primarily in Rhode Island, New York, Massachusetts, New Jersey, Maine, and North Carolina (Table 59). These vessels range in size from 9 to 258 gross tons (Table 60), and are between 27 and 138 feet in length (Table 61). Crew size for these vessels ranges between 1 and 14 (Table 62).

Rhode Island, New York, and New Jersey are the primary states where butterfish are landed commercially (Tables 63, 64). Landings have fluctuated in Rhode Island and New York from 1998 and 2004, and have generally declined in New Jersey (Tables 63, 64).

With regard to specific ports, the majority of butterfish revenues in recent years (2002-2004) came from landings Point Judith, RI, and Montauk, NY (Table 65). As a percentage of the total annual revenue for these ports, butterfish has been relatively insignificant in all of these ports where it is landed with a few exceptions such as Amagansett, NY and Green port, NY (Table 65).

Among the 68 vessels whose combined 2002 – 2004 butterfish revenues comprised ≥ 1% of the total 2002 – 2004 butterfish revenues for all vessels, the vast majority collected <5% of their total revenues through the landings of butterfish (Table 66).

Table 59. Top butterfish vessel home ports. Top vessels landed 95% of the combined 1998-2004 commercial landings.

Homeport	N Vessels
Point Judith, RI	38
New York, NY	24
Cape May, NJ	17
Montauk, NY	16
Boston, MA	11
Newport, RI	11
Belford, NJ	7
New Bedford, MA	6
Shinnecock, NY	6
Gloucester, MA	5
Greenport, NY	5
Hampton Bays, NY	5
Narragansett, RI	5
Point Pleasant, NJ	5
Wanchese, NC	5
Ocean City, MD	4
Barnegat Light, NJ	3
Portland, ME	3
Wakefield, RI	3
All Others	38
Total	217

Table 60. Distribution of vessel gross tonnage by home port state for major butterfish vessels.
Data source: Unpublished NMFS Permit Data

Gross Tonnage	NY	RI	NJ	MA	NC	MD	ME	Other	Total
<5	1								1
5-10	1	1		2					4
11-25	14	6	2	1			1	1	25
26-50	16	7	5	2		2		2	34
51-100	16	15	9	6		1			47
101-150	9	24	14	8	4	1	1	3	64
151-200	8	11	9	8	2		1	2	41
200-250		1							1
>250									
Total	65	65	39	27	6	4	3	8	217

Table 61. Distribution of vessel length (ft) by home port state for major butterfish vessels.
Data source: Unpublished NMFS Permit Data

Length (ft)	NY	RI	NJ	MA	NC	MD	ME	Other	Total
<25									0
25-50	26	10	5	4			1	3	49
51-75	29	38	19	9	3	4	1	2	105
76-100	10	15	14	13	3		1	2	58
100-125		1	1						2
125-150		1		1				1	3
>150									0
Total	65	65	39	27	6	4	3	8	217

Table 62. Distribution of vessel crew size by home port state for major butterfish vessels.
Data source: Unpublished NMFS Permit Data

CREW	NY	RI	NJ	MA	NC	MD	ME	Other	Total
1	8		1						9
2	18	7	7	1		1		2	36
3	15	11	9	4	1	2	1		43
4	12	31	4	9	3	1	2	2	64
5	7	12	7	9	1				36
6	5	1	3	3				1	13
7		1	5					1	7
9			3		1				4
10								1	1
14		1		1				1	3
15		1							1
>15									0
Total	65	65	39	27	6	4	3	8	217

Table 63. Butterfish commercial landings (mt) by state.
Data source: Unpublished NMFS dealer weighout data.

YEAR	RI	NY	NJ	All Others	Total
1998	1,193	381	190	202	1,966
1999	1,256	348	243	263	2,110
2000	584	400	237	227	1,449
2001	3,508	507	117	272	4,404
2002	414	238	59	162	872
2003	233	121	31	87	473
2004	164	154	36	69	422

Table 64. Butterfish commercial landings (pct) by state.
Data source: Unpublished NMFS dealer weighout data.

YEAR	RI	NY	NJ	All Others	Total
1998	61%	19%	10%	10%	100%
1999	60%	16%	12%	12%	100%
2000	40%	28%	16%	16%	100%
2001	80%	12%	3%	6%	100%
2002	47%	27%	7%	19%	100%
2003	49%	26%	7%	18%	100%
2004	39%	36%	8%	16%	100%

Table 65. Butterfish revenue and total port revenue (unadj. $1,000s) for major ports where Butterfish were landed in 2002 - 2004.
Data source: Unpublished NMFS Dealer Weighout Data

	2002			2003			2004		
PORTNAME	Butterfish revenue	Total revenue	Pct butterfish	Butterfish revenue	Total revenue	Pct butterfish	Butterfish revenue	Total revenue	Pct butterfish
Point Judith, RI	328	20,132	1.6%	248	19,896	1.2%	182	23,903	0.8%
Montauk, NY	170	6,648	2.6%	98	7,169	1.4%	98	10,705	0.9%
Hampton Bay, NY	80	6,774	1.2%	34	4,970	0.7%	38	5,543	0.7%
New London, CT	64	2,031	3.1%	24	1,227	1.9%	22	879	2.5%
Newport, RI	46	4,392	1.0%	41	5,430	0.7%	16	3,830	0.4%
Cape May, NJ	53	3,356	1.6%	16	3,366	0.5%	26	19,096	0.1%
Ammagansett, NY	28	349	8.0%	22	407	5.5%	34	353	9.6%
Greenport, NY	30	356	8.5%	10	426	2.4%	38	551	6.8%
New Bedford, MA	14	51,811	0.0%	10	50,250	0.0%	22	100,096	0.0%
Belford, NJ	15	1,779	0.9%	9	1,927	0.5%	10	2,609	0.4%
Freeport, NY	15	934	1.6%	13	603	2.1%	1	165	0.4%
Mattituck, NY	20	131	15.5%	2	258	0.8%	6	225	2.6%
Pt. Pleasant, NJ	9	3,431	0.3%	7	3,430	0.2%	12	4,898	0.2%

Table 66. Relative importance of butterfish revenue for major butterfish vessels from 2002 – 2004 (N = 68). Revenues are unadjusted gross $1,000s.
Data source: Unpublished NMFS Dealer Weighout Data

	2002			2003			2004		
Pct of annual revenue from butterfish	Vessels (N)	Mean butterfish revenue	Mean total revenue	Vessels (N)	Mean butterfish revenue	Mean total revenue	Vessels (N)	Mean butterfish revenue	Mean total revenue
< 5%	59	8	529	62	6	586	62	5	632
5%-10%	4	15	225	3	2	42	2	11	183
10%-25%	4	13	70	3	11	51	3	10	63
25%-50%	1	23	70	0			1	2	5
50%-75%	0			0			0		
75%-90%	0			0			0		
≥ 90%	0			0			0		

Trends in Butterfish Revenues

Annual gross revenues from U.S. commercial butterfish landings have declined considerably in recent years (Figure 83). In the 1980s, annual butterfish revenue ranged between $2.4 and $6.5 million. In the 1990s, revenue fluctuated within a similar range ($2.2 to $6.5 million). Since then, gross annual revenues peaked at around $3 million in 2001, but were less than $1 million in 2002 – 2004. The number of trips that landed butterfish fluctuated between 8,600 and 5,000 from 1998 to 2004. Revenue has fluctuated more widely over the same time period. Since butterfish are rarely the target species for a given fishing trip, a clear relationship between fishing effort and revenue is not expected (Figure 84).

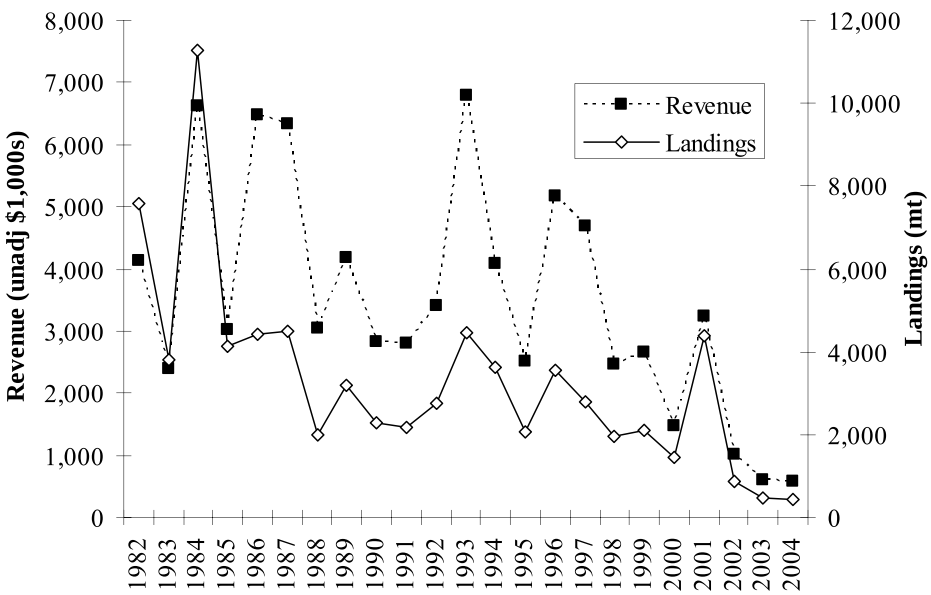


Figure 83. U.S. Commercial butterfish landings (mt) and revenue (unadjusted $1,000s) from 1982 – 2004. Data source: Unpublished NMFS dealer weighout data.

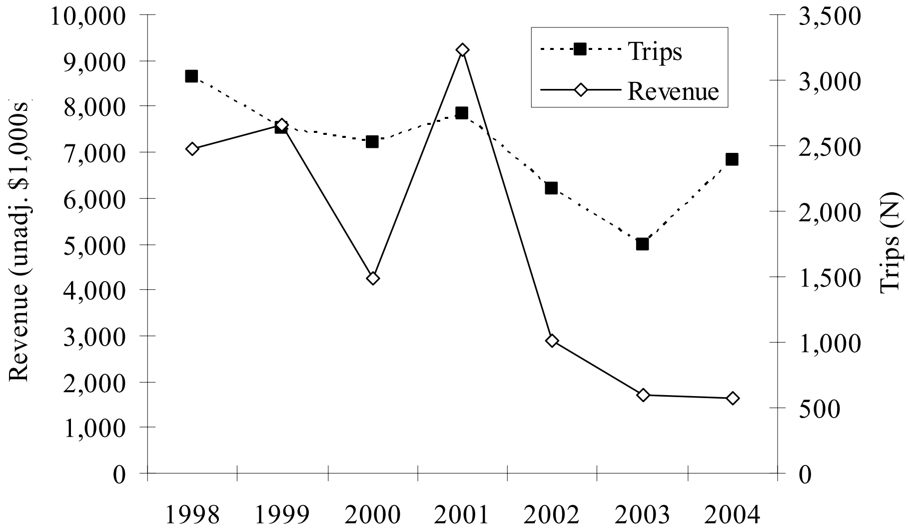


Figure 84. U.S. commercial butterfish trips (N) and landings (mt) from 1998 - 2004.
Data source: Unpublished NMFS dealer weighout data

Within years, revenue from the butterfish fishery is greatest in January through March after which is lowest in the summer months (Figure 85).

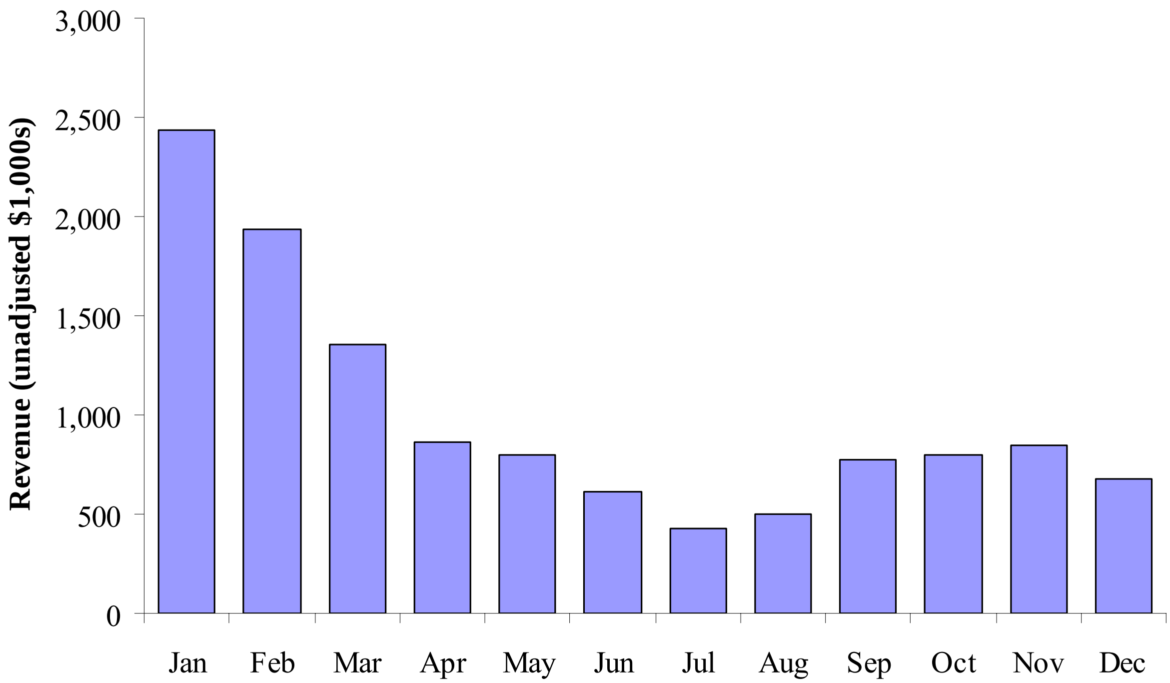


Figure 85. Butterfish value (unadjusted $1,000s) by month from 1998 – 2004.
Data source: Unpublished NMFS dealer weighout data

Over the past three years (2002-2004), the price of butterfish during the height of the fishery (Jan-Mar) has been fairly steady ranging from about $1,200/mt to $1,700/mt (Figure 86).

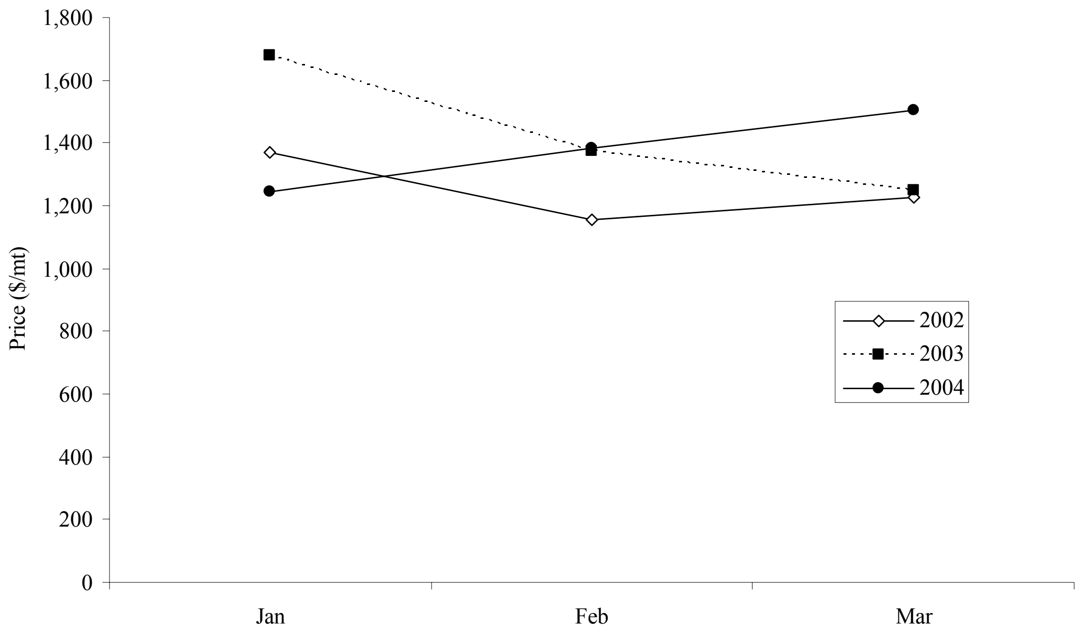


Figure 86. Butterfish price ($/mt) by month in 2002 – 2004.
Data source: Unpublished NMFS dealer weighout data

Commercial Gear

According to the 2002-2004 dealer reports, bottom otter trawls are the primary gear used in the commercial harvest of butterfish, and this is consistent across month and by state (Tables 67-69).

Table 67. Butterfish revenue (unadj. $1,000s) by gear for the top according to 2002-2004 dealer weighout data.

GEAR	2002	2003	2004
Trawl, Otter, Bottom, Fish	602	385	224
Unknown	4		99
All Others	7	3	15

Table 68. Commercial butterfish revenue (unadj. $1,000s) by gear and month (combined 2002-2004).
Data source: Unpublished NMFS dealer weighout data

GEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Trawl, Otter, Bottom, Fish	177	173	187	135	130	80	49	30	62	50	61	77
Unknown			4		24	14	9	6	16	16	10	4
All Others	4	<1	<1	1	2	2	1	1	<1	1	6	8

Table 69. Commercial butterfish revenue (unadj. $1,000s) by gear and state (combined 2002-2004).
Data source: Unpublished NMFS dealer weighout data

GEAR	RI	NY	NJ	All Others
Trawl, Otter, Bottom, Fish	635	435	74	68
Unknown	64	35	<1	1245
All Others	9	2	9	5

7.0 Analysis of the Impacts of the Alternatives

In the following sections, consideration is given to the potential impacts of the alternative management measures in Amendment 9. The impact analysis focuses on the valued ecosystem components (VECs) that were identified for Amendment 9 and described in detail in Section 6.0 of this document. These VECs include:

1. Managed Resources
   - Atlantic mackerel stock
   - *Illex* stock
   - *Loligo* stock
   - Atlantic butterfish stock
2. Non-target species
3. Habitat including EFH for the managed resources and non-target species
4. Endangered and other protected resources
5. Human Communities

Table 70 is provided as a summary of the likely impacts of the various management alternatives under consideration in Amendment 9.

Table 70. Management alternatives under consideration in Amendment 9 and expected impacts on VECs.

Management Measure		**VECs**				
		Managed resource	**Non-target species**	**Habitat including EFH**	**Protected Resources**	**Human Communities**
MULTI-YEAR SPECIFICATIONS FOR ALL SPECIES MANAGED UNDER THE FMP	Alternative 1A: No action	No Impact – administrative	No Impact – administrative	No Impact – administrative	No Impact – administrative	No Impact – specifications would continue to be set on an annual basis
	Alternative 1B: Allow for specification of management measures (including quota specifications) for all four species in the management unit for a period of up to three years (Preferred Alternative)	No Impact – administrative	No Impact – administrative	No Impact – administrative	No Impact – administrative	Potentially Low Positive – industry members could better plan future fishing operations, leading to greater economic benefits
	Alternative 1C: Allow for specification of management measures (including quota specifications) for all four species in the management unit for a period of up to five years	No Impact – administrative	No Impact – administrative	No Impact – administrative	No Impact – administrative	Potentially Low Positive – industry members could better plan future fishing operations, leading to greater economic benefits

Table 70 (continued)

Management Measure		VECs				
		Managed resource	**Non-target species**	**Habitat including EFH**	**Protected Resources**	**Human Communities**
MEASURES TO ADDRESS OVERCAPACITY IN THE DIRECTED *ILLEX* FISHERY	Alternative 2A: No action	Negative – may increase the number of vessels in the fishery, making it more difficult to monitor the quota and constrain fishing effort	Potentially Negative – may increase fishing effort but not expected to jeopardize the viability	Negative – if an increase in bottom otter trawling effort occurs, would increase habitat disturbances	Negative – increased effort could increase interactions with protected species, particularly pilot whales	Potentially Negative –further overcapitalization may have negative economic impacts on the fleet and communities which depend on the *Illex* resource
	Alternative 2B: Extend the moratorium on entry to the *Illex* fishery without sunset provision (Preferred Alternative)	Positive –would decrease the likelihood that the fishing quota would be exceeded	Positive – would maintain current effort constraints	Neutral – if current trawling effort is maintained, would not increase habitat disturbances	Positive – current effort constraints would not result in additional impacts to protected species	Potentially Positive –would help maintain net benefits to the fleet and communities which depend on the *Illex* resource
	Alternative 2C: Terminate the moratorium on entry to the *Illex* fishery	Negative – may increase the number of vessels in the fishery, making it more difficult to monitor the quota and constrain fishing effort	Potentially Negative – may increase fishing effort but not expected to jeopardize the viability	Negative – if an increase in bottom otter trawling effort occurs, would increase habitat disturbances	Negative – increased effort could increase interactions with protected species, particularly pilot whales	Potentially Negative –further overcapitalization may have negative economic impacts on the fleet and communities which depend on the *Illex* resource
	Alternative 2D: Extend the moratorium on entry to the *Illex* fishery without sunset provision and allow new entry into fishery through permit transfer system	Positive – maintaining current effort constraints would decrease the likelihood that the fishing quota would be exceeded	Positive – would maintain current effort constraints	Neutral – if current trawling effort is maintained, would not increase habitat disturbances	Positive – current effort constraints would not result in additional impacts to protected species	Potentially Positive – would help maintain net benefits to the fleet and communities which depend on the *Illex* resource

Table 70 (continued)

Management Measure		VECs				
		Managed resource	**Non-target species**	**Habitat including EFH**	**Protected Resources**	**Human Communities**
REVISED BIOLOGICAL REFERENCE POINTS FOR *LOLIGO*	Alternative 3.A: No action	Potentially negative – a less reliable Ftarget definition would be less precise for achieving long-term sustainable yield	Unknown – likely to result in neutral overall impact to non-target species which would not change mortality	Unknown – not likely to result in substantial changes to habitat disturbance	Unknown – not likely to result in substantial changes to protected resource encounters	Unknown – not expected to result in an immediate change to the *Loligo* quota, thus consumer demand will affect *Loligo* prices which will result in economic impacts on harvesters and processors
	Alternative 3.B: Adopt SARC 34 Recommendation (Preferred Alternative)	Potentially positive – incorporating a new Ftarget definition is expected to help better achieve long-term sustainable yield.	Unknown – likely to result in neutral overall impact to non-target species which would not change mortality	Unknown – if increases in *Loligo* abundance occur, it may increase participation in the fishery which could increase habitat degradation	Unknown – if increases in *Loligo* abundance occur, it may increase participation in the fishery which could increase protected resource interactions	Unknown – not expected to result in an immediate change to the *Loligo* quota, however, if the new Ftarget does ultimately result in increased availability of the resource, it would likely provide a beneficial effect

Table 70 (continued)

Management Measure		VECs				
		Managed resource	**Non-target species**	**Habitat including EFH**	**Protected Resources**	**Human Communities**
DESIGNATION OF EFH FOR *LOLIGO* EGGS	Alternative 4A: No action	Potentially Negative – lack of EFH designation would provide less oversight of fishing and non-fishing activities in the area	Potentially Negative – lack of EFH designation would provide less oversight of fishing and non-fishing activities in the area	Potentially Negative – would not permit the use of regulatory tools and measures that could reduce fishing effort and protect habitat from non-fishing impacts	Potentially Negative – would not change endangered species interactions but would provide less oversight of fishing and non-fishing activities that could harm protected species	Potentially Negative – would provide less oversight of fishing and non-fishing activities in the area, possibly decreasing sustainability of the resource, ultimately having a negative impact on communities dependent on the resource
	Alternative 4B: EFH designation based on documented observations of egg mops	Potentially Positive – EFH designation could provide greater oversight of fishing and non-fishing activities in the area	Potentially Positive – EFH designation could provide greater oversight of fishing and non-fishing activities in the area	Potentially Positive – would permit the use of regulatory tools and measures that could reduce fishing effort and protect habitat from non-fishing impacts	Potentially Positive – would permit the use of regulatory tools and measures that could reduce fishing effort and improve conditions for protected species	Potentially Negative Short-term, Positive Long-term – future management actions could have negative short-term impacts on communities dependent on the resource. For the long-term, would be expected to improve sustainability of the resource, which would have a positive impact

Table 70 (continued)

Management Measure		VECs				
		Managed resource	**Non-target species**	**Habitat including EFH**	**Protected Resources**	**Human Communities**
AREA CLOSURES TO REDUCE GEAR IMPACTS TO EFH	Alternative 5A: No Action	Neutral – changes to intensity or distribution of fishing effort are not expected	Neutral – changes to intensity or distribution of fishing effort are not expected	Neutral – would not afford additional habitat protection for any species	Neutral – changes to intensity or distribution of fishing effort are not expected	Neutral – changes to intensity or distribution of fishing effort are not expected, thus socio-economic impacts are not anticipated
	Alternative 5B: Prohibit fishing with bottom otter trawls in the area surrounding the head of the Hudson Canyon	Potentially Positive – expected to result in a localized reduction in harvest but increased harvest outside closure area is possible	Potentially Positive – localized effort reduction	Positive – would provide the second greatest amount of protection to habitat for any species	Low Positive – may slightly reduce marine mammal, turtle encounters	High Negative – likely to reduce revenue by 10% or more on approximately 65 bottom otter trawl vessels
	Alternative 5C: Prohibit fishing with bottom otter trawls in tilefish HAPC	Potentially Positive – expected to result in a localized reduction in harvest but increased harvest outside closure area is possible	Potentially Positive – localized effort reduction	Positive – would provide the greatest amount of protection to the greatest amount of habitat – particularly tilefish EFH	Positive – would reduce marine mammal encounters, no impacts on turtles.	High Negative – likely to reduce revenue by 10% or more for approximately 201 bottom otter trawl vessels
	Alternative 5D: Prohibit fishing with bottom otter trawls in Lydonia and Oceanographer Canyon (Preferred Alternative)	Low Positive – small size of area, non-discernable positive impacts	Low Positive – small size of area, non-discernable positive impacts	Low Positive – protects deep sea corals in small area	Low Positive – small size of area, non-discernable positive impacts	No Impact – catch from these areas account for less than 0.5% of overall SMB landings

Table 70 (continued)

Management Measure		VECs					
		Managed resource		Non-target species	Habitat including EFH	Protected Resources	Human Communities
MODIFY *LOLIGO* MINIMUM MESH SIZE REQUIREMENTS	Alternative 6A: No Action	Butterfish - Negative – would contribute to continued discarding and deterioration of the stock	Other SMB - No Impact – would not increase or decrease mortality	No Impact – would not increase or decrease mortality	No Impact – changes to intensity or distribution of fishing effort are not expected, resulting in no additional or fewer habitat disturbances	No Impact – changes to intensity or distribution of fishing effort are not expected, thus no additional or fewer protected resources interactions	No Impact – changes to intensity or distribution of fishing effort are not expected, thus socio-economic impacts are not expected
	Alternative 6B: Increase minimum codend mesh size to $2^{1/8}$ inches	Butterfish - Low Positive – little positive impact because mesh size ≥ to $2^{1/8"}$ is already in use by most of the *Loligo* fishery	Other SMB - No Impact – Impacts negligible because an increase in mesh size to $2^{1/8"}$ would affect only 10% of *Loligo* landings	Low Positive – a slight decrease in discard mortality would be expected	Low Negative – reduced retention of *Loligo* in trawls and corresponding increases in harvest effort would increase habitat disturbances	Low Negative – reduced retention of *Loligo* in trawls and corresponding increases in harvest effort could increase interactions with protected species	Low Negative – revenue loss associated with replacing codend nets should not be significant, however, revenue loss due to increased escapement of *Loligo* is likely to occur
	Alternative 6C: Increase minimum codend mesh size to $2^{1/2}$ inches	Butterfish - Low Positive – expected to provided benefit to butterfish stock through increased escapement	Other SMB - No Impact –an increase in mesh size to $2^{1/2"}$ would affect a negligible 10% of *Loligo* landings	Low Positive – a slightly greater decrease in discard mortality would be expected	Low Negative – reduced retention of *Loligo* in trawls and corresponding increases in harvest effort would increase habitat disturbances	Low Negative – reduced retention of *Loligo* in trawls and corresponding increases in harvest effort could increase interactions with protected species	Low Negative – revenue loss for replacing codend nets not significant, however, loss due to increased escapement of *Loligo* is likely to occur to a greater extent than under alternative 6B

Table 70 (continued)

Management Measure		VECs				
		Managed resource	Non-target species	Habitat including EFH	Protected Resources	Human Communities
MODIFY *LOLIGO* MINIMUM MESH SIZE REQUIREMENTS	Alternative 6D: Increase minimum codend mesh size to 3 inches	Butterfish - High Positive – expected to provided greatest benefit to butterfish stock through increased escapement Other SMB - No Impact –an increase in mesh size to 2 1/2" would affect a negligible 10% of *Loligo* landings	Positive – a greater decrease in discard mortality would be expected	Low Negative – reduced retention of *Loligo* in trawls and corresponding increases in harvest effort would increase habitat disturbances	Low Negative – reduced retention of *Loligo* in trawls and corresponding increases in harvest effort could increase interactions with protected species	Negative – revenue loss for replacing codend nets not significant, however, loss due to increased escapement of *Loligo* is likely to occur to a greater extent than under alternatives 6B-C
EXEMPTIONS FROM *LOLIGO* MINIMUM MESH REQUIREMENTS FOR *ILLEX* VESSELS	Alternative 7A: No Action (Preferred Alternative)	Butterfish - Low Negative – would not allow for increased escapement of butterfish Other SMB - No Impact - would not increase or decrease mortality	Low Negative – would not allow for increased escapement of non-target species	No Impact – changes to intensity or distribution of fishing effort are not expected, thus no additional or fewer habitat disturbances	No Impact – changes to intensity or distribution of fishing effort are not expected, thus no additional or fewer protected species interactions	No Impact – changes to intensity or distribution of fishing effort are not expected, thus socio-economic impacts are not expected

Table 70 (continued)

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<tr><th colspan="2" rowspan="2">Management Measure</th><th colspan="5">VECs</th></tr>
<tr><th>Managed resource</th><th>Non-target species</th><th>Habitat including EFH</th><th>Protected Resources</th><th>Human Communities</th></tr>
<tr><td rowspan="5">EXEMPTIONS FROM LOLIGO MINIMUM MESH REQUIREMENTS FOR ILLEX VESSELS</td><td rowspan="2">Alternative 7B: Modify exemption from Loligo mesh requirement for Illex vessels by excluding month of September from current mesh exemption for Illex fishery</td><td>Butterfish - Low Positive – may increase escapement of butterfish, thus reducing mortality</td><td rowspan="2">Low Positive – when the Illex fishery is not exempt from the Loligo minimum mesh size it would reduce mortality on non-target species</td><td rowspan="2">No Impact– changes to intensity or distribution of fishing effort expected to be minor, thus no additional or fewer habitat disturbances</td><td rowspan="2">No Impact– minor changes to intensity or distribution of fishing effort, thus no additional or fewer protected species interactions</td><td rowspan="2">Potentially Low Negative – any changes to harvest effort are expected to be minor, thus this measure would not generate measurable socio-economic impacts</td></tr>
<tr><td>Other SMB - No Impact - not expected to increase Illex or Loligo mortality</td></tr>
<tr><td rowspan="3">Alternative 7C: Modify exemption from Loligo mesh requirement for Illex vessels by excluding months of August and September from current mesh exemption for Illex fishery</td><td>Butterfish - Low Positive – may increase escapement of butterfish, thus reducing mortality</td><td rowspan="3">Low Positive –when the Illex fishery is not exempt from the Loligo minimum mesh size, it would reduce mortality on non-target species</td><td rowspan="3">Low Negative – may result in extra effort to achieve Illex harvest targets, resulting in increased effort and thus additional habitat disturbances</td><td rowspan="3">Low Negative – may result in extra effort to achieve Illex harvest targets, resulting in protected species interactions, particularly with pilot whales</td><td rowspan="3">Potentially Negative – likely to require additional harvest effort in order to meet harvest targets, thus expected to generate negative socio-economic impacts</td></tr>
<tr><td>Illex - Potentially Low Negative – mortality may increase, but the extent is unclear</td></tr>
<tr><td>Other SMB - No Impact – not expected to increase or reduce mortality</td></tr>
</table>

Table 70 (continued)

Management Measure		VECs				
		Managed resource	**Non-target species**	**Habitat including EFH**	**Protected Resources**	**Human Communities**
	Alternative 7D: Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels	Butterfish - Low Positive – would have greatest positive impact on butterfish because it would maximize the use of larger mesh, allowing greater escapement *Illex* - Low Negative – *Illex* would likely be lost through the larger mesh, resulting in increased mortality Other SMB - No Impact – not expected to increase or decrease mortality	Low Positive – would have the greatest positive impact because it would maximize the use of larger mesh, thus reducing mortality on non-target species	Low Negative – may result in extra effort to achieve *Illex* harvest targets, resulting in increased effort and thus additional habitat disturbances	Low Negative – may result in extra effort to achieve *Illex* harvest targets, resulting in additional protected species interactions, particularly with pilot whales	Negative – would require additional harvest effort in order to meet harvest targets, thus expected to generate negative socio-economic impacts
LOLIGO POSSESSION LIMIT FOR THE DIRECTED *ILLEX* FISHERY DURING CLOSURE OF THE DIRECTED *LOLIGO* FISHERY	Alternative 8A: No Action (For *Illex* moratorium permitted vessels, the *Loligo* possession limit during closures of the directed *Loligo* fishery is consistent with the incidental catch allowance for all vessels – currently 2,500 pounds)	*Loligo* - Negative – would maintain current levels of regulatory *Loligo* discarding Other SMB - No Impact – would not increase or decrease mortality	No Impact – would not increase or decrease mortality	No Impact – changes to intensity or distribution of fishing effort are not expected, resulting in no additional or fewer habitat disturbances	No Impact – changes to intensity or distribution of fishing effort are not expected, resulting in no additional or fewer protected species interactions	No Impact – changes to intensity or distribution of fishing effort are not expected, thus socio-economic impacts are not expected

Table 70 (continued)

Management Measure		VECs				
		Managed resource		Managed resource		Managed resource
LOLIGO POSSESSION LIMIT FOR THE DIRECTED *ILLEX* FISHERY DURING CLOSURE OF THE DIRECTED *LOLIGO* FISHERY (continued)	Alternative 8B: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of retained squid catch onboard, with a maximum limit of up to 30,000 pounds of *Loligo*	*Loligo* - Potentially Low Positive – would reduce the level of regulatory *Loligo* discarding, however, could result in directed *Loligo* fishing	Potentially Low Positive – may decrease effort on non-target species if a vessel achieves its trip target more quickly	Potentially Low Positive – may decrease effort if a vessel achieves its trip target more quickly, thus have positive impacts on habitat	Potentially Low Positive – may decrease effort if a vessel achieves its trip target more quickly, thus reducing potential for protected species interactions	*Illex* Fishery – Positive – would achieve the greatest economic gain by providing an additional ~33K per trip
		Other SMB - No Impact – would not increase or decrease mortality				*Loligo* Fishery – Negative –*Loligo* vessel owners and crew that do not possess an *Illex* permit may lose revenue if quota is harvested prematurely
	Alternative 8C: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 5% of the total weight of retained catch onboard, with a maximum limit of up to 20,000 pounds of *Loligo*	*Loligo* - Potentially Low Positive – would reduce the level of regulatory *Loligo* discarding, however, could result in directed *Loligo* fishing	Potentially Low Positive – may decrease effort on non-target species if a vessel achieves its trip target more quickly	Potentially Low Positive – may decrease effort if a vessel achieves its trip target more quickly, thus have positive impacts on habitat	Potentially Low Positive – may decrease effort if a vessel achieves its trip target more quickly, thus reducing potential for protected species interactions	*Illex* Fishery – Positive – would achieve the second greatest economic gain for the *Illex* fishery by providing an additional ~21K per trip
		Other SMB - No Impact – would not increase or decrease mortality				*Loligo* Fishery – Negative – *Loligo* vessel owners and crew that do not possess an *Illex* permit may lose revenue if quota is harvested prematurely

Table 70 (continued)

Management Measure		VECs				
		Managed resource	Non-target species	Habitat including EFH	Protected Resources	Human Communities
LOLIGO POSSESSION LIMIT FOR THE DIRECTED *ILLEX* FISHERY DURING CLOSURE OF THE DIRECTED *LOLIGO* FISHERY (continued)	Alternative 8D: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of retained catch onboard, with a maximum limit of up to 10,000 pounds of *Loligo*	*Loligo* - Low Positive – would likely have the most positive impact because it would reduce regulatory discards of *Loligo* but not create a directed *Loligo* fishery	Potentially Low Positive – would likely have the least non-target species effort reduction because a vessel would not achieve its trip target as quickly	Potentially Low Positive – may decrease effort if a vessel achieves its trip target more quickly, thus have positive impacts on habitat	Potentially Low Positive – would likely have the least impact on effort reduction because a vessel would not achieve its trip target as quickly, thus effort reductions would not be as likely. Despite this, may slightly reduce potential for protected species interactions	*Illex* Fishery - Low Positive – would achieve the third greatest economic gain for the *Illex* fishery by providing an additional ~10K per trip
		Other SMB - No Impact – would not increase or decrease mortality				*Loligo* Fishery - Low Negative – *Loligo* vessel owners and crew that do not possess an *Illex* permit may lose revenue if quota is harvested prematurely, though to a lesser extent than alternatives 8B and 8C

Table 70 (continued)

Management Measure		VECs				
		Managed resource	**Non-target species**	**Habitat including EFH**	**Protected Resources**	**Human Communities**
ELECTRONIC DAILY REPORTING REQUIREMENT FOR THE DIRECTED *ILLEX* FISHERY	Alternative 9A: No Action	- No Impact – would not increase or decrease mortality	No Impact – would not increase or decrease mortality	No Impact – not expected to change fishing effort using bottom otter trawls thus direct impacts to habitat are expected to be null	No Impact – not expected to change fishing effort, thus no additional or fewer protected species interactions are expected	No Impact - no additional costs because *Illex* vessel owners would not be required to purchase and utilize vessel monitoring equipment
	Alternative 9B: Require electronic daily reporting in the directed *Illex* fishery	- No Impact – would not increase or decrease mortality	No Impact – would not increase or decrease mortality	No Impact – not expected to change fishing effort using bottom otter trawls thus direct impacts to habitat are expected to be null	No Impact – not expected to change fishing effort, thus no additional or fewer protected species interactions are expected	Potentially Low Negative – *Illex* vessel owners would be required to purchase a vessel monitoring unit -($2,917-$3,475) and annually maintain the unit ($647-$1,260). Vessel size and/or revenue (gross revenue of the fleet is 1.4 million) may influence magnitude of effect.

Table 70 (continued)

Management Measure		VECs: Managed resource	Non-target species	Habitat including EFH	Protected Resources	Human Communities
IMPLEMENTATION OF SEASONAL GEAR RESTRICTED AREAS (GRAS) TO REDUCE BUTTERFISH DISCARDS	Alternative 10A: No Action (Preferred Alternative)	Butterfish - Negative – would not decrease butterfish discarding Other SMB - No Impact – would not increase or decrease mortality	No Impact – would not increase or decrease mortality	No Impact – not expected to change fishing effort, thus direct impacts to habitat would be null	No Impact – not expected to change fishing effort, thus no additional or fewer protected species interactions	No Impact – changes to intensity or distribution of fishing effort are not expected, thus socio-economic impacts are not expected
	Alternative 10B: Minimum of 3 inch codend mesh size in Butterfish GRA1	Butterfish - Positive – expect a reduction in butterfish discarding Other SMB – Unknown, Potentially Neutral – would likely result in a spatial shift in fishing effort (particularly for *Loligo fishery*) which may or may not decrease butterfish mortality	Positive – expect a reduction in non-target species discarding	Potentially Low Negative or Positive – least likely alternative to shift fishing effort, thus effort in areas outside the GRA may only slightly increase and have limited negative habitat impacts. Effort in GRA would be reduced, thus positively impacting habitat	Potentially Low Negative or Positive – least likely alternative to shift fishing effort, thus effort in areas outside the GRA may only slightly increase and have limited negative impacts on protected species. Effort in GRA would be reduced, thus positively impacting protected species	Negative – on average, ~105 vessels made trips into GRA1 with ~$14,255 revenue/trip. However, the actual loss of closing this area to vessels would depend upon how well vessels could make up catch in other areas or seasons or maintain previous revenue by changing mesh size

Table 70 (continued)

Management Measure		VECs				
		Managed resource	**Non-target species**	**Habitat including EFH**	**Protected Resources**	**Human Communities**
IMPLEMENTATION OF SEASONAL GEAR RESTRICTED AREAS (GRAS) TO REDUCE BUTTERFISH DISCARDS (continued)	Alternative 10C: Minimum of 3 inch codend mesh size in Butterfish GRA2	Butterfish - Positive – expect a reduction in butterfish discarding Other SMB - Unknown, Potentially Neutral – would likely result in a spatial shift in fishing effort (particularly for *Loligo fishery*) which may or may not decrease butterfish mortality	Positive – expect a reduction in non-target species discarding	Potentially Low Negative or Positive – may shift effort, thus effort outside the GRA may increase and have negative habitat impacts. Effort in GRA would be reduced, thus positively impacting habitat	Potentially Low Negative or Positive – shift in effort, thus effort outside the GRA may increase and have negative impacts on protected species. Effort in GRA would be reduced, thus a positive impact	Negative – on average, ~123 vessels made trips into GRA2 with ~$12,067 revenue/trip. Loss of closing this area to vessels would depend upon how vessels could make up catch in other areas or seasons or maintain revenue by changing mesh size
	Alternative 10D: Minimum of $3^{3/4}$ inch codend mesh size in Butterfish GRA1	Butterfish - Positive – increased mesh size expected to reduce discard and increase escapement Other SMB – Unknown, Potentially Neutral – would likely result in a spatial shift in fishing effort (particularly for *Loligo fishery*) which may or may not decrease butterfish mortality	Positive – expect a reduction in non-target species discarding and escapement is expected to be greater due to increased mesh size	Potentially Low Negative or Positive – shift in effort, effort outside the GRA may increase, have negative habitat impacts. Effort in GRA would be reduced positively impacting habitat	Potentially Low Negative or Positive – effort outside the GRA may increase, have negative impacts on protected species. Effort in GRA would be reduced, positively impacting P.R	High Negative – on average, ~133 vessels made trips into GRA1 with ~$13,581 revenue/trip. Loss of closing this area depends upon how vessels make up catch in other areas or seasons or maintain revenue by changing mesh size

Table 70 (continued)

Management Measure		VECs					
		Managed resource		Non-target species	Habitat including EFH	Protected Resources	Human Communities
IMPLEMENTATION OF SEASONAL GEAR RESTRICTED AREAS (GRAS) TO REDUCE BUTTERFISH DISCARDS (continued)	Alternative 10E: Minimum of $3^{3/4}$ inch codend mesh size in Butterfish GRA2	Butterfish - Positive – increased mesh size expected to reduce discard and increase escapement	Other SMB – Unknown, Potentially Neutral – would likely result in a spatial shift in fishing effort (particularly for *Loligo fishery*) which may or may not decrease butterfish mortality	Positive – expect a reduction in non-target species discarding and escapement is expected to be greater due to increased mesh size	Potentially Low Negative or Positive – most likely alternative to shift fishing effort, thus effort in areas outside the GRA would likely increase and have negative habitat impacts. Effort in GRA would be reduced, thus positively impacting habitat	Potentially Low Negative or Positive – most likely alternative to shift fishing effort, thus effort in areas outside the GRA would likely increase and have negative impact on protected species. Effort in GRA would be reduced, thus positively impacting protected species	High Negative – on average, ~154 vessels made trips into GRA2 with ~$11,413 revenue/trip. Actual loss of closing this area to vessels would depend upon how well vessels could make up catch in other areas or seasons or maintain previous revenue by changing mesh size and fishing in the GRA

7.1 Impacts on Managed Resources

The following subsections discuss the short-term and long-term impacts of the management alternatives on the managed resources. The significance of the potential impacts is determined from the perspective of the stock status determination criteria (e.g., effects on biomass and fishing mortality). In most cases, quantitative estimates of the likely changes to these stock status determination criteria is not possible, and qualitative descriptions of the likely direction and magnitude of the impacts are given.

Indirect impacts on managed resources as a result of direct or indirect effects of management alternatives on ecologically related (i.e., predator/prey) species are largely unquantifiable. This is due to the high degree of uncertainty in predicting future outcomes that involve multiple inter-related ecological linkages. Nevertheless, when implementation of a given alternative changes the condition of a managed species, for example, by increasing stock size, species that are (directly) ecologically linked to that resource will be affected. In simplistic terms, increases in the abundance of a managed species would improve forage availability for species that prey upon that species, and place a greater demand on food resources needed by the managed species.

7.1.1 Alternatives for the Allowance of Multi-Year Quota Specifications

- Alternative 1A: No action (Specify management measures for *Illex*, Atlantic mackerel and butterfish annually, and specify management measures for *Loligo* for up to three years)
- **Alternative 1B: Allow for specification of management measures (including quota specifications) for all four species in the management unit for a period of up to three years (Preferred Alternative)**
- Alternative 1C: Allow for specification of management measures (including quota specifications) for all four species in the management unit for a period of up to five years

None of these alternatives, by themselves, establish any management measures. Rather, they affect the periodicity for specifying such regulatory actions. Furthermore, in the case that an allowance for multi-year specification of management measures is implemented (Alternative 1B or 1C), either would require annual review of updated information on the fishery by the Monitoring Committee during the period of multi-year specifications. As such, the Committee would examine, as it does currently, data collected from the fishery and resource surveys, and will raise to the Council any changes in stock status that might require the Council to revise the specifications before the multi-year period runs its course. Under all of the alternatives, specification of management measures would include all of the environmental impact review procedures currently required under the Magnuson-Stevens Act, and other applicable laws, including NEPA. These review procedures collectively ensure that impacts on fishery resources be considered prior to implementation of the proposed harvest levels.

Because all of the alternatives deal entirely with the administrative periodicity by which annual management measures are specified and would not affect fishing vessel effort, operations, species targeted, or areas fished, there would be no direct or indirect impacts of the any of the alternatives on any of the managed resources.

7.1.2 Measures to Address Overcapacity in the Directed *Illex* Fishery

- Alternative 2A: No action (The moratorium on the issuance of *Illex* permits expires July 1, 2009)
- **Alternative 2B: Extend the moratorium on entry to the *Illex* fishery without sunset provision (Preferred Alternative)**
- Alternative 2C: Terminate the moratorium on entry to the *Illex* fishery
- Alternative 2D: Extend the moratorium on entry to the *Illex* fishery without sunset provision and allow new entry into fishery through permit transfer system

Alternatives 2A and 2C would cause the directed *Illex* fishery to revert to open access conditions which may increase *Illex* fishing effort. The potential for an increase in effort is addressed through a socio-economic analysis which summarized in Section 7.5.2, below. Because that analysis produced ambiguous results, the magnitude of any future increase in fishery effort remains unquantifiable. The harvesting of *Illex* would continue to be controlled by a quota monitoring system. However, with a quota system, open access conditions increase the potential for "derby fishing", whereby effort becomes concentrated at the start of the fishing season rather than spread out across the fishing season. "Derby fishing" may result in negative impacts to the US component of the *Illex* stock because the early-season cohort of this sub-annual species produces the cohort that recruits to the fishery later in the fishing season (Hendrickson 2004). Thus, Alternatives 2A and 2C are expected to result in negative impacts on the *Illex* stock due to the sole reliance on quota control, rather than a combination of limited access and quota control, to decrease the potential for *Illex* overfishing.

Alternatives 2B and 2D would maintain the current constraints on the number of participating vessels. This outcome should increase the chance that current levels of fishing effort will be maintained. By preventing expansion of the permitted fleet, Alternatives 2B and 2D are expected to have no effect on the condition of the *Illex* stock and other managed resources relative to the baseline.

7.1.3 Revised Biological Reference Points for *Loligo pealeii*

- Alternative 3A: No action (Maintain the status quo definitions for the F_{target} and $F_{threshold}$ biological reference points for *Loligo pealeii*)
- **Alternative 3B: Adopt SARC 34 Recommendation (Preferred Alternative)**

The action alternative (Alternative 3B) is being proposed in order to manage the *Loligo* stock using the best available scientific information, as required under National Standard 2 of the Magnuson-Stevens Act. In this case, the best available scientific information comes from a peer review of the most recent *Loligo* stock assessment (SAW 34), which considered the current F_{target} to be inappropriate for status determination.

The impacts of Alternatives 3A and 3B on the *Loligo* resource are difficult to predict. Harvesting of *Loligo* will continue to be controlled by annual and quarterly quotas under either alternative. The quotas are set with the expectation that a target fishing mortality rate will not be exceeded. For this sub-annual species, it has not been possible to accurately predict future stock biomass. The implementation of Alternative 3B would result in annual harvest limits for *Loligo* being based on a constant, quarterly F_{Target} (0.24) which was the average quarterly F for 1987 - 2000. If stock biomass during some future time period is below the 1987 - 2000 average, then harvesting the quota is likely to exceed the target F. If stock size is well below average, the potential exists for harvest to exceed $F_{Threshold}$ (i.e., overfishing will occur). On the other hand, in periods with larger than average stock size, forgone yield will occur. The F_{Target} and $F_{Threshold}$ reference points under Alternative 3B are considered to be more robust than the current reference points (Alt 3A) with respect to sustainability of the stock. The relative merit of the alternative reference points, however, remains to be empirically proven.

7.1.4 Designation of EFH for *Loligo pealeii* eggs

- Alternative 4A: No action (No designation of *Loligo* EFH)
- Alternative 4B: EFH designation based on documented observations of egg mops

Loligo egg masses are found attached to rocks and boulders on sand or mud bottom, as well as attached to aquatic vegetation on primarily coastal bottom substrates from Georges Bank southward to Cape Hatteras as depicted in Figure 1. Generally, the following conditions exist where *Loligo* egg masses are found: sea surface temperatures between 10^{o} C and 23^{o} C, a salinity of 30 to 32 ppt, and water less than 50m in depth, although they can also be found offshore.

To the degree that EFH is vulnerable to damage by fishing and/or non-fishing activities, management oversight of these activities in areas designated as EFH for a given life stage of any managed resource will allow for direct and indirect benefits for that resource. That oversight cannot occur, however, without first identifying the geographical locations of the EFH in question. Alternative 4B identifies EFH for *Loligo* eggs based upon documented observations. By implementing Alternative 4B, fishing and/or non-fishing activities would not be restricted; however, a requirement would be established whereby NOAA fisheries must be consulted for future Federal fishing and non-fishing activities in those areas. A range of habitat protection measures exist that could be implemented if protection of *Loligo* egg EFH is determined to be necessary. The common feature of these measures is that they would decrease damage to EFH. This could come about by preventing or mitigating non-fishing activities in EFH areas or by reducing fishing effort, or restricting the use of certain gear types or configurations in those areas. Habitat protection provided by these actions would also be extended to other species and ecosystem functions that utilize or are affected by *Loligo* egg EFH.

Alternative 4A, on the other hand, does not extend the suite of regulatory tools that could be implemented to protect *Loligo* egg EFH. Furthermore, the no action alternative is in contradiction with the mandates of the Magnuson-Stevens Act which requires that EFH be identified for all federally managed species. EFH is defined as "…those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" which implies designation throughout the entire life cycle.

7.1.5 Area closures to reduce gear impacts on EFH

- Alternative 5A: No Action (No new areas closed to fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls)
- Alternative 5B: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in the area surrounding the head of the Hudson Canyon
- Alternative 5C: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in tilefish HAPC
- **Alternative 5D: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in Lydonia and Oceanographer Canyons (Preferred Alternative)**

Figures 87-90 illustrate the distribution of commercial harvest of SMB species by bottom otter trawls in relation to the potential area closures. Each point corresponds to a trip on which SMB species were harvested, so that concentrations of points illustrate areas where harvest effort is particularly high. Table 71 provides more quantitative information - the percentage of SMB bottom otter trawl landings that have historically come from the EFH areas.

The impacts of any or all of the action alternatives on the managed resources will be a function of the degree to which overall SMB harvest will be reduced by the potential area closures. In general, the area closures are expected to result in localized reductions in harvest of the managed resources, with a shift in fishing effort to open areas adjacent to the area closure boundaries. A reliable quantitative prediction of these changes is not possible because of the uncertainty in forecasting which economic choices will be made by fishery participants. Because the prohibition of bottom otter trawls would be year-round rather than seasonal, fishery participants may opt to use alternative gear types which do not contact the seabed. This is likely to be an economic decision that will differ among individual harvesters.

Nevertheless, the closure of (particularly large) areas (5B, 5C) is expected to contribute to an overall reduction in fishing mortality for each of the managed resources. The landings levels for each species/area-closure combination in Table 71 provide a loose measure of the relative magnitude of potential decreases in harvest. In other words, the closure of tilefish HAPC is expected to have a much greater effect on reducing fishing mortality for butterfish and *Loligo* than the closure of Lydonia and Oceanographer Canyons. Naturally, the greatest overall reduction in fishing mortality for all SMB species would occur if all of the areas were closed to bottom otter trawl gear, while, the no action alternative (5A) is associated with no impacts on the managed resources since no changes in the intensity or distribution of effort would occur.

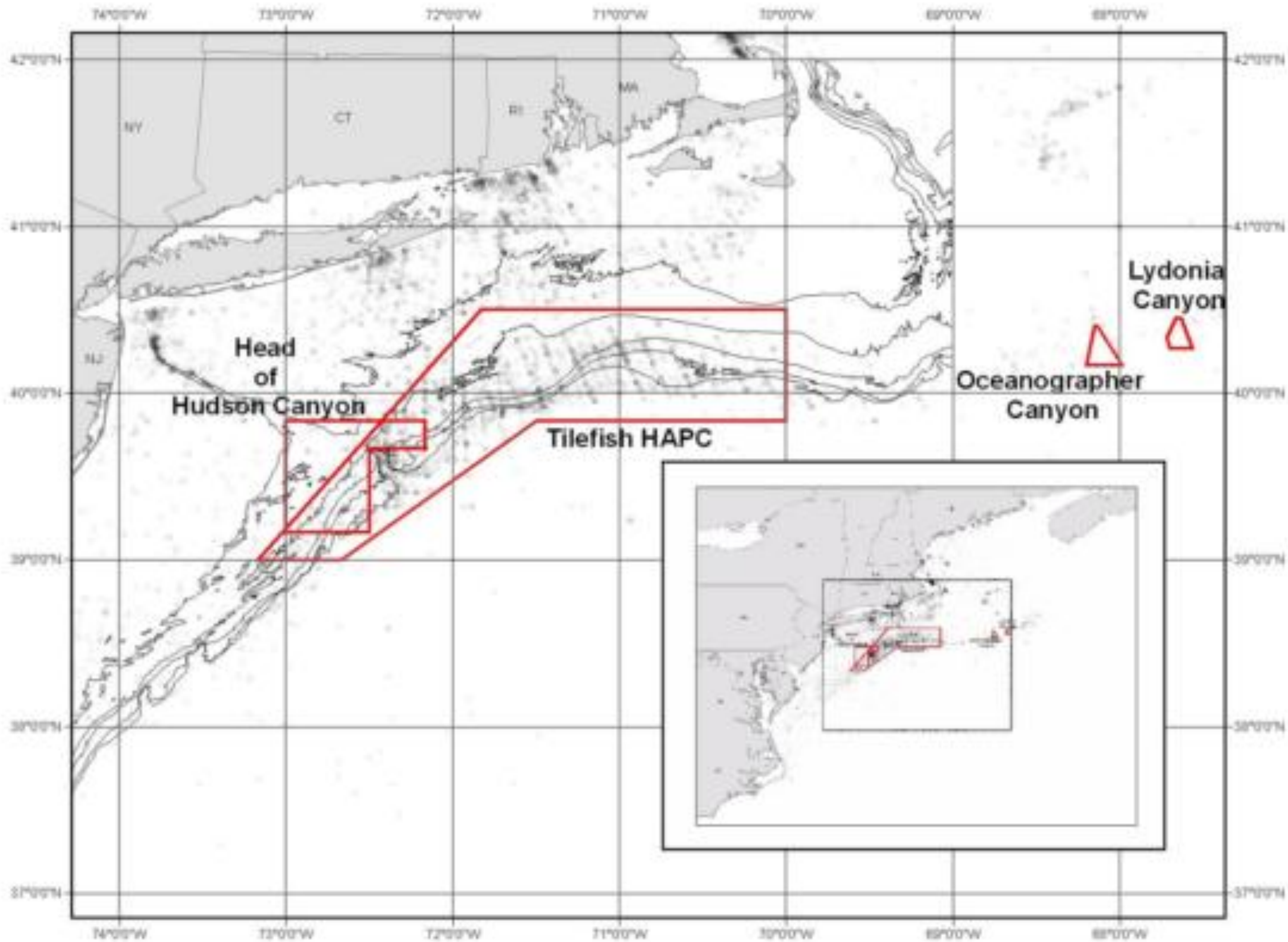

Figure 87. Distribution of bottom otter trawl trips that landed Atlantic mackerel from 1996-2004 relative to proposed EFH area closures.

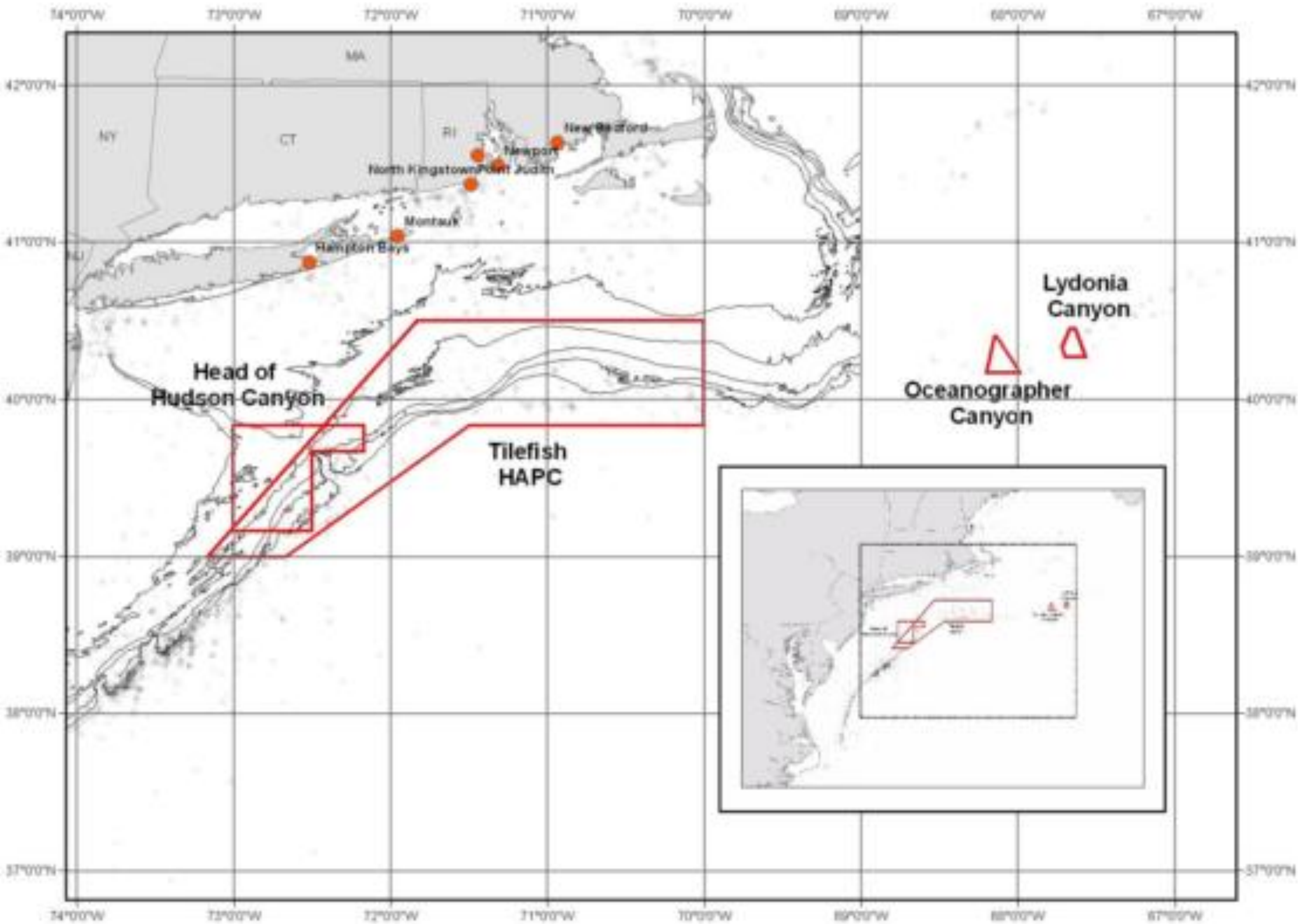

Figure 88. Distribution of bottom otter trawl trips that landed *Illex* from 1996-2004 relative to proposed EFH area closures.

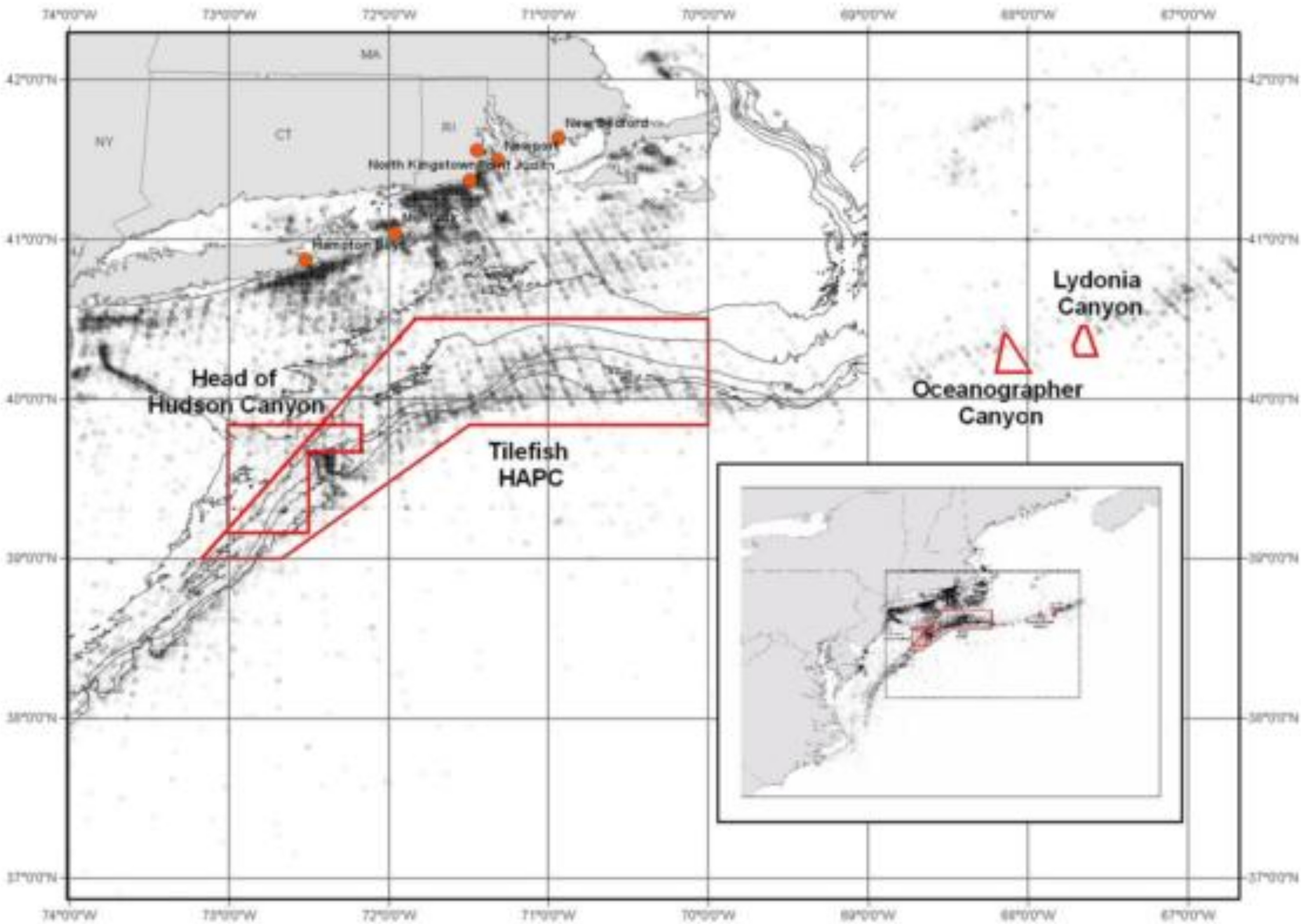

Figure 89. Distribution of bottom otter trawl trips that landed *Loligo* from 1998-2004 relative to proposed EFH area closures.

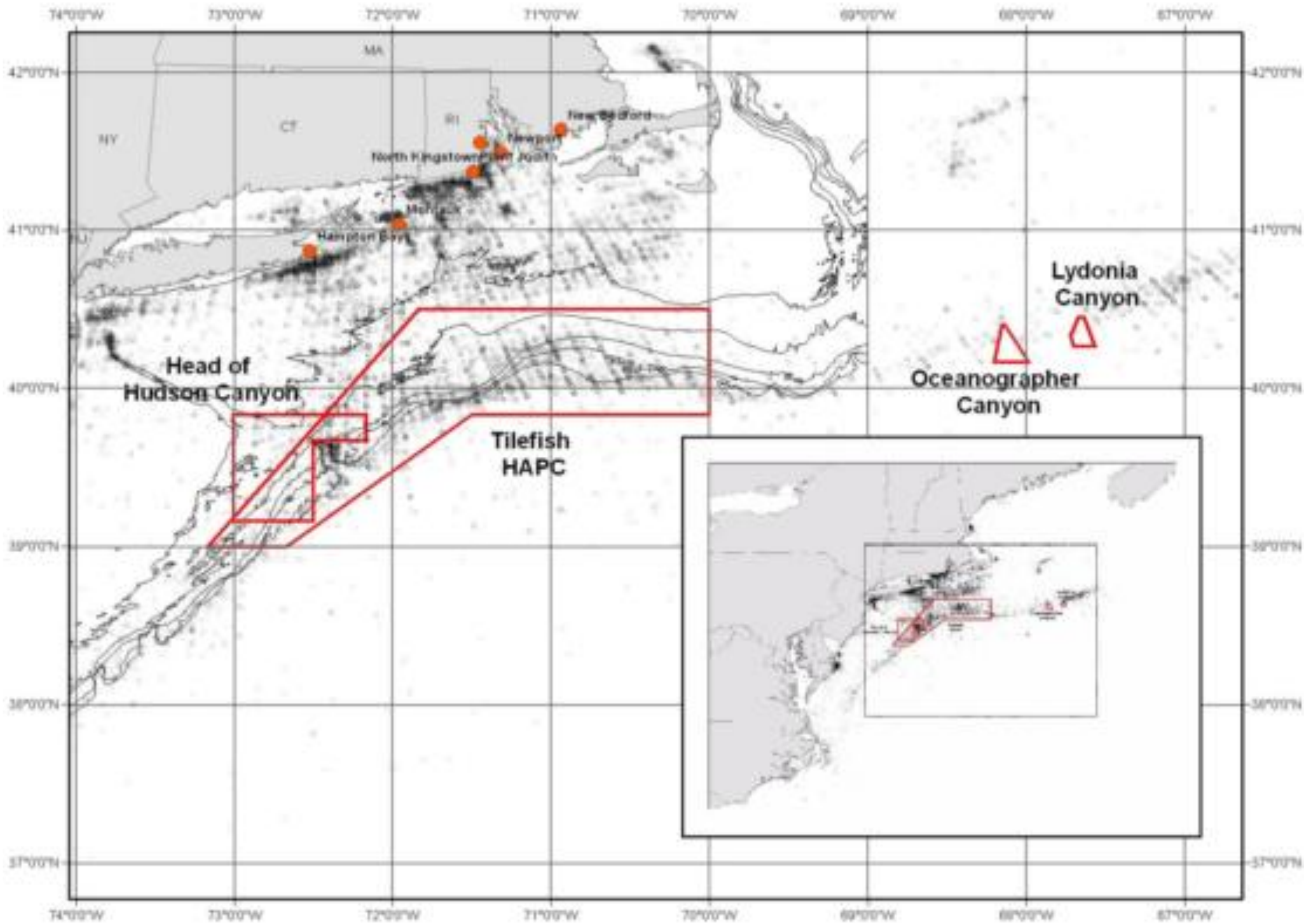

Figure 90. Distribution of bottom otter trawl trips that landed butterfish from 1996-2004 relative to proposed EFH area closures.

Table 71. Percentages of bottom otter trawl fishery landings associated with alternative area closures and closure combinations.
Source: VTR data (1996-2004 for all SMB except *Loligo*; 1998-2004 for *Loligo*).

	Closure Area						
SMB species	5B Head of Hudson Canyon	5C Tilefish HAPC	5D Lydonia and Oceanographer Canyons	5B & 5C Head of Hudson and Tilefish HAPC	5B & 5D Hudson and Lyd/Ocean Canyons	5C & 5D Tilefish HAPC and Lyd/Ocean Canyons	5B,5C,5D Hudson, Tilefish HAPC, and Lyd/Ocean Canyons
Atlantic Mackerel	8.2%	28.0%	0.0%	30.6%	8.2%	28.0%	30.6%
Illex	1.9%	4.9%	0.0%	5.0%	1.9%	4.9%	5.0%
Loligo	3.7%	27.4%	0.2%	28.5%	3.9%	27.6%	29.6%
Butterfish	1.9%	46.1%	0.5%	46.4%	2.4%	46.6%	47.9%

7.1.6 *Loligo* minimum mesh size requirements

- Alternative 6A: No Action (Maintain 1 7/8 inch minimum codend mesh requirement)
- Alternative 6B: Increase minimum codend mesh size to $2^{1/8}$ inches
- Alternative 6C: Increase minimum codend mesh size to $2^{1/2}$ inches
- Alternative 6D: Increase minimum codend mesh size to 3 inches

Potential impacts on butterfish, silver hake, red hake and scup stocks

The action alternatives (6B - 6D) are intended to reduce the incidence of butterfish discarding in the *Loligo* fishery, the primary source of discarding for the overfished butterfish stock (NEFSC 2004), on a year-round basis. In addition, the action alternatives should also reduce the levels of red hake, silver hake, and scup discards which occur in the *Loligo* fishery. The potential for a codend mesh size increase in the *Loligo* fishery to positively impact the aforementioned stocks is primarily dependent on the degree to which the mesh size increase will reduce the retention of each species in relation to the current retention level. The effectiveness of a mesh size increase on bycatch reduction is also dependent on the frequency of encounters with the specific species by the fishery. Both research survey data and fishery data indicate that butterfish encounters are high in the *Loligo* fishery. This is supported by the finding that annual ratios of *Loligo* to butterfish catches in the fishery are similar to the spring and fall survey ratios of both species (Murawski and Waring 1979). Lange and Waring (1992) also determined that butterfish bycatch in the *Loligo* fishery occurs year-round (high rate of encounter) and is due to year-round co-occurrence of the two species (refer to Figure 5 in Appendix 1). It is important to note that high bycatch rates of species which either school or have aggregated distributions (e.g., butterfish, silver hake and scup) can occur on a per tow basis. Given the issue of co-occurrence, a year-round bycatch reduction measure such as a codend mesh size increase will have a more positive impact on the butterfish stock than would a seasonal measure (e.g., seasonal GRAs), particularly if the mesh size increase is large enough to allow increased spawner escapement.

An increase in butterfish spawning biomass will be required to rebuild the butterfish stock. In order to allow some spawner escapement, a mesh size increase greater than 67 mm (diamond mesh, inside stretched mesh measurement) or 2 $^{5/8}$ inches will be necessary. This is because 67 mm mesh will retain 50% of the butterfish that are 12 cm (4 $^{3/4}$ inches fork length) or greater in length, the length at 50% maturity for female butterfish (O'Brien et al. 1983), based on a butterfish mesh selection factor of 1.8 (Myer and Merriner 1976). A mesh size increase greater than 67 mm is needed because the Myer and Merriner (1976) study was based on mesh selection in pound nets (a static gear) and the *Loligo* fishery employs diamond mesh bottom trawls, the latter which is likely to exhibit greater retention of small fish due to constriction of the meshes during towing. As an example, 50% of the butterfish ≥ 13.7 cm (5 $^{3/8}$ inches) in fork length would be retained with a codend mesh size of 76 mm (3 inches). Female butterfish are partially mature at age one, the age at 50% maturity is 0.9 yrs (O'Brien et al 1983), and fully mature at age 2 (Bigelow and Schroeder 2002). NEFSC research bottom trawl survey data for 1996-2002 show that the modal length for age 0 butterfish in the autumn ranges from 9-11 cm and the modal length for age 1 butterfish in March ranges from 11-13 cm. Butterfish spawn once per year, inshore during May-July (Bigelow and Schroeder 2002), a time when the species also co-occurs with *Loligo*. A year-round reduction in the retention of butterfish ≤ 12 cm in the *Loligo* fishery would increase the spawning biomass of the butterfish stock.

The impact of the various mesh size increase alternatives on the discards of red hake, silver hake, butterfish, and scup is also dependent on the amount of the increase in relation to the mesh sizes currently in use in the *Loligo* fishery because the retention of these species should decrease with increasing codend mesh size. Consequently, Alternative 6D would provide the most benefit to the butterfish stock among the alternatives under consideration because its implementation will increase spawning biomass (by increasing the butterfish L_{50} to 14 cm and thereby reducing the retention level of partially mature age 1 butterfish) as well as allow a larger fraction of the age 0 fish to survive. According to actual codend mesh size measurements, the highest percentage (47%) of butterfish discards (weight) and the second highest frequency of tows containing butterfish (19%) occurs with the use of 48-50 mm mesh codends (inside stretched mesh, Figures 28 and 29). Alternative 6D would also result in discard reductions for the greatest number of species discarded in the *Loligo* fishery. Continuing to allow fishing with 48-50 mm mesh codends (no action alternative) will have the greatest negative impact, in terms of discard mortality, on the all four discard species of concern. For stocks that are overfished, such as butterfish and scup, or that are rebuilding (southern silver hake), the no-action alternative will contribute to continued butterfish discarding and further deterioration of the stocks in the short term and will constrain rebuilding in the long term. For the action alternatives, a mesh size increase of 2 $^{1}/_{8}$ inches (54 mm) would have the least positive impact on all four discard species. For butterfish, spawner escapement will not be increased at this mesh size. A mesh size increase to 2 ½ inches (64 mm) would provide more juvenile escapement of butterfish than would a mesh size of $2\ ^{1}/_{8}$ inches, but is also not large enough to increase spawner escapement.

<u>Potential impacts on the *Loligo* stock</u>

The effects of the proposed codend mesh size increases on the *Loligo pealeii* stock are largely unknown due to a lack of scientific research on this topic. The potential for a codend mesh size increase to negatively impact the *Loligo* stock is primarily dependent on the degree to which the mesh size increase reduces *Loligo* retention in relation to current retention levels and whether this results in increased fishing mortality rates. However, there are no published studies of *Loligo pealeii* selectivity. Therefore, it is unknown whether *Loligo* retention will be reduced at the proposed codend mesh size increases, and if so, the percent losses associated with such increases are unknown. Consequently, it is also unknown whether the proposed mesh size increases will result in an increase in *Loligo* fishing mortality (i.e., from increased fishing effort due to reduced retention rates). Increased codend mesh sizes in the *Loligo* fishery should not increase fishing mortality on the *Loligo* stock because harvesting is currently controlled by seasonal (trimester) quotas. Impacts from increased fishing mortality as a result of increased squid escapement or loss are unknown because escapement survival rates for *Loligo pealeii* are unknown. However, any potential increase in fishing effort would be time-limited by fuel capacity and daylight hours when the squid are available to bottom trawls.

If there is any increase in effort in the *Loligo* fishery it would be limited to the daytime because that is when the species is distributed near the bottom and available to bottom trawls. Effort (days at sea) would also be limited by vessel fuel and hold capacities, which generally increase with vessel size. If retention is solely dependent on body size, then *Loligo* retention should decrease as mesh size is increased, and likewise, retention should increase as squid growth larger in size. If *Loligo* fishing mortality is increased as a result of increased effort, bottom trawl selectivity studies of other squid species indicate that the magnitude of any increase in fishing mortality will be rapidly mitigated by the fact that a reduction in the retention of squid will decline rapidly over time as squid increase in body size over their lifespan (Amaratunga et al. 1979; Fonseca et al. 2002). Therefore, squid retention rates vary by season and cohort. Growth rates of *L. pealeii* are rapid and squid hatched during June-October (squid caught during the offshore winter *L. pealeii* fishery) have significantly faster growth rates, in both length and weight, than squid hatched during November-May (squid caught during the summer and fall *L. pealeii* fishery, Brodziak and Macy 1996). For example, Brodziak and Macy (1996) found that the average monthly growth rate, in mantle length, was 13.9 mm for males hatched in December and was 40.9 mm for males hatched in June. The average monthly growth rate, in weight, was 3.4 g for males hatched in December and 53.3 g for males hatched in June. Due to seasonal growth rate differences for *L. pealeii*, potential impacts from a mesh size increase would be greater for the inshore summer/fall fishery catches than for the offshore winter fishery catches.

The no action alternative (6A) will maintain the same level of impact currently experienced by the *Loligo* stock. Due to partial masking of the codend meshes by a strengthener, composed primarily of double-twine, 140 to 160-mm diamond mesh (Hendrickson 2005), the "effective" codend mesh size that results is likely to further reduce butterfish escapement. Impacts of the "effective" codend mesh sizes currently used in the *Loligo* fishery, on the *Loligo* stock, are unknown. However, fishery length-frequency data indicate that about 2-5% of the *Loligo* landings are comprised of immature individuals (Figure 91) and Brodziak and Macy (1996) determined that intensive harvesting of immature *L. pealeii* has the potential to reduce fishery production (yield-per-recruit) because immature squid grow more slowly than mature individuals. The proposed alternative mesh sizes of 2 $^1/_8$ in. (54 mm) and 2 ½ in. (64 mm) will have minimal impact on the *Loligo* stock because 40% (60-76 mm mesh) and 28% (63-76 mm mesh) of the *Loligo* landings, respectively, are currently obtained with mesh sizes greater than or equal to these values (Table 1 of Appendix 3a). Furthermore, a minimum codend mesh size of 60 mm has historically supported an economically viable *Loligo pealeii* fishery in U.S. waters during 1978-1982 (ICNAF 1978).

Comparison of predicted L_{50} values to the length composition of the *L. pealeii* catch in the existing commercial fishery can be used to estimate the relative magnitude of the reductions in retention. The selection factor is computed as L_{50}/codend mesh size. As such, when the selection factor is known, the L_{50} can be calculated over a range of codend mesh sizes. Because the L_{50} is indicative of the modal size of the squid in the catch, increases in L_{50} in the presence of uniform size distribution mean that the larger squid are being retained, while smaller squid are being lost through the net.

A mesh selection factor of 1.9 was reported by Chris Glass (Manomet Center for Conservation Sciences in Plymouth, MA), in Fonseca et al. (2002), for *L. pealeii* caught in U.S. waters with codend mesh sizes of 1 $^{7/8}$ and 2 $^{1/2}$ inches. However, the season during which the study was conducted is unknown. A similar selection factor of 1.2 has been reported for a covered codend mesh selectivity study of a congener, *Loligo vulgaris* (Fonseca et al. 2002). Therefore, in order to investigate the potential for reduced *Loligo* retention attributable to mesh size increases in the directed fishery, relative changes in L_{50} values (length at 50% retention) were computed using selection factors of 1.2 and 1.9 for codend mesh sizes which retained a majority of the *Loligo* landings during 1997-2003.

The length composition of *L. pealeii* landings can be assumed to approximate the length composition of the catches because discarding of *Loligo* in the directed fishery is low, averaging about 6% per year (Cadrin and Hatfield 1999). The Fonseca et al. (2002) study, which compared squid caught in 63-mm (~2 $^{1/2}$ in.) diamond mesh codends to 80 mm and 90 mm mesh codends, indicated that all three mesh sizes retained squid of similar size ranges and modes, whereby mantle length ranged from 9 to 37 cm (4-15 in.) with a mode at 13 to 14 cm (~ 5 in.), but consisting predominately of squid in the 10 to 25 cm (4-10 in.) size range. Application of the *L. vulgaris* selection factor is appropriate for comparative purposes because the length composition of squid used to compute the selection factor is similar to the length composition of *L. pealeii* caught in the U.S.

directed fishery (Figure 91) and includes data for a codend mesh size of 2 $^{5/9}$ inches (65 mm), similar to the Alternative 6C mesh size increase of 2 $^{1/2}$ inches (64 mm).

A codend mesh size increase to 2 $^{1/8}$ inches (Alternative 6B) would have little if any effect on the *Loligo* stock because it would result in only a slight decrease in the retention of *Loligo*. As indicated in Table 72, 10% of the *Loligo* landings would be affected by an L_{50} increase of 8-12 mm (1/3 to 1/2 inch) and 34 % of the landings would be affected by an increase of 4-6 mm (1/6 to 1/4 inch). At least 40% of the *Loligo* landings would be unaffected by the Alternative 6B mesh size increase. Under Alternative 6C, L_{50} increases of 19-30 mm (3/4 to 1 1/6 in.) and 15-24 mm (3/5 to 1 in.) would affect 10% and 34% of the *Loligo* landings for selection factors of 1.2 and 1.9, respectively. A minor increase in L_{50} (4 – 6 mm) is predicted to affect 11% of the *Loligo* landings under Alternative 6C, but at least 28% of the *Loligo* landings will be unaffected by the mesh size increase under this Alternative. Finally, under Alternative 6D, L_{50} increases of 34-54 mm (1 1/3 to 2.1 in.) and 30-48 mm (1 1/6 to 2 in.) would affect 10% and 34% of the *Loligo* landings for selection factors of 1.2 and 1.9, respectively. An increase in L_{50} of 19-30 mm is predicted to affect 11% of the *Loligo* landings and an L_{50} increase of 15-24 mm is predicted to affect 15% of the landings under Alternative 6D. About 14% of the *Loligo* landings will be unaffected by the mesh size increase under Alternative 6D. These L_{50} ranges vary widely for the two selection factors and the precision of these estimates is unknown.

For selection factors of 1.2 and 1.9, the Alternative 6B mesh size increase will result in an L_{50} of 65- to 103 mm (2 $^{5/9}$ to 4 in.), respectively, and the Alternative 6C mesh size increase will result in an *L. pealeii* L_{50} of 76 to 121 mm (3 to 4 $^{3/4}$ in.), respectively. The Alternative 6D mesh size increase will result in an *L. pealeii* L_{50} of 91 to 145 mm (3.5 to 5.7 in.) for selection factors of 1.2 and 1.9, respectively. Estimates of the *L. pealeii* selectivity in the directed fishery during winter (Nov.-Feb.) and summer through fall (June-Oct.), for 1991-2001, are similar but slightly greater retention occurs in the winter fishery (Figure 92). Based on the *L. pealeii* size composition in the directed fishery, partial selectivity occurs at 70-260 mm (2 $^{3/4}$ to 10 $^{1/4}$ in.). Given that 50% retention by the *Loligo* fishery occurs at a length of 140 mm (5 $^{1/2}$ in.) (Figure 2), the selection factor for *L. pealeii* is probably closer to the 1.9 estimate suggested by C. Glass in Fonseca et al. (2002) rather than 1.2 (the L_{50} for *L. vulgaris*). Therefore, the results for the selection factor of 1.9 may be more reliable.

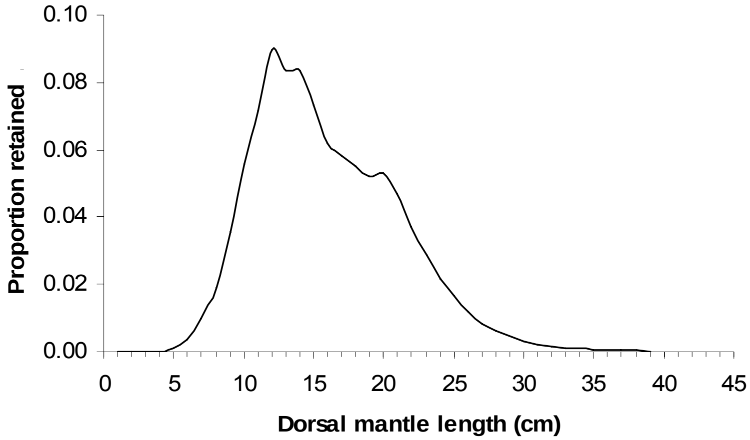

Figure 91. Length composition (proportion at length, cm) of *Loligo pealeii* landings from the US directed fishery (during all months of the year) in 1991-2001.

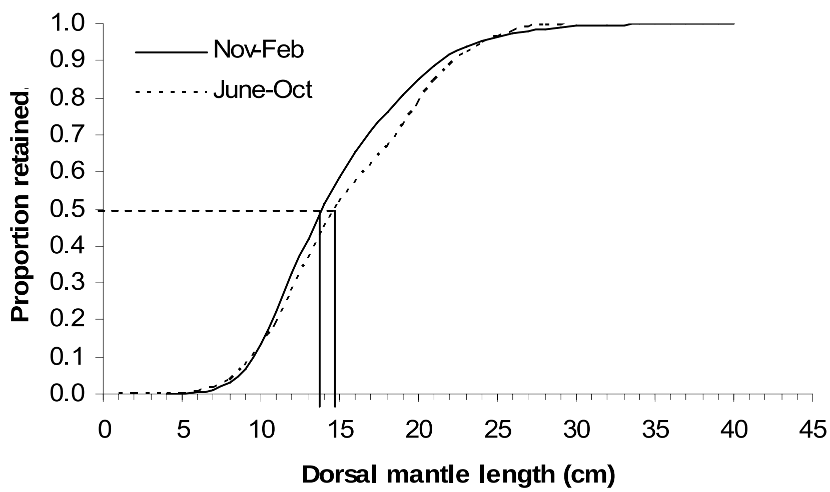

Figure 92. Proportion of *Loligo pealeii* landed, by length, in the directed fishery during November through February versus June through October, in 1991-2001.

Table 72. Effects of codend mesh size increases on *Loligo* L_{50} (length at 50% retention) values, for diamond mesh bottom trawl codends, at mesh sizes that comprise the majority of *Loligo* pealeii catches in US waters.
The L_{50} values (mm) associated with a selection factor (SF) of 1.2 are based on the results of a *Loligo vulgaris* covered codend bottom trawl selectivity study (Fonseca et al. 2002) and the L_{50} values (mm) associated with a selection factor of 1.9 are based on a SF reported by C. Glass in Fonseca et al. (2002) for *L. pealeii* caught in US waters with mesh sizes of 48 mm (1 ⅞ inches; Alt 6A), 54 mm (2 ⅛ inches; Alt 6B), 64 mm (2 1/2 inches; Alt 6C), 76 mm (3 inches; Alt 6D).

Codend mesh size (mm)	% of *L. pealeii* landings affected by mesh size increase	*Loligo* L_{50} for SF = 1.2(mm)	*Loligo* L_{50} for SF = 1.9(mm)	Relative increase in *Loligo* L_{50} (mm) Alternative 6B (increase to 54 mm)		Relative increase in *Loligo* L_{50} (mm) Alternative 6C (increase to 64 mm)		Relative increase in *Loligo* L_{50} (mm) Alternative 6D (increase to 76 mm)	
				SF = 1.2	SF = 1.9	SF = 1.2	SF = 1.9	SF = 1.2	SF = 1.9
44		53	84						
48	10.4	57	90	8	12	19	30	34	54
51	33.7	61	97	4	6	15	24	30	48
54		65	103						
57		69	109						
60	11.2	72	115	0	0	4	6	19	30
64	14.8	76	121	0	0	0	0	15	24
67		80	127						
70		84	133						
73		88	139						
76	13.5	91	145	0	0	0	0	0	0
79		95	151						

7.1.7 Exemptions from *Loligo* minimum mesh requirements for *Illex* vessels

- **Alternative 7A: No Action (Preferred Alternative)**
- Alternative 7B: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding the month of September from the current mesh exemption for the *Illex* fishery
- Alternative 7C: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding the months of August and September from the current mesh exemption for the *Illex* fishery
- Alternative 7D: Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels

The action alternatives (7B-7D) are intended to reduce butterfish bycatch in the directed *Illex* fishery. Unlike the *Loligo* fishery, the *Illex* fishery is not subject to a minimum codend mesh size of 1 $^{7/8}$ inches. The Vessel trip Report data indicate that 29% of the *Illex* landings are taken with codend mesh sizes smaller than the *Loligo* minimum mesh size of 1 $^{7/8}$ inch and another 22% are taken with 1 $^{7/8}$ inch -2 inch codends (Appendix 3a). The US *Illex* bottom trawl fishery occurs near the shelf edge, primarily at depths of 128-366 m, during June-November, primarily south of 39° N (NEFSC 2003). NEFSC Observer Program data suggest that butterfish discards are the second largest source of discards (in terms of weight), other than *Illex* discards, in the *Illex* fishery (Table 11A in Section 6.2). For codend mesh sizes ≤ 65 mm, the mesh size range in which most of the butterfish discards occur, the *Illex* fishery accounted for 30% of the butterfish discards (by weight) during 1996-2003 (Appendix 3a). The ratio of butterfish discard weight to kept weight is fairly high in the *Illex* fishery and was 0.945 during 1989-2003 (Table 11A). A primary reason is the incidental bycatch of butterfish is a result of the co-occurrence of *Illex* and butterfish during September and October (Figure 93) when *Loligo* begins to migrate into deeper offshore waters which constitute *Illex* habitat (Hendrickson and Holmes 2004).

Due to a rapid increase in the growth rate of *Illex* between June and October (Dawe and Beck 1997), the percent loss of *Illex* catches due to an increase in codend mesh size, declines as the fishing season progresses. Increased effort due to an increase in codend mesh size in the September *Illex* fishery (Alternative 7B) is not expected because a bottom trawl selectivity study indicates that losses of *Illex* are nearly zero in October for a codend mesh size of 60 mm and only 1-2% for a mesh size of 90 mm (Amaratunga *et al*. 1979). Consequently, a codend mesh size increase during September, while aiding in reducing butterfish bycatch, is not expected to increase *Illex* fishing mortality.

Assuming a decreasing linear relationship for the monthly *Illex* losses reported by Amaratunga et al. for a 60 mm mesh codend (13% in June and zero in October), *Illex* losses in July, August and September would be 10%, 7%, and 4%, respectively. It is unlikely that *Illex* losses of less than 10% (August and September losses) would result in increased fishing effort, particularly in September which is near the end of the fishing season. If a 7% loss, in August, is high enough to necessitate an increase in fishing effort, then *Illex* fishing mortality will also increase slightly.

The Alternative that would remove the exemption in June - September (7D) would likely correspond to an increase in fishing effort at least in June because the highest *Illex* loss (13%) was observed in June for a codend mesh size of 60 mm (Amaratunga et al. 1979). Like other cephalopods, *Illex* losses through the codend are likely to have a very low survival rate as a result of the negative impacts of net abrasions on their fragile body tissues. As such, *Illex* fishing mortality is likely to increase under Alternative 7D.

If none of the action alternatives are implemented (7A), then no change in *Illex* fishing effort is expected, and no direct or indirect impacts on the *Illex* stock should occur.

Among the alternatives under consideration, the most beneficial alternative for the butterfish managed resource is 7D, because this Alternative would maximize the use of larger mesh codends by the *Illex* fishery and is directly linked to a higher probability of butterfish escapement throughout most of the *Illex* fishing season.

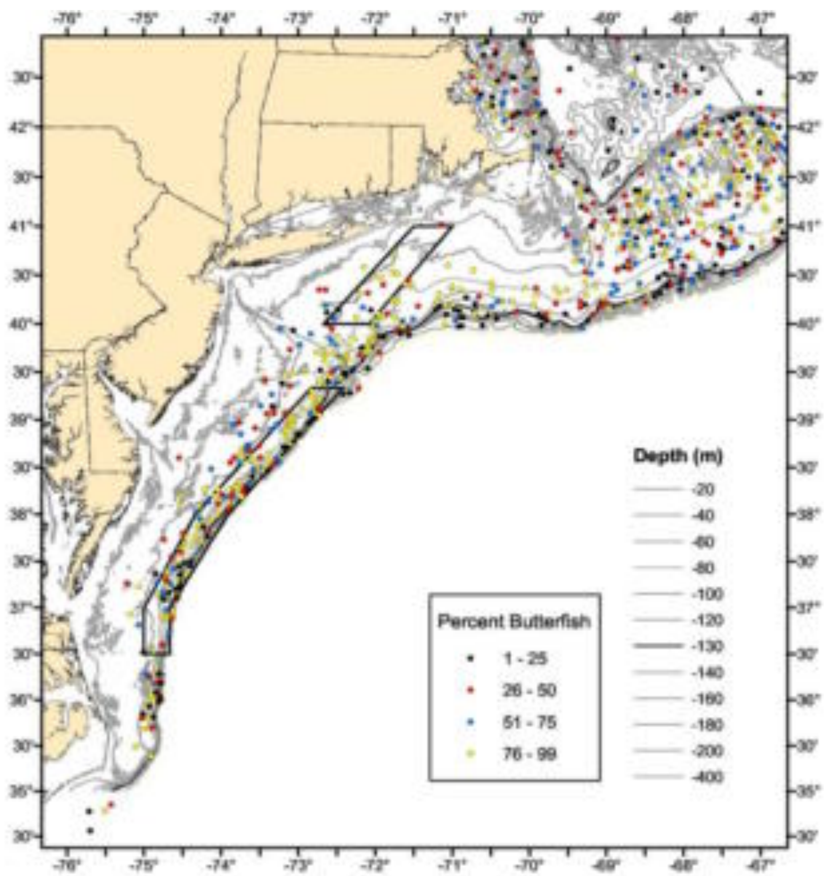

Figure 93. Co-occurrence (percent butterfish versus *Illex*) of butterfish and *Illex* during NEFSC autumn research bottom trawl surveys (September-October, 1992-2003).
The polygons shown represent Gear Restricted Areas that are seasonally closed to fishing with a codend mesh size smaller than 11.43 cm diamond.

7.1.8 *Loligo* possession limit for the directed *Illex* fishery during closure of the directed *Loligo* fishery

- Alternative 8A: No Action (For *Illex* moratorium permitted vessels, the *Loligo* possession limit during closures of the directed *Loligo* fishery is consistent with the incidental catch allowance for all vessels – currently 2,500 pounds)
- Alternative 8B: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of retained squid catch onboard, with a maximum limit of up to 30,000 pounds of *Loligo*
- Alternative 8C: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of retained catch onboard, with a maximum limit of up to 20,000 pounds of *Loligo*
- Alternative 8D: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of retained catch onboard, with a maximum limit of up to 10,000 pounds of *Loligo*

Each of the action alternatives (8B-8D) is intended to reduce regulatory discarding of *Loligo* by the directed *Illex* fishery during *Loligo* fishery closure periods. When *Loligo* fishery closures have occurred during the end of the *Illex* fishing season (Sept.-Oct.), regulatory discarding of *Loligo* has occurred in the *Illex* fishery because *Loligo* bycatch is unavoidable due to the fact that the two species co-occur during September and October on the *Illex* fishing grounds. As a result, Alternatives 8B-D pertain to increases in the *Loligo* bycatch possession limit for the *Illex* fishery, during *Loligo* fishery closures so that *Loligo* regulatory discards can be converted into landings, resulting in a more precise estimate of fishery removals.

An evaluation of *Loligo* landings reported in the Dealer Database during *Loligo* fishery closure periods, in 2000-2003, indicates that the current *Loligo* trip limit (2,500 lbs) during directed fishery closures was exceeded for 6-19% of the bottom trawl trips annually, which equated to 1-34% of the annual *Loligo* landings during these years (Table 2 of Appendix 2). The Observer Program Database indicates that *Loligo* and *Illex* vessels can catch as much as 50,000 lbs of *Loligo* per tow (Table 10 of Appendix 2). Therefore, Dealer and VTR data that indicate landings of 2,500 lbs per trip during *Loligo* fishery closure periods are likely to also have associated regulatory discards. In addition to the reported purchases of *Loligo* that exceeded the regulatory trip limit, data from the Observer Program Database and VTR Database indicate that regulatory discarding of *Loligo* also occurred during directed fishery closure periods in 2000-2003. Annual discard to kept ratios of *Loligo* were higher during directed fishery closure periods (0.05-0.21 per year) than during open periods (0.01-0.06 per year) and during 2000 and 2002, monthly ratios during closures were highest during August (0.23-0.77, respectively) and September (0.16-0.22, respectively, Tables 8 and 9 of Appendix 2). When *Loligo* fishery closures occurred during June through October, *Loligo* discards were primarily associated with the *Illex* fishery. During periods when the *Loligo* fishery was open, in 1998-2004, the Observer Database indicates that most (63%) of the bottom trawl trips with *Loligo* bycatch greater than 2,500 lbs occurred in the *Illex* fishery (Table 12 of Appendix 2). In addition, the VTR data also indicate that discard to kept ratios of *Loligo* during directed fishery closure periods and the incidence of trips that exceeded the closure period trip limit were highest during closures coincident with the *Illex* fishing season (June through October).

During most of the *Illex* fishing season (June through August), the majority of the *Illex* and *Loligo* landings occur at different depth ranges. Throughout the *Illex* fishing season (June through October), the VTR data for 1997-2003 indicate that 95-99% of the *Illex* landings occur at depths ≥ 80 fathoms. Most of the *Loligo* landings (91-94 %) occur at depths < 80 fathoms during June through August. However, *Loligo* landings from depths ≥ 80 fathoms increase from 6-9%, during June-August, to 12-20% during September-October (Figure 23 in Section 6.1.3). This increased overlap in the depth range of *Loligo* and *Illex* catches occurs in offshore waters because of the increased co-occurrence between both species during autumn. NEFSC autumn bottom trawl surveys indicate that co-occurrence during September and October is most prevalent at depths of 33 to 200 fathoms in southern New England and the Mid-Atlantic Bight (Figure 94). However, landward of 80 fathoms, most of the catches (76-99%) are comprised of *Loligo* rather than *Illex*. During September through October, habitat association tests that incorporated NEFSC research survey data for 1967-1994 also indicate that *L. pealeii* is most abundant at depths of 61-101 fathoms and least abundant at depths of 102- 200 fathoms, (Brodziak and Hendrickson 1999). Therefore, increasing the closure period possession limit of *Loligo*, should reduce the amount of *Loligo* regulatory discards in the *Illex* fishery and this effect would be most effective for *Illex* fishing seaward of 80 fathoms. The alternatives under consideration do not specify a depth limit. Waters seaward of the 50 fathom contour are currently considered to comprise the *Illex* fishing grounds. Therefore the benefit to the *Loligo* resource under the current suite of alternatives would be somewhat less than what would be expected with an 80 fathom depth limit.

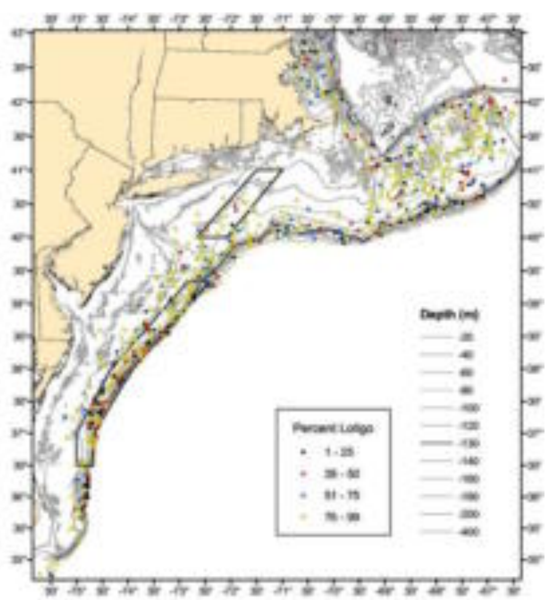

Figure 94. Co-occurrence of *Loligo* and *Illex* (percent *Loligo* versus *Illex*) during NEFSC autumn research bottom trawl surveys (September-October, 1992-2003).
The polygons represent Gear Restricted Areas that are seasonally closed to fishing with a codend mesh size smaller than 4.5 inches.

In order to evaluate the past landings of *Loligo* by the *Illex* fishery for comparison with the possession limits listed under Alternatives 8B – 8D, landings data from the NMFS dealer database were analyzed for August and September during 1996-1999. This was a time period when there were no *Loligo* closures that would impose possession limits on the *Illex* fleet. As such, it was judged to be reflective of the *Illex* fleet's maximum *Loligo* retention potential. *Illex* trips were defined as trips with *Illex* landings > 10,000 lbs for vessels in possession of *Illex* moratorium permits. There was total of 387 *Illex* trips, but on four of these, the *Loligo* catch was greater than 50% of the total squid landings (Table 73). These trips were not considered reflective of *Loligo* bycatch which was defined as 10% or less of the combined squid catch. Most of the *Illex* trips (260 or 67%) had no *Loligo* landings. For the 127 *Illex* trips with *Loligo* landings, *Loligo* comprised 10% or less of the total trip landings (i.e., qualified as bycatch) on 106 of these trips and averaged 3,511 lbs (Table 73). The largest bycatch of *Loligo* was 60,400 lbs.

Table 73. Summary of *Loligo* landings in *Illex* trips based data from the Dealer Database for August and September, 1996-1999.

Pct *Loligo* in Total Trip Landings	*Illex* Trips (N)	Pct of *Illex* Trips	Pct of *Illex* trips with *Loligo* landings	Average *Loligo* landings
0%	260	67.2%	N/A	N/A
<1%-9%	101	26.1%	79.5%	2,430
10%-19%	13	3.4%	10.2%	14,909
20%-29%	4	1.0%	3.1%	22,400
30%-39%	3	0.8%	2.4%	14,670
40%-49%	2	0.5%	1.6%	47,970
50%-59%	2	0.5%	1.6%	22,306
60%-69%	1	0.3%	0.8%	26,514
70%-79%	0	0.0%	0.0%	N/A
80%-89%	1	0.3%	0.8%	132,894
90%-100%	0	0.0%	0.0%	N/A
Total	387			

An examination of the NMFS Observer data was conducted in order to quantify the magnitude of regulatory discards that would be eliminated at various possession limits. According to Observer data increasing the closure period possession limit to 5,000 lbs would eliminate most of the regulatory *Loligo* discards (82%) on *Illex* trips (Table 74). The elimination of discards would increase to 87% with a 7,500 lb possession limit, and 92% with a 10,000 lb possession limit (Alternative 8D). Above 10,000 lbs (e.g., Alternatives 8B and 8C), there are diminished benefits in regulatory discard reductions. An increase in the *Loligo* trip limit in the *Illex* fishery during *Loligo* fishery closures would be beneficial to the *Loligo* stock because it would allow regulatory discards to be converted to landings, resulting in a more accurate quantification of fishery removals. A closure period possession limit of approximately 5,000 lbs, but potentially as much as 10,000 lbs of *Loligo* for *Illex* trips would be a reasonable solution to reducing regulatory discards of *Loligo* on the *Illex* fishing grounds during *Loligo* fishery closures. Nevertheless, as the possession allowance is increased from 5,000 lbs toward 10,000 lbs, there is a corresponding increase in the risk of directed fishing on *Loligo*, unless the fleet is restricted to fishing for *Illex* seaward of the 80 fathom contour during *Loligo* closures, where the overlap of *Loligo* and *Illex* is greatly diminished.

Table 74. Percentage of bottom trawl trips with *Loligo pealeii* bycatch, by amount based on *Illex* trips recorded in the NMFS Observer Program Database during 1998-2004.

L. pealeii bycatch (lbs)	*Illex* trips, N	%	cum. %
2,500	27	69.2	69.2
5,000	5	12.8	82.0
7,500	2	5.1	87.1
10,000	2	5.1	92.2
12,500	0	0.0	92.2
15,000	0	0.0	92.2
17,500	1	2.6	94.8
20,000	0	0.0	94.8
22,500	0	0.0	94.8
25,000	1	2.6	97.4
27,500	1	2.6	100.0
Total	39	100.0	

7.1.9 Electronic daily reporting requirement for the directed *Illex* fishery

- Alternative 9A: No Action
- Alternative 9B: Require electronic daily reporting in the directed *Illex* fishery

The action alternative (9B) is intended to work in combination with alternatives to the *Loligo* closure possession limit for the directed *Illex* fishery (8B-8D). During most of the *Illex* fishing season (June through August), the majority of the *Illex* and *Loligo* landings occur at different depth ranges. However, as explained in Section 7.1.7 and 7.1.8, *Illex* and *Loligo* co-occur on the *Illex* fishing grounds during September and October. Therefore, the avoidance of *Loligo* bycatch in the *Illex* fishery during autumn is not possible. VTR data indicate that most (91-99%) of the *Illex* landings occur at depths ≥ 80 fathoms throughout the *Illex* fishing season (June-Oct). Most of the *Loligo* landings (91-94 %) occur at depths < 80 fathoms during June through August, but during September and October *Loligo* landings from the *Illex* fishing grounds (depths ≥ 80 fathoms) increase from 6-9% (in June-August) to 12-20 %. During *Loligo* fishery closures that occur in September-October, fishing by the *Illex* fleet at depths ≥ 80 fathoms would reduce the amount of *Loligo* bycatch in the *Illex* fishery with a minimal reduction in *Illex* landings (0.5-2% of the *Illex* landings during 1997-2003 occurred at depths < 80 fathoms). The alternatives under consideration do not specify a depth limit. Waters seaward of the 50 fathom contour are currently considered to comprise the *Illex* fishing grounds. Therefore the benefit to the *Loligo* resource under the current suite of alternatives would be somewhat less than what would be expected with an 80 fathom depth limit.

Electronic daily reporting could provide a means for real-time monitoring of *Loligo* bycatch in the *Illex* fishery. Real-time electronic reporting of tow-based fishing effort, catch by species and location data has been successfully implemented on a voluntary basis in the *Illex* fishery since 2002 (Hendrickson et al. 2003). At the beginning and end of each tow, the vessel operator sends a macro through his Boatracs e-mail messaging unit and a satellite signal indicating fishing location, along with a date, time, and vessel messaging unit identification number is e-mailed to the NEFSC. In addition, the vessel operator also enters data pertaining to water depth and temperature at the beginning and end of each tow. Thus, the automatic fishing location data, along with depth and *Loligo* and *Illex* catch data can be used to monitor *Loligo* bycatch in the *Illex* fishery. Tows which result in *Loligo* bycatch greater than the closure period possession limit could move seaward of their current fishing location to avoid additional *Loligo* bycatch.

In the absence of electronic daily reporting and restriction of *Illex* fishing operations to *Illex* fishing grounds during September and October, there is an increased probability that regulatory discarding of *Loligo* during directed fishery closures will continue in the *Illex* fishery.

The likelihood that the desired benefit to the *Loligo* managed resource would be achieved through Alternative 9B is unknown. It is unlikely, however to result in negative impacts on either the *Loligo* or *Illex* stocks.

7.1.10 Implementation of seasonal gear restricted areas (GRAs) to reduce butterfish discards

- **Alternative 10A: No Action (No butterfish GRAs - Preferred Alternative)**
- Alternative 10B: Minimum of 3 inch codend mesh size in Butterfish GRA1
- Alternative 10C: Minimum of 3 inch codend mesh size in Butterfish GRA2
- Alternative 10D: Minimum of 3 ¾ inch codend mesh size in Butterfish GRA1
- Alternative 10E: Minimum of 3 ¾ inch codend mesh size in Butterfish GRA2

The action alternatives (10B-10E) are intended to decrease butterfish discarding in the small mesh bottom otter trawl fishery. However, implementation of any of the action Alternatives will also reduce discard mortality on other species that are currently being discarded in the small-mesh fisheries. The Observer Program data indicate that the small-mesh *Loligo* and butterfish fisheries (Table 12) are associated with high discards of silver hake, red hake, and spiny dogfish and that both fisheries combined account for 53%, 48%, and 22% of the total amount of discards recorded in the Observer Program database for each species, respectively. In addition to reducing butterfish discards, the GRAs are also likely to reduce the high levels of discards of silver hake, red hake, and spiny dogfish that occur in the *Loligo* and butterfish fisheries, particularly the GRAs associated with Alternatives 10D or 10E (because of the minimum codend mesh size of 3.75 in.), because the winter distributions of red hake and silver hake (Sosebee and Cadrin 2006) and spiny dogfish (Sosebee and Rago 2000) overlap with the proposed GRA boundaries during the effective time period. In addition, the GRAs may aid in rebuilding the southern stock of silver hake and the scup stock.

With respect to butterfish, the areas delineated by the GRAs (Figures 32 and 33 in Section 6.1.4) encompass spatial concentrations of observed butterfish discarding in the small mesh bottom otter trawl fishery in January – April. The areas described by the alternative GRAs reflect high levels of both fishery effort and high butterfish discard rates. This suggests that butterfish discarding in these areas is a function of *Loligo* fishing effort. Lange and Waring (1992) also found high butterfish bycatch in the domestic *Loligo* fishery and attributed it to overlapping habitats of the two species. As such, GRAs are likely to be effective at reducing butterfish discarding during the GRA effective period. Although the two mesh sizes evaluated did not make a notable difference in the size of the areas that correspond to 50% and 90% reductions in discards (GRAs 1 and 2, respectively), the escapement of butterfish as well as is expected to be greater under Alternative 10E followed by Alternative 10D. These two Alternatives will also provide the most benefit to the silver hake, red hake, and spiny dogfish stocks because discards of these species occur in both the *Loligo* and butterfish fisheries and a 3.75-inch codend mesh size is larger than the predominate 3.0 inches mesh size used in the butterfish fishery (J. Ruhle pers. comm.)

The GRAs may not comprehensively solve the issue of small-mesh fishery discarding of butterfish during winter if the small-mesh fishing effort shifts to other areas. According to NEFSC surveys, butterfish distribution is widespread along the shelf break in the winter. A portion of the southern part of the butterfish population is currently protected during January through March 15 by an existing small-mesh GRA for scup (prohibition on fishing with trawl gear with codends < 4.5 inches). Because the GRAs are of limited geographic scope, the expected shifts in the spatial distribution of small-mesh fishing effort (particularly in the *Loligo* fishery) may supplant current butterfish discard patterns, resulting in butterfish discarding in other time/area combinations. However, the prediction of spatial shifts in fishing effort and the amount of non-target species discarding associated with such effort shifts are difficult if not impossible to accurately predict, so the impacts of any fishing effort shifts are unknown. In addition, fishers may chose to continue to fish within the GRAs but with codend mesh sizes greater than the minimum mesh size.

Shifts in the distribution of fishery effort are likely to have a primarily economic basis. The potential responses by the fisheries are considered in detail in Section 7.5.10 below. According to the economic analysis each of the GRA alternatives is associated with an incentive to alter fishing effort patterns. These alternatives are ranked in descending order: 10E, 10C, 10D, 10B, with the no-action alternative (10A) associated with maintaining status quo effort patterns.

The other managed resource likely to be impacted by the implementation of the GRAs is *Loligo* since the majority of butterfish discarding in January – April occurs within the directed *Loligo* fishery and there has been no butterfish fishery since 2002. Shifts in the distribution of *Loligo* fishing effort during the GRA effective period are not expected to affect the resource, however. This is because total landings would continue to be controlled by the quota monitoring system.

7.2 Impacts on Non-Target Species

As indicated in Section 6.2, the sources of information that are currently available (NMFS Observer Program and VTR data) provide limited information on the overall nature and extent of non-target species discarding by the directed SMB fisheries. As such, consideration of the impacts of the various alternatives in this amendment on non-target species is by-in-large qualitative. In general, it is expected that implementation of management alternatives that would reduce SMB fishing effort or increase codend mesh size are expected to reduce the incidence of non-target species discarding within the various SMB fisheries. Expansion of SMB fishing effort is expected to have the opposite effect, and maintaining status quo mesh sizes is expected to have a null effect on non-target species. Alternatively, when SMB fishery participants shift effort into other fisheries, the potential is created for bycatch and discarding of non-target species in those fisheries to increase. The list of major non-target species encountered by the SMB fisheries (Table 11A in Section 6.2) may be used as a reference when considering which non-target species are more or less likely to be affected by a given alternative. However, given that seasonal spatial and temporal discard patterns of many of these bycatch species are poorly understood (Appendix 3b), it is difficult to characterize the impacts on a given species with any acceptable degree of confidence.

7.2.1 Alternatives for the Allowance of Multi-Year Quota Specifications

- Alternative 1A: No action (Specify management measures for *Illex*, Atlantic mackerel and butterfish annually, and specify management measures for *Loligo* for up to three years)
- **Alternative 1B: Allow for specification of management measures (including quota specifications) for all four species in the management unit for a period of up to three years (Preferred Alternative)**
- Alternative 1C: Allow for specification of management measures (including quota specifications) for all four species in the management unit for a period of up to five years

As explained in Section 7.1.1, Alternatives 1A-C are purely administrative in nature. As such there should be no direct or indirect impacts on non-target species.

7.2.2 Measures to Address Overcapacity in the Directed *Illex* Fishery

- Alternative 2A: No action (The moratorium on the issuance of *Illex* permits expires July 1, 2009)
- **Alternative 2B: Extend the moratorium on entry to the *Illex* fishery without sunset provision (Preferred Alternative)**
- Alternative 2C: Terminate the moratorium on entry to the *Illex* fishery
- Alternative 2D: Extend the moratorium on entry to the *Illex* fishery without sunset provision and allow new entry into fishery through permit transfer system

Alternatives 2A and 2C would cause the directed *Illex* fishery to revert to open access conditions which may increase *Illex* fishing effort. The potential for an increase in effort is addressed through a socio-economic analysis which summarized in Section 7.5.2. Because that analysis produced ambiguous results, the magnitude of any future increase in fishery effort remains unquantifiable. The directed *Illex* fishery is associated with relatively low levels of non-target species which are few in number. As such, although fishing effort would be expected to increase, it is not expected to jeopardize the viability of non-target species stocks in the short and long term. What about an increase in tuna and swordfish discards with an increase in *Illex* effort?

Alternatives 2B and 2D would maintain the current constraints on participation. As such, relative to the baseline, Alternatives 2B and 2D are expected to have no impact on non-target species mortality attributable to the directed *Illex* fishery, both in the long and short term.

7.2.3 Revised Biological Reference Points for *Loligo pealeii*

- Alternative 3A: No action (Maintain the status quo definitions for the F_{target} and $F_{threshold}$ biological reference points for *Loligo pealeii*)
- **Alternative 3B: Adopt SARC 34 Recommendation (Preferred Alternative)**

The impacts of Alternatives 3A and 3B on harvest of the *Loligo* resource are difficult to predict. The reasons for this are explained above in Section 7.1.3. Under either alternative, the impacts on non-target species are linked to *Loligo* harvest effort, changes in which would correspond to changes in encounters with non-target species. The harvest of a given amount of *Loligo* should correspond to more or less effort when the abundance of *Loligo* is below or above average, respectively. When less effort is needed, encounter rates with non-target species should be expected to decrease, and the opposite should occur when more effort is needed. Nevertheless, increases in the abundance of *Loligo* may also increase participation in the directed fishery. As such, benefits to non-target species from increased efficiency in the harvest of the *Loligo* resource would be offset by the additional interest in harvesting *Loligo*. This somewhat complicated scenario is likely to result in a neutral overall impact on non-target species from either of the alternatives. Neither alternative is expected to result in substantial changes in encounters with non-target species, which would not change discard mortality from baseline (current) conditions.

7.2.4 Designation of EFH for *Loligo pealeii* eggs

- Alternative 4A: No action (No designation of *Loligo* EFH)
- Alternative 4B: EFH designation based on documented observations of egg mops

Loligo egg masses are found attached to rocks and boulders on sand or mud bottom, as well as attached to aquatic vegetation on primarily coastal bottom substrates from Georges Bank southward to Cape Hatteras as depicted in Figure 1. Generally, the following conditions exist where *Loligo* egg masses are found: sea surface temperatures between 10^{o} C and 23^{o} C, a salinity of 30 to 32 ppt, and water less than 50m in depth, although they can also be found offshore.

By implementing Alternative 4B, no immediate action is expected that would restrict fishing or non-fishing activity, however, a requirement would be established whereby consultation with NOAA fisheries would be required for future Federal fishing and non-fishing activities in *Loligo* egg EFH areas. The impacts of this alternative on non-target species cannot be evaluated until specific management actions related to *Loligo* egg EFH are proposed. Alternative 4B has the potential to indirectly impact non-target species if, at some point in the future, management actions are implemented that would reduce fishing effort or decrease non-fishing impacts on non-target species.

If no action is taken with respect to EFH for *Loligo* eggs, then no change from the status quo condition of non-target specie is expected.

7.2.5 Area closures to reduce gear impacts on EFH

- Alternative 5A: No Action (No new areas closed to fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls)
- Alternative 5B: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in the area surrounding the head of the Hudson Canyon
- Alternative 5C: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in tilefish HAPC
- **Alternative 5D: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in Lydonia and Oceanographer Canyons (Preferred Alternative)**

Alternatives 5B through 5D are expected to directly and indirectly impact non-target species because any given alternative or combination of alternatives would result in some degree of spatial re-distribution of bottom otter trawl fishing effort. Refer to Figures 87 - 90 above and Table 75 below for guidance on the relative importance of the potential area closures to SMB bottom otter trawl effort fishing. Although long-term proportional effort within the potential closure areas is quantified in Table 75, decreases in effort under the action alternatives are not expected to exactly match these percentages. Furthermore, it is not known where increases in SMB otter trawl fishing effort will occur within the area that will remain open to bottom otter trawl use. In general, for areas where bottom otter trawling effort decreases the capture of non-target species is expected to decrease, and for open areas where bottom otter trawl effort may increase, the opposite outcome is expected.

Under the action alternatives, indirect impacts on non-target species would be the result of decreased damage to EFH by bottom tending mobile gear in closed areas, and, potentially increased damage to EFH in open areas. The list of species that should benefit from closure of the various EFH areas is discussed in Section 6.3.4.3 and is repeated below in Table 76. Clearly, the closure of tilefish HAPC would be expected to generate substantial protection of tilefish EFH, both for juvenile and adult life stages (see Section 7.3.5 below). Other species' life stages that have greater than 10% EFH within tilefish HAPC include juvenile and adult rosette skates, juvenile silver hake, and adult summer flounder. In the head of Hudson Canyon area, the amount of EFH for a given species' life stage exceeds 5% for juvenile Atlantic scallops, juvenile rosette skate, and juvenile silver hake, but is 5% or less for all other species. Lydonia and Oceanographer Canyons comprise approximately 3% of EFH for juvenile tilefish, but no more than 2% for any other species.

The no-action alternative (5A) is not expected to affect non-target species mortality rates relative to the status quo since no changes in the intensity or distribution of effort would occur.

Table 75. Percentages of bottom otter trawl fishery trips associated with alternative area closures and closure combinations.
Source: VTR data (1996-2004 for all SMB except *Loligo*; 1998-2004 for *Loligo*).

	Closure Area						
SMB species	5B Head of Hudson Canyon	5C Tilefish HAPC	5D* Lydonia and Oceanographer Canyons	5B & 5C Head of Hudson and Tilefish HAPC	5B & 5D Hudson and Lyd/Ocean Canyons	5C & 5D Tilefish HAPC and Lyd/Ocean Canyons	5B,5C,5D Hudson, Tilefish HAPC, and Lyd/Ocean Canyons
Atlantic Mackerel	4.9%	32.9%	0.02%	33.5%	4.9%	32.9%	33.5%
Illex	1.9%	10.6%	0.03%	10.8%	1.9%	10.7%	10.8%
Loligo	2.4%	14.8%	0.02%	15.4%	2.5%	14.8%	15.4%
Butterfish	2.4%	17.6%	0.02%	18.2%	2.5%	17.7%	18.2%
All SMB	2.6%	17.2%	0.02%	17.7%	2.7%	17.2%	17.8%

* preferred alternative

Table 76. The percentage of EFH designated for Federally-managed species, by life stage, that overlap with the Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries, and have one or more life stages with medium or high vulnerability to bottom otter trawling, relative to their total designated EFH.
(E=Egg, J=Juvenile, A=Adult).

Species	**5B** **Mouth of Hudson Canyon**	**5C** **Tilefish HAPC**	**5D*** **Lydonia and Oceanographer Canyons**
Atlantic sea scallops (J)	6	1	0
Barndoor skate (J)	0	8	2
Black sea bass (J)	2	3	0
Black sea bass (A)	4	8	0
Clearnose skate (J)	1	0	0
Clearnose skate (A)	0	0	0
Little skate (J)	2	6	1
Little skate (A)	2	5	1
Ocean pout (E)	2	4	0
Ocean pout (J)	3	2	0
Ocean pout (A)	2	4	0
Red hake (J)	2	5	0
Red hake (A)	2	9	1
Rosette skate (J)	6	16	0
Rosette skate (A)	0	56	0
Scup (J)	0	2	0
Silver hake (J)	6	19	1
Summer flounder (J)	0	0	0
Summer flounder (A)	3	10	0
Tilefish (J)	3	68	3
Tilefish (A)	0	68	0
Winter flounder (A)	0	0	0
Winter skate (J)	1	2	0
Winter skate (A)	1	1	0
Witch flounder (J)	1	7	1
Yellowtail flounder (J)	5	2	0
Yellowtail flounder (A)	2	3	0

* preferred alternative

7.2.6 *Loligo* minimum mesh size requirements

- Alternative 6A: No Action (Maintain 1 $^{7/8}$ inch minimum codend mesh requirement)
- Alternative 6B: Increase minimum codend mesh size to $2^{1/8}$ inches
- Alternative 6C: Increase minimum codend mesh size to $2^{1/2}$ inches
- Alternative 6D: Increase minimum codend mesh size to 3 inches

The action alternatives (6B – 6D) are intended to reduce discard mortality of bycatch species, especially for butterfish, in the directed *Loligo* fishery. The magnitude of these discard reductions is likely to vary by species. The species that would derive the greatest benefit from the proposed increases in *Loligo* codend mesh sizes include the following bycatch species: john dory, scup, sea robins, silver hake, four spot flounder, blueback herring, red hake, and spiny dogfish (see Table 11A in Section 6.2). Selectivity studies, if available, would be useful in quantifying escapement probabilities at the alternative mesh sizes. In the absence of this information, it is generally expected that escapement, and hence benefit to non-target species stocks, is positively correlated with minimum mesh used by the *Loligo* fishery. As such, Alternative 6D should generate the greatest benefit to non-target species, while Alternative 6A is expected to do nothing to decrease discard mortality for non-target species relative to baseline levels. However, the range of proposed codend mesh size increases is limited such that only the juveniles stages of some of the bycatch species have the potential to escape the codend.

7.2.7 Exemptions from *Loligo* minimum mesh requirements for *Illex* vessels

- **Alternative 7A: No Action (*Illex* vessels are exempt from *Loligo* minimum mesh requirements in the months of June through September - Preferred Alternative)**
- Alternative 7B: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding month of September from current mesh exemption for *Illex* fishery
- Alternative 7C: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding months of August and September from current mesh exemption for *Illex* fishery
- Alternative 7D: Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels

The action alternatives (7B-7D) are intended to reduce finfish bycatch, especially for butterfish, in the directed *Illex* fishery. By expanding the timeframe when the directed *Illex* fishery is not exempt from the *Loligo* minimum mesh requirement, escapement of non-target species through *Illex* trawls should increase. The species that would derive the greatest benefit from an increase in *Illex* codend mesh size include the following bycatch species: chub mackerel, herring, and john dory (see Table 11A in Section 6.2). By taking no action (Alternative 7A) no reductions in status quo discarding by the *Illex* fishery is expected. This would perpetuate a source of fishing mortality for non-target species encountered by the *Illex* fishery.

7.2.8 *Loligo* possession limit for the directed *Illex* fishery during closure of the directed *Loligo* fishery

- Alternative 8A: No Action (For *Illex* moratorium permitted vessels, the *Loligo* possession limit during closures of the directed *Loligo* fishery is consistent with the incidental catch allowance for all vessels – currently 2,500 pounds)
- Alternative 8B: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of retained squid catch onboard, with a maximum limit of up to 30,000 pounds of *Loligo*
- Alternative 8C: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 5% of the total weight of retained catch of squid onboard, with a maximum limit of up to 20,000 pounds of *Loligo*
- Alternative 8D: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of retained catch of squid onboard, with a maximum limit of up to 10,000 pounds of *Loligo*

Each of the action alternatives (8B-8D) is intended to reduce regulatory discarding of *Loligo* by the directed *Illex* fishery through increases in closure period possession limits. This outcome is unlikely to greatly affect *Illex* fishery effort, however, to the degree that a given vessel is allowed to retain greater amounts of *Loligo*, that vessel's trip revenue target may be achieved more quickly, and effort may be reduced. Under this scenario, the alternative with the largest *Loligo* possession limit (8B) should reduce fishing effort and, correspondingly, non-target species capture by the greatest amount. However, if directed fishing for *Loligo* were to occur, the suite of non-target species that would be impacted is likely to change such that it is reflects offshore *Loligo* discard patterns. Offshore, *Loligo* harvest during September and October is coincident with *Illex* harvest, and, therefore, the suite of species likely to be impacted can be found in Table 11A in Section 6.2 under the *Illex* fishery heading. The other action alternatives (8C-D) should affect effort to lesser degrees, and the no action alternative (8A) is not expected to change non-target species discard mortality rates relative to baseline conditions.

7.2.9 Electronic daily reporting requirement for the directed *Illex* fishery

- Alternative 9A: No Action (No requirement for electronic daily reporting in the directed *Illex* fishery)
- Alternative 9B: Require electronic daily reporting in the directed *Illex* fishery

The action alternative (9B) is intended to work in combination with alternatives to the *Loligo* closure possession limit for the directed *Illex* fishery (8B-8D). The likelihood that some benefit to non-target species would be achieved through Alternative 9B is unknown; it is unlikely, however to result in increased discarding of non-target species.

7.2.10 Implementation of seasonal gear restricted areas (GRAs) to reduce butterfish discards

- **Alternative 10A: No Action (No butterfish GRAs - Preferred Alternative)**
- Alternative 10B: Minimum of 3 inch codend mesh size in Butterfish GRA1
- Alternative 10C: Minimum of 3 inch codend mesh size in Butterfish GRA2
- Alternative 10D: Minimum of 3 ¾ inch codend mesh size in Butterfish GRA1
- Alternative 10E: Minimum of 3 ¾ inch codend mesh size in Butterfish GRA2

The action alternatives (10B-10E) are intended to decrease butterfish discarding in the small mesh bottom otter trawl fishery. It is expected that the impacts of the action alternatives on the butterfish can also be extended to small individuals of some non-target finfish species, as well. In Section 7.5.10, it is suggested that small mesh bottom otter trawl fishing patterns will likely be re-distributed if any of the action alternatives is implemented. As such, spatial patterns of non-target species discarding during GRA effective period (Jan – Apr) are likely to shift compared to the status quo. It is not clear which species would be most greatly affected by these shifts, however, it is likely that they would be the same species currently encountered under the small mesh SMB bottom trawl operations. These species are listed in Section 6.2. Among the alternatives, the escapement of non-target finfish species is expected to be greater under Alternative 10D than 10B if GRA1 is established and greater under Alternative 10E than 10C if GRA2 is established. The no action alternative (10A), which would not establish any butterfish GRAs, would result in no changes in discarding patterns relative to baseline conditions.

7.3 Impacts on Habitat (including EFH)

The following subsections discuss the short-term and long-term impacts of the management alternatives identified in Section 5.0 that were developed to minimize, to the extent practicable, adverse effects of directed fishing activities in pursuit for the managed resources on EFH for the managed resources themselves, as well as other Federally managed non-target species. The effort to minimize any adverse habitat (EFH) impacts from the prosecution of the Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries is for the direct benefit to the habitat itself by maintaining integrity and the indirect benefits/effects they afford. Impacts on habitat directly and indirectly affect the managed resources and other federally managed non-target species that are ecologically linked to that habitat, as well non-federally managed species and general ecosystem processes and functions that occur in relation to these areas. General descriptions of potential direct and indirect impacts of fishing activity on habitat were discussed in Section 6.3.2.

Because in many cases, information on the direct linkages between habitat and the productivity of fish species are lacking, it is difficult to quantify the direct and indirect impacts that fishing activity will have on habitat, and how this in turn will affect the managed resources and other non-target species. Therefore, the likely direction and magnitude of impacts on habitat from the prosecution of the Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries will be described based on the results of evaluation of gear effects and EFH assessment conducted in Sections 6.3.3 and 6.3.4.

7.3.1 Alternatives for the Allowance of Multi-Year Quota Specifications

- Alternative 1A: No action (Specify management measures for *Illex*, Atlantic mackerel and butterfish annually, and specify management measures for *Loligo* for up to three years)
- **Alternative 1B: Allow for specification of management measures (including quota specifications) for all four species in the management unit for a period of up to three years (Preferred Alternative)**
- Alternative 1C: Allow for specification of management measures (including quota specifications) for all four species in the management unit for a period of up to five years

As explained in Section 7.1.1, Alternatives 1A-1C are purely administrative in nature. As such there should be no direct or indirect impacts on habitat including EFH.

7.3.2 Measures to Address Overcapacity in the Directed *Illex* Fishery

- Alternative 2A: No action (The moratorium on the issuance of *Illex* permits expires July 1, 2009)
- **Alternative 2B: Extend the moratorium on entry to the *Illex* fishery without sunset provision (Preferred Alternative)**
- Alternative 2C: Terminate the moratorium on entry to the *Illex* fishery
- Alternative 2D: Extend the moratorium on entry to the *Illex* fishery without sunset provision and allow new entry into fishery through permit transfer system

Alternatives 2A and 2C would cause the directed *Illex* fishery to revert to open access conditions which may increase SMB fishing effort. The potential for an increase in effort is addressed through a socio-economic analysis which summarized in Section 7.5.2. Because that analysis produced ambiguous results, the magnitude of any future increase in fishery effort remains unquantifiable. Nevertheless, the direct impacts on EFH from slight increases in bottom otter trawling effort would be expected to increase habitat disturbance. This outcome would indirectly reduce habitat quality or availability for species whose habitat is affected by bottom otter trawling.

Alternatives 2B and 2D would maintain the current constraints on participation. This outcome should increase the chance that current levels of fishing effort will be maintained and therefore an increase in fishing effort using bottom otter trawls would not be expected. Therefore, incremental impacts on EFH from these alternatives would not be expected.

7.3.3 Revised Biological Reference Points for *Loligo pealeii*

- Alternative 3.A: No action
- **Alternative 3.B: Adopt SARC 34 Recommendation (Preferred Alternative)**

The impacts of Alternatives 3A and 3B on harvest of the *Loligo* resource are difficult to predict. The reasons for this are explained above in Section 7.1.3. Under either alternative, the impacts on habitat are linked to *Loligo* harvest effort, changes in which would correspond to changes in levels of disturbance to bottom habitat by bottom tending mobile gear. Harvesting a given amount of *Loligo* should correspond to more or less effort when the abundance of *Loligo* is below or above average, respectively. When less effort is needed, habitat disturbance should decrease, and the opposite should occur when more effort is needed. Nevertheless, increases in the abundance of *Loligo* may also increase participation in the directed fishery. As such, benefits to habitat from increased efficiency in the harvest of the *Loligo* resource would be offset by the additional fishery interest in harvesting *Loligo*. This somewhat complicated scenario is likely to result in a neutral overall impact on habitat from either of the alternatives. Neither is expected to result in substantial changes in habitat disturbance, which would not change habitat impacts from baseline (current) conditions.

7.3.4 Designation of EFH for *Loligo pealeii* eggs

- Alternative 4A: No action (No designation of *Loligo* EFH)
- Alternative 4B: EFH designation based on documented observations of egg mops

Alternative 4B identifies EFH for *Loligo* eggs based upon documented observations. By implementing Alternative 4B, fishing and/or non-fishing activities would not be restricted; however, a requirement would be established whereby NOAA fisheries must be consulted for future Federal fishing and non-fishing activities in those areas. These consultations provide a process to avoid, minimize, or mitigate adverse impacts to EFH that may be caused by these activities. A range of habitat protection measures exists that could be implemented if protection of *Loligo* egg EFH is determined to be necessary. The common feature of these measures is that they would decrease damage to EFH. This could come about by preventing or mitigating non-fishing activities in EFH areas or by reducing fishing effort, or restricting the use of certain gear types or configurations in those areas. Habitat protection provided by these actions would also be extended to other species and ecosystem functions that utilize or are affected by *Loligo* egg EFH.

Alternative 4A, on the other hand, does not extend the suite of regulatory tools that could be implemented to protect *Loligo* egg EFH. Furthermore, the no action alternative is in contradiction with the mandates of the Magnuson-Stevens Act which requires that EFH be identified for all federally managed species. EFH is defined as "…those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" which implies designation throughout the entire life cycle.

7.3.5 Area closures to reduce gear impacts on EFH

- Alternative 5A: No Action (No new areas closed to directed fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls)
- Alternative 5B: Prohibit directed fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in the area surrounding the head of the Hudson Canyon
- Alternative 5C: Prohibit directed fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in tilefish HAPC
- **Alternative 5D: Prohibit directed fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in Lydonia and Oceanographer Canyons (Preferred Alternative)**

Each of the action alternatives (Alternatives 5B-D) is intended to protect habitat, especially EFH, from damage by the activities of the Atlantic mackerel, squid, and butterfish fisheries. Analyses presented in Section 6.3 describe the interactions between habitat and these fisheries. Those analyses indicate that the primary source of bottom habitat disturbance gear type by SMB fisheries occurs through the use of bottom tending mobile gear (e.g., bottom otter trawl). As such, the action alternatives propose to restrict the use of bottom otter trawls by SMB fisheries through the indefinite closure of the certain areas in the EEZ to this gear type.

Relative to the no action alternative (5A), the area closures would all be expected to have direct impacts of varying magnitude on EFH, as well as indirect impacts on the managed resources, other managed and non-managed species, and ecosystem function. These impacts are expected to vary spatially such that there is an improvement in habitat quality within the closed areas, while increased bottom otter trawl effort could increase habitat disturbance outside of the closed areas. If, however, harvest effort shifts to already highly-trawled areas, this is likely to result in minimal offsetting impacts such that the decrease in overall habitat disturbances will be approximately equivalent to the decreases in the closed area. This scenario is considered likely, since the basis for the concentration of effort in these areas is that they are the locations of productive fishing grounds. It is unlikely that bottom trawl effort will shift to unproductive area.

Within the area closures, there are a number of factors that would affect the speed and degree of habitat recovery. 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.

Additionally, the benefits of year-round closed areas are dependent upon the types of habitat within the closed area and the sensitivity of that habitat to disturbances. Sensitive habitats that require long periods of time for recovery from disturbances (e.g. complex habitats with biogenic structure) would accrue greater benefits from long-term closure. Less sensitive habitats that have rapid recovery rates (e.g. high energy sand environments) may not accrue additional benefits from long-term closures.

Given the wide range of influences on habitat impacts both within and outside of the proposed area closures, predictions of overall impacts will necessarily be qualitative in nature.

The Head of Hudson Canyon area (Alternative 5B) is subject to a high level of fishing effort by SMB bottom otter trawl fisheries (Table 71). As indicated in Section 6.3.4.3, the area contains some portion of the overall designated EFH for 17 federally managed species. The importance of the area with respect to the overall availability of EFH varies by species and species' lifestage. Specifically, the amount of EFH is approximately 6% for juvenile Atlantic scallops, juvenile rosette skate, and juvenile silver hake, 5% for juvenile yellowtail flounder, between 1% and 4% for nine species, and 0% for three species.

Sediment in this area is predominantly sand, but also includes different combinations of sand, silt, and clay, and gravelly bottom (Figure 63 in Section 6.3.4.3). The prevalence of sensitive habitats in this area cannot be accurately quantified. Four benthic habitat surveys were conducted in the Hudson Canyon and adjoining shelf areas between October 2001 and November 2005 (Guida et al. unpublished). The availability of information from these studies should provide additional detail on the composition of the benthic habitat, including sediment composition, and the suite of benthic fish and invertebrates that populate this area. Overlap analysis (Section 6.3.4.1) identified the Head of Hudson Canyon as an area with potentially important SMB fishery/habitat interactions. Nevertheless, the limited degree of dependence on this area by any species' lifestage suggests that a permanent closure would impart minor direct and indirect benefits to federally managed species.

The tilefish HAPC area (Alternative 5C) is also subject to a high level of fishing effort by SMB bottom otter trawl fisheries (Table 71). The area contains designated EFH for 22 federally managed species. Clearly, with 68% of either juvenile or adult tilefish habitat being located in the tilefish HAPC area, closure of that area would generate substantial habitat protection for both life stages. Other species' life stages that have greater than 10% of their total EFH within this area include juvenile and adult rosette skates (16% and 56%, respectively), juvenile silver hake (19%), and adult summer flounder (10%). Species' life stages that have between 5% and 10% EFH within tilefish HAPC include adult red hake (9%), juvenile barndoor skate (8%), adult black sea bass (8%), juvenile witch flounder (7%), juvenile and adult little skate (6% and 5%, respectively), and juvenile red hake (5%). Five species have 1-4% of their EFH in tilefish HAPC, and two species have 0% in that area.

Sediment in this area consists of sand and combinations of sand, silt, and clay, although some gravelly sediment is also present (Figure 63 in Section 6.3.4.3). Importantly, a significant proportion of EFH for tilefish is encompassed by this potential area closure. The clay outcroppings found on the slopes of the submarine canyons that intersect the shelf on the southern edge of Georges Bank and the New York Bight provide important habitat for tilefish. The removal of hard clay habitat by trawls is considered to be a permanent change to a major physical feature, and has been rated as a high degree of impact ((NMFS 2002). Tilefish are unique among the species with high proportions of EFH in this area in that they are "shelter-seeking and habitat limited". This part of their EFH was designated as HAPC because it meets three of four criteria used to designate HAPC for a species (50 CFR Part 600.815 (a)(9)). These criteria are ecological function, sensitive to human-induced environmental degradation, and rarity of habitat. Because of the "permanent change" associated with damage to tilefish habitat, the rate of improvement in habitat quality and stock conditions would likely be protracted. Other species with a relatively high proportion of EFH in this area are generally associated with less sensitive habitat types. The high proportion of their EFH is reflective of the large size of the area designated as tilefish HAPC relative to the overall distribution of these species. As such, the benefits to these species from closure of this area are expected to be of a lower magnitude.

Lydonia and Oceanographer Canyons (Alternative 5D) are subject to minimal fishing effort by SMB bottom otter trawl fisheries (Table 71). The area contains designated EFH for six federally managed species. For all of these species the proportion of total EFH for a given lifestage is 3% or less. Nevertheless, the canyons contain sensitive habitat types, such as deep sea alcyonarian and scleractinian corals and their associated benthic communities. Damage to these corals, which are restricted to hard substrate areas, is considered permanent. Closure of these canyons to bottom otter trawls would afford protection of these sensitive habitats. Additionally, because of the protracted recovery period from any damage that has occurred, observable improvement from baseline conditions would likely take many years.

7.3.6 *Loligo* minimum mesh size requirements

- Alternative 6A: No Action (Maintain 1 $^{7/8}$ inch minimum codend mesh requirement)
- Alternative 6B: Increase minimum codend mesh size to $2^{1/8}$ inches
- Alternative 6C: Increase minimum codend mesh size to $2^{1/2}$ inches
- Alternative 6D: Increase minimum codend mesh size to 3 inches

As with other habitat impact analyses, the primary factor to consider is the degree to which fishery effort by bottom tending mobile gear will be affected by the alternatives. Mesh selectivity studies on *Loligo*, which are not available, would be informative in terms of quantifying the potential decrease in catch efficiency of *Loligo* by trawls using the larger alternative mesh sizes. Reduced retention of *Loligo* in trawls and corresponding increases in harvest effort would tend to increase habitat damage. Under this scenario, the greatest (albeit inestimable) increase in habitat damage by bottom otter trawls would occur under Alternative 6D.

7.3.7 Exemptions from *Loligo* minimum mesh requirements for *Illex* vessels

- **Alternative 7A: No Action (*Illex* vessels are exempt from *Loligo* minimum mesh requirements in the months of June through September - Preferred Alternative)**
- Alternative 7B: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding month of September from current mesh exemption for *Illex* fishery
- Alternative 7C: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding months of August and September from current mesh exemption for *Illex* fishery
- Alternative 7D: Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels

The action alternatives (7B-7D) are intended to reduce finfish bycatch in the directed *Illex* fishery. As described in Section 7.1.7, the alternative that is most likely to achieve that goal without a corresponding increase in fishery effort is Alternative 7B. Alternatives 7C and 7D may result in extra effort needed to achieve *Illex* harvest targets. As such, these alternatives may increase fishery impacts on habitat. Alternative 7A (no action) is not expected to change the incidence of habitat impacts by *Illex* gear relative to baseline conditions.

7.3.8 *Loligo* possession limit for the directed *Illex* fishery during closure of the directed *Loligo* fishery

- Alternative 8A: No Action (For *Illex* moratorium permitted vessels, the *Loligo* possession limit during closures of the directed *Loligo* fishery is consistent with the incidental catch allowance for all vessels – currently 2,500 pounds)
- Alternative 8B: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of retained squid catch onboard, with a maximum limit of up to 30,000 pounds of *Loligo*
- Alternative 8C: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 5% of the total weight of retained catch of squid onboard, with a maximum limit of up to 20,000 pounds of *Loligo*
- Alternative 8D: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of retained catch of squid onboard, with a maximum limit of up to 10,000 pounds of *Loligo*

Each of the action alternatives (8B-8D) is intended to reduce regulatory discarding of *Loligo* by the directed *Illex* fishery through a variety of increases in closure period possession limits. These alternatives, by means of reducing regulatory discards would not be expected to have direct impacts on EFH. However, increasing the trip limit to the levels proposed in the action alternatives may encourage directed fishing, although the extent to which this would occur is not well understood. If directed fishing results in an increase in directed bottom trawling effort, then negative direct impacts on habitat would be expected, although the magnitude of these impacts is uncertain. Likewise, negative indirect impacts on species associated with this EFH would be expected as well.

7.3.9 Electronic daily reporting requirement for the directed *Illex* fishery

- Alternative 9A: No Action (No requirement for electronic daily reporting in the directed *Illex* fishery)
- Alternative 9B: Require electronic daily reporting in the directed *Illex* fishery

The action Alternative (9B) is intended to work in combination with alternatives to the *Loligo* closure possession limit for the directed *Illex* fishery (8B-8D). Electronic daily reporting could potentially provide a means for real time monitoring of *Loligo* retention by *Illex* vessels such that the directed *Illex* fishery could be informed as to when the harvest cap on *Loligo* has been achieved. This alternative is however, unlikely to result in changes in fishing effort using bottom otter trawls in the *Illex* fishery, and therefore direct impacts to habitat are expected to be null relative to the no action Alternative 9A.

7.3.10 Implementation of seasonal gear restricted areas (GRAs) to reduce butterfish discards

- **Alternative 10A: No Action (No butterfish GRAs - Preferred Alternative)**
- Alternative 10B: Minimum of 3 inch codend mesh size in Butterfish GRA1
- Alternative 10C: Minimum of 3 inch codend mesh size in Butterfish GRA2
- Alternative 10D: Minimum of 3 ¾ inch codend mesh size in Butterfish GRA1
- Alternative 10E: Minimum of 3 ¾ inch codend mesh size in Butterfish GRA2

Impacts on EFH associated with the action alternatives are likely linked to ways in which fishing patterns are affected. Changes in fishing patterns are expected to have a primarily economic basis. In Section 7.5.10, below, the economic costs associated with the GRA alternatives are considered. According to that analysis, the greatest economic incentive to alter fishing patterns relative to the status quo (10A) is associated with Alternative 10E, while the action alternative that is the least likely to change patterns in bottom otter trawl activity is Alternative 10B. The no action alternative, which would establish no butterfish GRA is expected to result in EFH impacts consistent with the status quo. With regard to the action alternatives, it is not possible to quantitatively characterize how the shifts in effort will occur. In general, to the degree that effort within the potential GRAs is reduced, interactions in those areas should decrease. On the other hand, to the degree that effort outside the GRAs increases interactions with EFH may increase.

7.4 Impacts on Protected Resources

The impacts on protected resources that may come about through the actions being considered in Amendment 9 are expected to be an indirect consequence of shifts in the distribution and/or magnitude of fishing effort. In general, it is expected that implementation of management alternatives that would reduce SMB fishing effort would also reduce the incidence of protected resource interactions with SMB fisheries. Expansion of SMB fishing effort, if it occurs is expected to have the opposite effect; however this effect would also be influenced by any changes in the spatial distribution of effort. Another outcome of the alternatives under consideration is that SMB fishery participants may shift effort into other fisheries. If this occurs, the potential is created for increased interactions with protected resources in those fisheries. The list of protected resources with documented encounters by the SMB fishing activity is given in Section 6.4. The following figures (95 – 98) are provided as a reference for discussion about possible shifts in the spatial distribution of effort within the SMB fisheries, especially as that outcome relate to EFH area closures and butterfish GRAs.

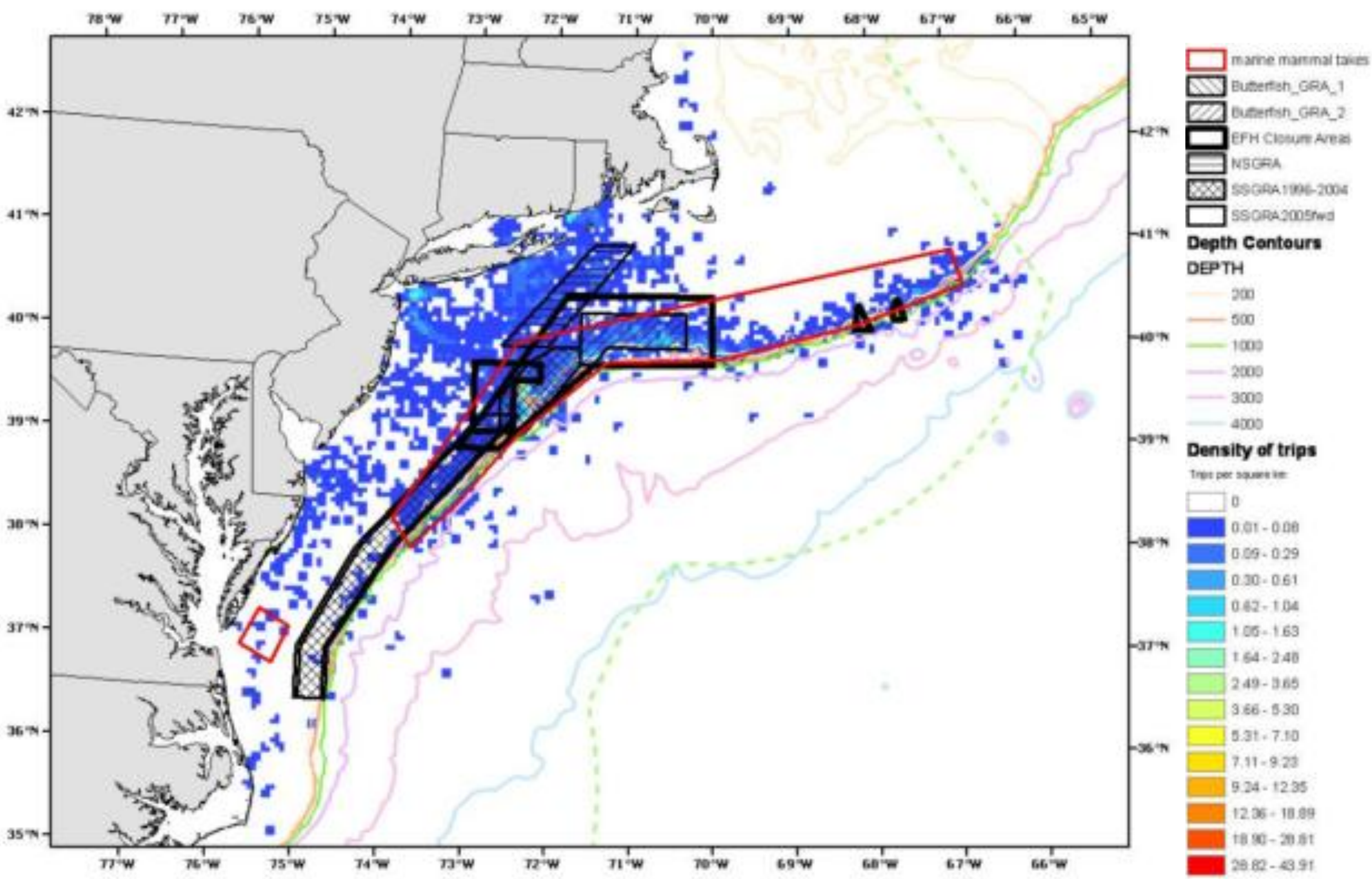

Figure 95. Distribution of SMB fishing effort, proposed area closures, existing area closures, and observed encounters with protected resources during winter (Dec-Feb) 1996-2005.
There are no observed turtle encounters in the winter fishery. Source: NEFSC Protected Species Branch.

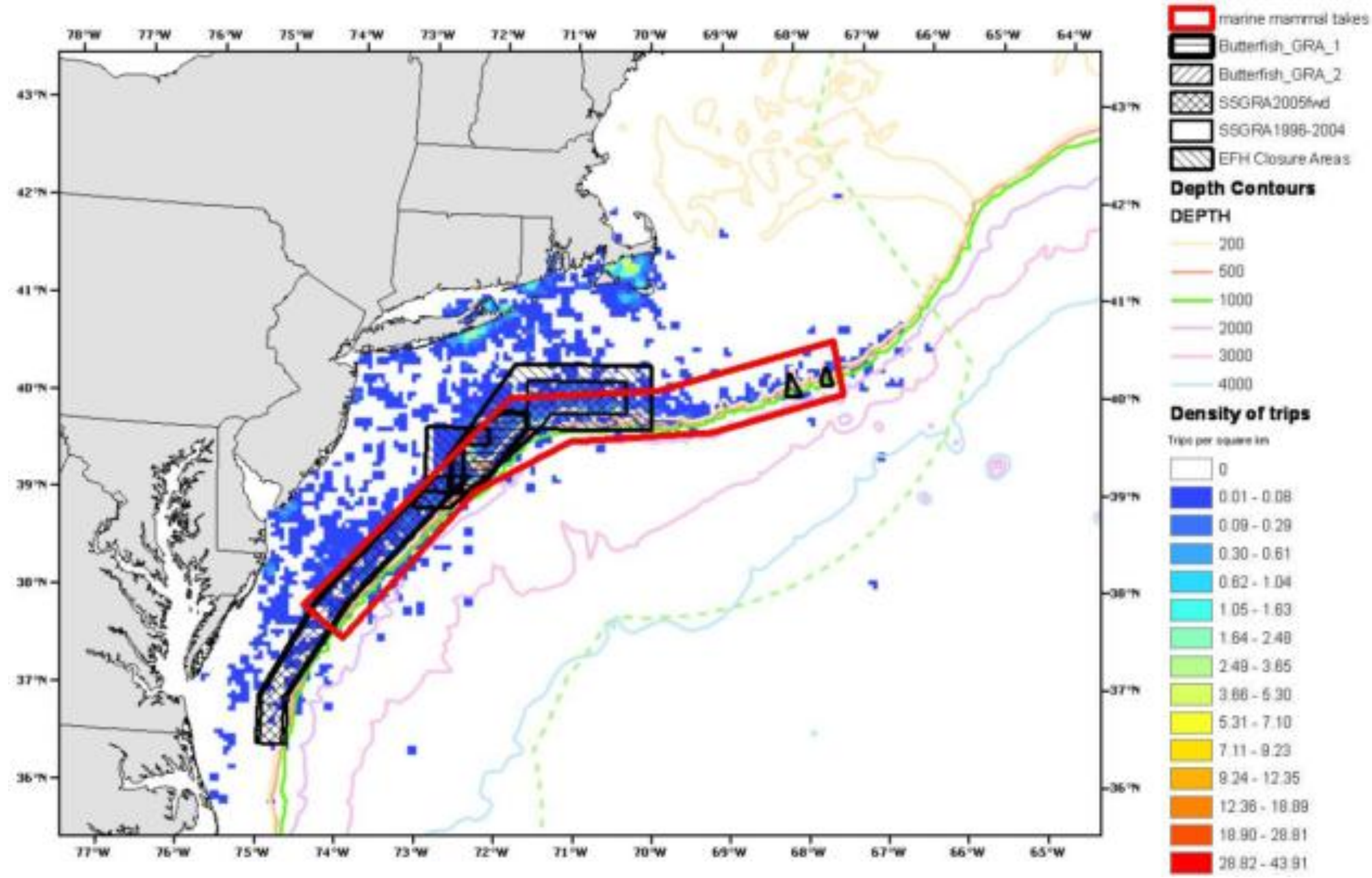

Figure 96. Distribution of SMB fishing effort, proposed area closures, existing area closures, and observed encounters with protected resources during spring (Mar-May) 1996-2005.
There are no observed turtle encounters in the spring fishery. Source: NEFSC Protected Species Branch.

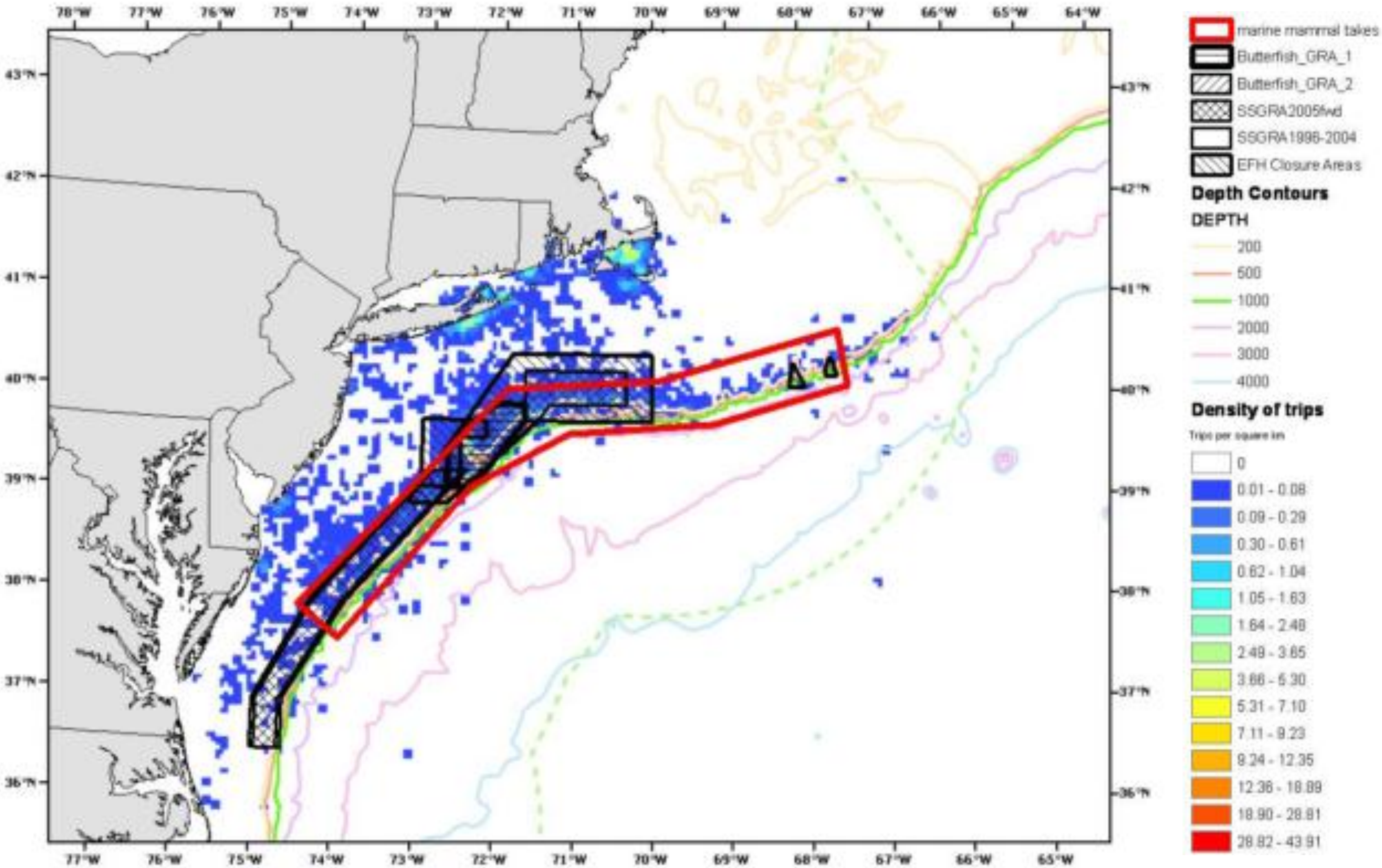

Figure 97. Distribution of SMB fishing effort, proposed area closures, existing area closures, and observed encounters with protected resources during summer (Jun-Aug) 1996-2005.
Source: NEFSC Protected Species Branch.

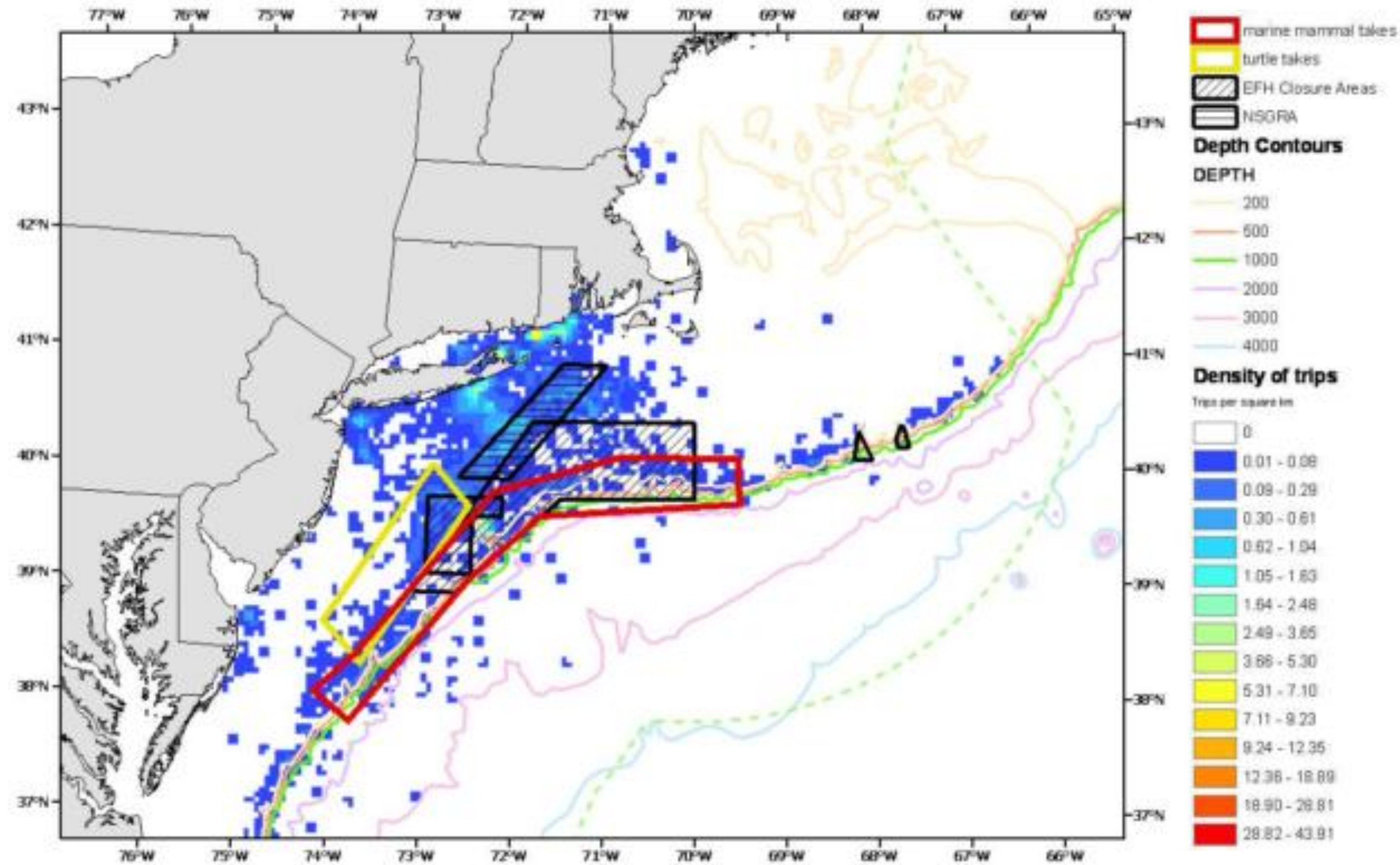

Figure 98. Distribution of SMB fishing effort, proposed area closures, existing area closures, and observed encounters with protected resources during fall (Sep-Nov) 1996-2005.
Source: NEFSC Protected Species Branch.

7.4.1 Alternatives for the Allowance of Multi-Year Quota Specifications

- Alternative 1A: No action (Specify management measures for *Illex*, Atlantic mackerel and butterfish annually, and specify management measures for *Loligo* for up to three years)
- **Alternative 1B: Allow for specification of management measures (including quota specifications) for all four species in the management unit for a period of up to three years (Preferred Alternative)**
- Alternative 1C: Allow for specification of management measures (including quota specifications) for all four species in the management unit for a period of up to five years

As explained in Section 7.1.1, Alternatives 1A-C are purely administrative in nature. As such there will be no direct or indirect impacts on protected resources.

7.4.2 Measures to Address Overcapacity in the Directed *Illex* Fishery

- Alternative 2A: No action (The moratorium on the issuance of *Illex* permits expires July 1, 2009)
- **Alternative 2B: Extend the moratorium on entry to the *Illex* fishery without sunset provision (Preferred Alternative)**
- Alternative 2C: Terminate the moratorium on entry to the *Illex* fishery
- Alternative 2D: Extend the moratorium on entry to the *Illex* fishery without sunset provision and allow new entry into fishery through permit transfer system

Alternatives 2A and 2C would cause the directed *Illex* fishery to revert to open access conditions which may increase SMB fishing effort. The potential for an increase in effort is addressed through a socio-economic analysis which summarized in Section 7.5.2. Because that analysis produced ambiguous results, the magnitude of any future increase in fishery effort remains unquantifiable. However, slight increases in interactions with protected resources would be expected in both the short and long terms. Because of the documented history of interactions between pilot whales and the *Illex* fishery, increased interactions are most likely to involve this species group. The increase is unlikely to be significant since vessels that currently participate in the fishery are a small fraction of the currently permitted fleet which suggests that interest in entry to the fishery is limited.

Alternatives 2B and 2D would maintain the current constraints on participation. As such, Alternatives 2B and 2D are expected to maintain status quo interactions with protected resources encountered by the directed *Illex* fishery, both in the long and short term.

7.4.3 Revised Biological Reference Points for *Loligo pealeii*

- Alternative 3A: No action (Maintain the status quo definitions for the F_{target} and $F_{threshold}$ biological reference points for *Loligo pealeii*)
- **Alternative 3B: Adopt SARC 34 Recommendation (Preferred Alternative)**

The impacts of Alternatives 3A and 3B on harvest of the *Loligo* resource are difficult to predict. The reasons for this are explained above in Section 7.1.3. Under either alternative, the impacts on protected resources are linked to *Loligo* harvest effort, changes in which would correspond to changes in encounters with protected resources. Harvesting a given amount of *Loligo* should correspond to more or less effort when the abundance of *Loligo* is below or above average, respectively. When less effort is needed, encounter rates should decrease, and the opposite should occur when more effort is needed. Nevertheless, increases in the abundance of *Loligo* may also increase participation in the directed fishery. As such, benefits to protected resources from increased efficiency in the harvest of the *Loligo* resource would be offset by the additional fishery interest in harvesting *Loligo*. This somewhat complicated scenario is likely to result in a neutral overall impact on protected resources from either of the alternatives. Neither is expected to result in substantial changes in protected resource encounters, which would not change impacts on these species from baseline (current) conditions (see section 6.4).

7.4.4 Designation of EFH for *Loligo pealeii* eggs

- Alternative 4A: No action (No designation of *Loligo* EFH)
- Alternative 4B: EFH designation based on documented observations of egg mops

By implementing Alternative 4B, no immediate action is expected that would restrict fishing or non-fishing activities, however, a requirement would be established whereby consultation with NOAA fisheries would be required for future Federal fishing and non-fishing activities in those areas. Alternative 4B has the potential to indirectly impact protected species if, at some point in the future, management actions are implemented that would reduce fishing effort or decrease non-fishing impacts on protected resources in those areas. Because the specifics of any future actions are speculative at this point, it is unclear what the nature of the impacts on protected resources would be. In the long term, however, protection of habitat needed by *Loligo* eggs would be expected to improve conditions for protected resources that are associated with that habitat. An analysis of the likely impacts of specific future actions would be required under NEPA prior to their implementation.

If no action is taken with respect to EFH for *Loligo* eggs, then no change from the status quo condition of protected resources is expected.

7.4.5 Area closures to reduce gear impacts on EFH

- Alternative 5A: No Action (No new areas closed to fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls)
- Alternative 5B: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in the area surrounding the head of the Hudson Canyon
- Alternative 5C: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in tilefish HAPC
- **Alternative 5D: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in Lydonia and Oceanographer Canyons (Preferred Alternative)**

The no action alternative (5A) is expected to result in no change in the distribution and intensity of SMB fishing effort. As such, under this alternative, encounters with protected resources are expected to be consistent with base line conditions (described in Section 6.4). Alternatives 5B through D are expected to indirectly impact protected resources because any given alternative or combination of alternatives would result in some degree of spatial re-distribution of bottom otter trawl fishing effort. Refer to Figures 95 – 98 above for information regarding the spatial relationships between SMB fishery effort, potential EFH area closures, and protected species encounters by the SMB fisheries. Because each of the action alternatives would produce year round permanent closures, patterns in fishery effort would be expected to shift from that depicted in the each of the figures (95 – 98). In each of these cases, the change in encounters could be a reduction, an increase, or offsetting reductions and increases, depending on where displaced effort is concentrated. If a small fraction of a P.R. encounter area overlaps a potential closure area, then it is unlikely that a significant change in encounter rates will occur, since vessels would not have to travel far to access waters open to bottom otter trawling. When fishing is displaced it is not expected to shift to areas with no history if SMB fishing activity (open areas on map). Instead, it is expected that effort would increase in areas in which a relatively high degree of fishing effort already occurs. This expectation is based on the assumption that the availability of target SMB species is low in areas where fishing effort is relatively low.

The closure of the head of Hudson Canyon (5B) would reduce the area in which marine mammal encounters might occur by a small amount in all seasons except the summer (Jun – Aug). In the fall (Sept-Nov), a fraction of the area in which turtle encounters have been documented would be closed (Fig. 7.4.1-7.4.4). Neither of these outcomes is expected to be significant since the overlap with the encounter areas is small.

The closure of Tilefish HAPC (5C) would have the most profound effect on marine mammal encounters since this large region overlaps much of the area (~50%) where documented encounters have occurred, except in the summer. The change in effort is expected to result in an overall reduction if marine mammal encounters. No impacts on turtle encounters are expected, however (Fig. 7.4.1-7.4.4).

The closure of Lydonia and Oceanographer Canyons could reduce encounters with marine mammals in the winter and spring, but because of the small size of these closure areas, the magnitude of the change is not expected to be significant.

7.4.6 *Loligo* minimum mesh size requirements

- Alternative 6A: No Action (Maintain 1 $^{7/8}$ inch minimum codend mesh requirement)
- Alternative 6B: Increase minimum codend mesh size to $2^{1/8}$ inches
- Alternative 6C: Increase minimum codend mesh size to $2^{1/2}$ inches
- Alternative 6D: Increase minimum codend mesh size to 3 inches

As with all protected species impacts, the primary factor to consider is the degree to which fishery effort is affected by the alternatives. Mesh selectivity studies on *Loligo*, which are not available, would be informative in terms of quantifying the potential decrease in catch efficiency of *Loligo* by trawls using the larger alternative mesh sizes. Reduced retention of *Loligo* in trawls and corresponding increases in harvest effort would tend to increase encounters with protected resources. Under this scenario, the greatest (albeit inestimable) increase in protected resource encounters would occur under Alternative 6D. Because a subset of the fleet already fishes with codend mesh greater than or equal to 2 $^{1/2}$ inches or greater the increase in protected resource interactions would not be as large as it would have been if the entire fleet was using 1 $^{7/8}$ inch mesh. As discussed in Section 7.1.6, approximately 11% of the existing fleet uses 1 $^{7/8}$ inch mesh

7.4.7 Exemptions from *Loligo* minimum mesh requirements for *Illex* vessels

- **Alternative 7A: No Action (*Illex* vessels are exempt from *Loligo* minimum mesh requirements in the months of June through September - Preferred Alternative)**
- Alternative 7B: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding month of September from current mesh exemption for *Illex* fishery
- Alternative 7C: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding months of August and September from current mesh exemption for *Illex* fishery
- Alternative 7D: Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels

The action alternatives (7B-7D) are intended to reduce finfish bycatch in the directed *Illex* fishery. As described in Section 7.1.7, the alternative that is most likely to achieve that goal without a corresponding increase in fishery effort is Alternative 7B. Alternatives 7C and 7D may result in extra effort needed to achieve *Illex* harvest targets. As such, these alternatives may increase fishery encounters with protected resources. Because the *Illex* fishery has numerous documented encounters with pilot whales, fishery interactions with this species are likely to increase if fishery effort increases. Alternative 7A (no action) is not expected to change the incidence of protected species encounters relative to baseline conditions.

7.4.8 *Loligo* possession limit for the directed *Illex* fishery during closure of the directed *Loligo* fishery

- Alternative 8A: No Action (For *Illex* moratorium permitted vessels, the *Loligo* possession limit during closures of the directed *Loligo* fishery is consistent with the incidental catch allowance for all vessels – currently 2,500 pounds)
- Alternative 8B: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of retained squid catch onboard, with a maximum limit of up to 30,000 pounds of *Loligo*
- Alternative 8C: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 5% of the total weight of retained catch of squid onboard, with a maximum limit of up to 20,000 pounds of *Loligo*
- Alternative 8D: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of retained catch of squid onboard, with a maximum limit of up to 10,000 pounds of *Loligo*

Each of the action alternatives (8B-8D) is intended to reduce regulatory discarding of *Loligo* by the directed *Illex* fishery through increases in closure period possession limits. This outcome is unlikely to greatly affect *Illex* fishery effort, however, to the degree that a given vessel is allowed to retain greater amounts of *Loligo*, that vessel's trip target may be achieved more quickly, and effort may be reduced. Under this scenario, the alternative with the largest *Loligo* possession limit (8B) should reduce fishing effort and, correspondingly, protected species encounters by the greatest amount. The other action alternatives (8C-D) are likely to affect effort to lesser degrees; and the no action alternative (8A) is not expected to affect protected resource interactions relative to baseline conditions.

7.4.9 Electronic daily reporting requirement for the directed *Illex* fishery

- Alternative 9A: No Action (No requirement for electronic daily reporting in the directed *Illex* fishery)
- Alternative 9B: Require electronic daily reporting in the directed *Illex* fishery

The action alternative (9B) is intended to work in combination with alternatives to the *Loligo* closure possession limit for the directed *Illex* fishery (8B-8D). The likelihood that some benefit to protected resources would be achieved through Alternative 9B is unknown; it is unlikely, however, to result in increased encounters with protected and endangered species.

7.4.10 Implementation of seasonal gear restricted areas (GRAs) to reduce butterfish discards

- **Alternative 10A: No Action (No butterfish GRAs - Preferred Alternative)**
- Alternative 10B: Minimum of 3 inch codend mesh size in Butterfish GRA1

- Alternative 10C: Minimum of 3 inch codend mesh size in Butterfish GRA2
- Alternative 10D: Minimum of 3 ¾ inch codend mesh size in Butterfish GRA1
- Alternative 10E: Minimum of 3 ¾ inch codend mesh size in Butterfish GRA2

Impacts on protected resources associated with the action alternatives are likely linked to ways in which fishing patterns are affected. Changes in fishing patterns are expected to have a primarily economic basis. In Section 7.5.10, below, the economic costs associated with the GRA alternatives are considered. According to that analysis, the greatest economic incentive to shift fishing patterns is associated with Alternative 10E, while the action alternative that is the least likely to change patterns in bottom otter trawl activity is Alternative 10B.

The no action alternative (10A) is expected to result in no change in the distribution and intensity of SMB fishing effort. As such, under this alternative, encounters with protected resources are expected to be consistent with base line conditions (described in Section 6.4). Alternatives 10B through E are expected to indirectly impact protected resources because the alternatives would result in some degree of spatial re-distribution of bottom otter trawl fishing effort. Refer to Figures 95 – 96 above (winter and spring maps) for information regarding the spatial relationships between SMB fishery effort, butterfish GRAs, and protected species encounters by the SMB fisheries. Because each of the action alternatives is limited to a seasonal (Jan-Apr) restriction on bottom otter trawl gear, patterns in fishery effort would not be expected to shift from that depicted in Figures 97 – 98 (summer and fall). In each of these cases, no change in turtle encounters are expected since turtle encounters with the SMB fisheries have not been observed in the winter or spring.

Because the primary small mesh fishery affected by the GRAs would be the *Loligo* fishery, changes in fishery encounters with marine mammals is expected to be limited to the common dolphin. As noted in Section 6.4, observed *Loligo* fishery encounters with this species have been limited to the first quarter of the year. No encounters with white-sided dolphins or pilot whales have been observed since 1996. Because Alternative 10E is associated with the greatest potential for redistribution of effort, a reduction in common dolphin encounters is most likely to occur under this alternative. In descending order of magnitude, reductions in encounters with common dolphins are also expected under Alternatives 10C, 10D, and 10B. This order matches the characterization of likely shifts in fishery behavior produced by the economic analysis of these alternatives in Section 7.5.10.

7.5 Social and Economic Impacts

This section discusses the impacts of the proposed management alternatives and independent measures on the human communities VEC. To the extent possible, the analyses in the following subsections considers the short-term and long-term impacts of the Amendment 1 measures on fisheries and communities in the context of revenues from the SMB resources, changes in fishing opportunity, the influence of market conditions, and the importance of SMB fishing to fishery-dependent communities. In Section 6.5, a detailed description of the socio-economic characteristics of these fisheries is provided. That document section should be referenced in order to understand the basis for the impacts described below.

7.5.1 Alternatives for the Allowance of Multi-Year Quota Specifications

- Alternative 1A: No action (Specify management measures for *Illex*, Atlantic mackerel and butterfish annually, and specify management measures for *Loligo* for up to three years)
- **Alternative 1B: Allow for specification of management measures (including quota specifications) for all four species in the management unit for a period of up to three years (Preferred Alternative)**
- Alternative 1C: Allow for specification of management measures (including quota specifications) for all four species in the management unit for a period of up to five years

The implementation of either of the action alternatives would provide industry with a longer planning horizon. This could lead to better business plans and ultimately greater economic benefits. If no action is taken (Alt 1A), no direct or indirect impacts on the socio-economic environment are expected relative to current (i.e., baseline) conditions.

7.5.2 Measures to Address Overcapacity in the Directed *Illex* Fishery

- Alternative 2A: No action (The moratorium on the issuance of *Illex* permits expires July 1, 2009)
- **Alternative 2B: Extend the moratorium on entry to the *Illex* fishery without sunset provision (Preferred Alternative)**
- Alternative 2C: Terminate the moratorium on entry to the *Illex* fishery
- Alternative 2D: Extend the moratorium on entry to the *Illex* fishery without sunset provision and allow new entry into fishery through permit transfer system

An extensive examination of the potential socioeconomic impacts of Alternatives 2A-D was conducted by Dr James Kirkley of the Virginia Institute of Marine Sciences. The details of his analysis are provided in Appendix 10, while the conclusions are summarized here.

It was possible to provide only a limited analysis of capacity and the potential economic ramifications of the various alternatives considered relative to the moratorium. There is no doubt that the existing fleet has the capability to harvest in excess of the present TAC. Analysis indicated that 24 moratorium permitted vessels had the capability in 1998 to harvest more than the 2004 TAC of 52.9 million pounds (24,000 mt). The 1998 fleet harvested well in excess of the allowable 41.9 million pound (19,000 mt) TAC and only about 900,000 pounds (408.2 mt) less than the 2004 TAC. If the fleet had been allowed to continue fishing in 1998, it is highly likely that landings would have been considerably higher than the nearly 52.0 million pounds actually landed. In 2004, 51 vessels (moratorium and non-moratorium) landed 54.3 million pounds of *Illex*, and the fishery had to be closed. Without the present moratorium, increased participation would have made it likely that the fishery would have been closed earlier.

The available economic analysis does lead to a clear conclusion that would allow the Council to determine the most appropriate regulatory option regarding the moratorium. The present fleet is capable of harvesting well in excess of the TAC of 24,000 mt as shown by harvest of more than the TAC the 2004 fleet. Reduced world supplies of squid and increased world prices for squid are believed to be responsible for the increased effort on domestic squid. International market reports suggest that the world supplies of squid will be tight for several years, and therefore, prices are expected to be high (http://www.globefish.org/). This, coupled with the fact that resource productivity is low to moderate, argues for making the moratorium permanent (Alternative 2B).

Unfortunately, the benefits and costs of the moratorium options cannot be easily analyzed. Maintaining the moratorium, however, does offer the opportunity to prevent the dissipation of rent or producer surplus in the future. Available data suggest that vessel activity related to *Illex* in the near future, and thus, implementing Alternative 2B would help maintain net benefits to society, or at least, prevent the decrease of net benefits.

The available information suggests that if the moratorium were terminated (Alternative 2C) or were allowed to expire in 2009 (Alternative 2A) and economic and resource conditions remain relatively unchanged from recent levels, there would not be any substantial increase in landings of *Illex* relative to the landings likely to occur with or without a moratorium. If, however, economic conditions changed to promote increased activity on *Illex* as occurred in 2004, landings of *Illex* would increase. Alternatives 2B and 2D offer protection against risk of an expanding fishery and risk of further depressing the resource. These options, however, do not appear to generate landings, revenue, or potential benefit streams any different that those levels most likely to occur with a removal of the moratorium (given current conditions).

Alternative 2B and 2D impose some short-run costs in that they constrain expansion of the fishery, either until 2009 or permanently. That is, individuals desiring to enter the fishery would be denied the potential revenues that might be realized if they could land more *Illex*, unless they purchased an *Illex* permitted vessel (2B) or an existing *Illex* permit (2D). However, the Council could offset these discrepancies by increasing the non-moratorium catch allowance to allow increased participation- albeit controlled. For example, in 2004, the Council increased the non-moratorium incidental catch limit to 10,000 pounds of *Illex* per day. In the future, the Council could increase the incidental catch allowance to even higher levels. This would allow temporary entry into the fishery, but would not result in permanent, long term over-capitalization of the fishery.

Failure to extend the moratorium could result in further overcapitalization of this sector of the fishing industry, which in turn could have negative economic consequences for the vessels and communities which depend upon the *Illex* resource. Extension of the *Illex* moratorium program will provide positive benefits to the communities which are dependent on the commercial *Illex* fishery. The primary ports and surrounding communities where *Illex* are landed would be the most affected by this action (see Section 6.5.1).

In relation to the alternatives of lifting or not lifting the moratorium on *Illex* permits, interviews with key informants in the *Illex* fishery indicated concern about overcapitalization in the industry, given decline in demand as indicated by declining catches up to 2003. This was not a major interest of others, but it may become a greater issue affecting the fishing communities of the region as other fisheries become even more constrained than they are now. No new information has been gathered since the large increase in *Illex* landings that occurred in 2004.

Fishermen interviewed in Wanchese and Hampton favored a continued moratorium on entry into the *Illex* fishery. They expressed the concern that allowing more fishermen to enter the fishery would increase competition for *Illex* and also reduce the market value of *Illex*. It is not known if lifting the moratorium on entry would negatively affect the fishermen of these ports.

Note that although the removal of the moratorium on *Illex* permits would allow for new entry into the fishery, the existing set of *Illex* permitted vessels is in excess of the number that actually harvest *Illex* in any given year. While the annual harvest of *Illex* generally falls short of the quota, in those years when the quota has been exceeded (1998 and 2004), the number of active vessels comprises less than half of the number of permitted vessels (active/permitted = 36/73 in 1998; 26/75 in 2004). Compare these ratios to the average from 2000 through 2003, where active/permitted vessel ratio was 19/74. In other words, participation in the fishery increases in years when market demand is high for *Illex* (i.e., 1998, 2004); however, there is still a significant amount of non-participation in the fishery. This suggests that a remarkable increase in the fishery participation is unlikely to occur if the permit was converted to open access, which further implies that there is likely to be little demand for new entry into the fishery.

7.5.3 Revised Biological Reference Points for *Loligo pealeii*

- Alternative 3A: No action (Maintain the status quo definitions for the F_{target} and $F_{threshold}$ biological reference points for *Loligo pealeii*)
- **Alternative 3B: Adopt SARC 34 Recommendation (Preferred Alternative)**

The socio-economic impacts of these alternatives are difficult to predict. This is, in large part, because the socio-economic impacts are contingent upon the impacts of the alternatives on the *Loligo* resource, which, as explained in Section 7.1.3 above, cannot be quantified. Most importantly, the revised reference points (Alternative 3B) are not expected to result in an immediate change in the *Loligo* quota. The annual quota has been set at 17,000 mt each year since 2001 and is specified at this level for 2006. Consumer demand for *Loligo* will affect *Loligo* prices, which, in turn, will result in economic impacts on *Loligo* harvesters, processors, and consumers that are currently unquantifiable. To those consumers for whom *Loligo* is a desirable food item, increased availability of the resource, if it occurs, would be expected to provide a beneficial effect. If, on the other hand, *Loligo* stock size decreases such that harvest costs increase, then *Loligo* prices would be expected to increase.

The communities most likely to be impacted by the action alternative are identified in Section 6.5.1 and Section 6.5 2.3. As stated above, the directionality of the impacts on these communities is unpredictable at present.

7.5.4 Designation of EFH for *Loligo pealeii* eggs

- Alternative 4A: No action (No designation of *Loligo* EFH)
- Alternative 4B: EFH designation based on documented observations of egg mops

By implementing Alternative 4B, no immediate action is expected that would restrict fishing or non-fishing activities, however, a requirement would be established whereby consultation with NOAA Fisheries would be required for future Federal fishing and non-fishing activities which may adversely affect EFH in the area. It should be noted that the areas described by alternative 4B are currently designated as EFH for numerous other managed species, including but not limited to winter flounder, monkfish, Atlantic sea herring, Atlantic cod, summer flounder, scup, Atlantic mackerel, and whiting.

Alternative 4B has the potential to indirectly impact human communities if, at some point in the future, management actions are implemented in order to reduce fishing effort or decrease non-fishing impacts in those EFH areas. Because the specifics of any future actions are speculative at this point, it is unclear what the nature of the impacts on human communities would be. In the long term, however, protection of habitat needed by *Loligo* eggs would be expected to improve the sustainability of the *Loligo* resource, and other managed resources that share those habitats, indirectly benefiting human communities dependent on those resources. An analysis of the likely impacts of specific future actions would be required under NEPA prior to their implementation.

If no action is taken with respect to EFH for *Loligo* eggs, then no change from the status quo condition of human communities is expected.

7.5.5 Area closures to reduce gear impacts on EFH

- Alternative 5A: No Action (No new areas closed to fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls)
- Alternative 5B: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in the area surrounding the head of the Hudson Canyon
- Alternative 5C: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in tilefish HAPC
- **Alternative 5D: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in Lydonia and Oceanographer Canyons (Preferred Alternative)**

Because geographic analysis of fishing effort reveals very little use of bottom otter trawl gear in Lydonia and Oceanographer Canyons, it is suggested that the closure of these areas to the use of bottom otter trawl gear will have insignificant socio-economic effects. For the period 2001 – 2004, bottom otter trawl landings were reported to have come from within these areas for 22 different species. Compared to total landings of these species by bottom otter trawls over the same timeframe, the percentage that came from Lydonia and Oceanographer Canyons comprised a range of 0.00002% to 0.2% for black sea bass and *Loligo*, respectively. The Head of Hudson Canyon (HH) and Tilefish HAPC (THAPC) EFH areas are much larger in comparison to Lydonia and Oceanographer Canyons. As such the magnitude of any socioeconomic impacts if either or both of these areas are made unavailable to bottom otter trawl fishing is likely to be more substantial.

According to vessel trip reports, 252 distinct vessels fished bottom otter trawls in HH between 2001 and 2004. These vessels harvested 76 different species or species groups. Table 77 lists the top twelve commercially important species reported to have been harvested by bottom otter trawls in HH. These twelve species comprised 1% or more of the total landings reported from HH from 2001-2004. Table 77 also indicates the relative importance of HH to the average vessel harvesting these species. The data suggest that revenue losses associated with *Loligo* harvest are likely to be the greatest, on average. However, in terms of dependence on HH for revenue, scup revenues may be the most greatly impacted.

Table 78 ranks the level of dependence on HH by vessels. In general the level of dependency on HH is positively correlated with the average revenue derived from that area. Closing HH to bottom otter trawling is likely to reduce revenue by 10% or more for about 65 bottom otter trawl vessels. Table 79 gives some of the characteristics of these 65 vessels.

Table 77. Commercially important species landed by bottom otter trawling in Head of Hudson Canyon (HH) from 2001 – 2004. Relative importance of HH by species landings is also indicated.

Species	Vessels	Pct of total vessels that fished in HH (N = 252)	Ave price ($/lb)	Ave annual vessel landings that came from HH	Ave annual vessel landings that came from all areas	Average annual vessel revenue from HH	Average annual vessel revenue from all areas	Ave pct of vessel revenue that came from HH
SQUID (*LOLIGO*)	186	74%	0.69	16,724	162,219	11,556	112,089	10.3%
SCALLOP, SEA	73	29%	4.20	2,251	58,222	9,453	244,448	3.9%
FLOUNDER, SUMMER	216	86%	1.44	5,660	43,657	8,159	62,936	13.0%
SCUP	163	65%	0.64	10,457	26,400	6,704	16,926	39.6%
SQUID (*ILLEX*)	20	8%	0.28	15,293	616,675	4,266	172,022	2.5%
HAKE, SILVER	113	45%	0.47	5,098	138,666	2,412	65,596	3.7%
MACKEREL, ATLANTIC	72	29%	0.10	20,770	202,696	2,148	20,958	10.2%
SEA BASS, BLACK	174	69%	1.81	1,129	7,095	2,046	12,853	15.9%
HERRING, ATLANTIC	10	4%	0.05	15,451	338,046	782	17,115	4.6%
ANGLER	196	78%	1.40	277	9,149	389	12,854	3.0%
BUTTERFISH	135	54%	0.40	620	7,761	247	3,092	8.0%
HAKE, RED	98	39%	0.29	628	15,760	183	4,605	4.0%

Table 78. Vessel dependency on bottom otter trawl revenue from HH.

Percentage of revenue from HH	Number of vessels	Average annual revenue from HH
.01%-1%	43	2,107
1%-5%	95	14,558
5%-10%	49	29,509
10%-25%	38	44,722
25%-50%	24	67,569
50%-71%	3	143,028

Table 79. Characteristics of bottom otter trawls vessels that are likely to have >10% annual revenue loss if Head of Hudson Canyon is closed (N = 65).

Vessel Characteristics

	Length	Gross Tonnage	Crew Size
Average	70	106	4
Min	48	36	2
Max	87	192	9

According to vessel trip reports, landings from HH of the species listed in Table 77 occurred at 34 distinct ports. The ports whose HH revenues were > 1% are listed in Table 80, and the relative importance of landings from HH to those ports is also indicated. Most of the ports that would experience revenue losses consist of small ports in North Carolina and New York. The major ports that would experience revenue losses include, in descending order, Point Judith, RI, North Kingstown, RI, Cape May, NJ, and Hampton, VA.

Table 80. Port dependency on the major species landed by bottom otter trawls from Head of Hudson Canyon (2001 to 2004).

PORTNAME	Ave annual HH revenue	Ave annual revenue from all areas	Pct HH
BELFORD, NJ	310,390	1,458,948	21%
PT. PLEASANT, NJ	1,228,504	9,339,293	13%
SHINNECOCK, NY	590,645	4,772,978	12%
ELIZABETH, NJ	38,990	386,405	10%
ORIENTAL, NC	82,466	1,009,792	8%
MONTAUK, NY	527,052	6,568,758	8%
HAMPTON BAY, NY	62,841	789,336	8%
VANDEMERE, NC	11,791	153,717	8%
ENGELHARD, NC	97,412	1,364,804	7%
WANCHESE, NC	265,113	3,976,799	7%
BEAUFORT, NC	104,282	1,689,666	6%
FREEPORT, NY	5,804	105,769	5%
BAYBORO, NC	11,050	206,358	5%
NEWPORT, RI	190,845	3,659,711	5%
LOWLAND, NC	9,688	244,957	4%
POINT JUDITH, RI	745,562	19,037,257	4%
NORTH KINGSTOWN, RI	230,224	8,221,733	3%
GREENPORT, NY	4,806	180,421	3%
CHINCOTEAGUE, VA	114,129	4,518,376	3%
CAPE MAY, NJ	874,916	45,134,931	2%
NEW LONDON, CT	66,360	3,988,882	2%
HAMPTON, VA	258,612	20,118,519	1%

In the THAPC closure area, 344 distinct vessels fished bottom otter trawls between 2001 and 2004. These vessels harvested 93 different species or species groups. Table 81 lists the top 16 commercially important species reported to have been harvested by bottom otter trawls in THAPC. These 16 species comprised 1% or more of the total landings reported for THAPC from 2001-2004. Table 81 also indicates the relative importance of THAPC to the average vessel harvesting these species. The data suggest that revenue losses associated with *Loligo,* and silver hake are likely to be the greatest, on average. In terms of dependence on THAPC for revenue, 14 out of 16 species show average vessel dependence greater than 10%. As such it is likely that the negative socio-economic impacts associated with this alternative are likely to be large and widespread.

Table 82 ranks the level of dependence on THAPC by vessels. In general the level of dependency on THAPC is positively correlated with the average revenue derived from that area. Closing THAPC to bottom otter trawling is likely to reduce revenue by 10% or more for about 201 bottom otter trawl vessels. Table 83 gives some of the characteristics of these 201 vessels.

Table 81. Commercially important species landed by bottom otter trawling in Tilefish HAPC (THAPC) from 2001 – 2004. An estimate of the relative importance of THAPC by species landings is also indicated.

Species	Vessels	Pct of total vessels that fished in THAPC (N = 402)	Ave price ($/lb)	Ave annual vessel landings that came from THAPC	Ave annual vessel landings that came from all areas	Average annual vessel revenue from THAPC	Average annual vessel revenue from all areas	Ave pct of vessel revenue that came from THAPC
SQUID (*LOLIGO*)	235	67%	0.70	37,480	122,496	26,223	85,705	30.6%
HAKE, SILVER	169	45%	0.48	27,731	103,218	13,327	49,605	26.9%
MACKEREL, ATLANTIC	125	90%	0.10	14,267	48,068	1,485	5,003	29.7%
FLOUNDER, SUMMER	303	36%	1.45	5,662	26,408	8,218	38,330	21.4%
BUTTERFISH	193	60%	0.40	8,635	14,056	3,472	5,652	61.4%
SCUP	210	53%	0.66	6,246	19,022	4,096	12,474	32.8%
SQUID (*ILLEX*)	33	10%	0.28	23,222	354,401	6,580	100,422	6.6%
HAKE, RED	147	38%	0.30	3,297	13,370	989	4,011	24.7%
HERRING, ATLANTIC	26	8%	0.07	17,682	80,055	1,225	5,545	22.1%
ANGLER	263	80%	1.41	1,596	9,000	2,244	12,655	17.7%
SEA BASS, BLACK	226	65%	1.82	1,088	4,497	1,976	8,169	24.2%
WHITING, BLACK	31	9%	0.52	7,036	11,467	3,652	5,951	61.4%
SKATES	93	26%	0.21	2,315	102,819	491	21,810	2.3%
WHITING, KING	55	16%	0.77	2,888	10,111	2,233	7,820	28.6%
TILEFISH, GOLDEN	123	67%	1.70	1,049	1,330	1,787	2,264	78.9%
HAKE, WHITE	54	45%	0.73	2,390	7,597	1,740	5,531	31.5%

Table 82. Vessel dependency on bottom otter trawl revenue from THAPC (2001-2004).

Percentage of revenue from THAPC	Number of vessels	Average revenue from THAPC
.02%-1%	32	1,503
1%-5%	73	27,943
5%-10%	59	97,487
10%-25%	81	157,400
25%-50%	76	450,978
50%-100%	10	369,195

Table 83. Characteristics of bottom otter trawls vessels that are likely to have >10% annual revenue loss if Tilefish HAPC is closed (N = 167).

	Vessel Characteristics		
	Length	Gross Tonnage	Crew Size
Average	72	116	5
Min	42	28	1
Max	111	246	10

According to vessel trip reports, landings from THAPC occurred at 30 distinct ports. The ports whose THAPC revenues were > 1% are listed in Table 84, and the relative importance of landings from THAPC to those ports is also indicated. Most of the ports that would experience revenue losses consist of relatively small ports in New York, North Carolina, New Jersey, and Massachusetts. The large ports that would experience revenue losses include Point Judith, RI and Cape May, NJ.

Table 84. Port dependency on the major species landed by bottom otter trawls from Tilefish HAPC (2001 to 2004).

PORTNAME	Average annual THAPC revenue	Average annual revenue	pct THAPC
HAMPTON BAY, NY	299,279	841,671	36%
MONTAUK, NY	2,314,095	7,651,857	30%
POINT LOOKOUT, NY	69,178	296,443	23%
POINT JUDITH, RI	4,912,444	21,700,975	23%
SHINNECOCK, NY	988,497	5,079,637	19%
NEWPORT, RI	691,239	4,959,372	14%
BELFORD, NJ	224,294	1,651,093	14%
NEW SHOREHAM, RI	42,128	310,166	14%
ELIZABETH, NJ	43,448	386,405	11%
PT. PLEASANT, NJ	997,891	10,282,312	10%
NORTH KINGSTOWN, RI	789,249	9,040,873	9%
GREENPORT, NY	18,373	211,348	9%
VANDEMERE, NC	11,791	153,726	8%
SCITUATE, MA	26,479	345,516	8%
NEW LONDON, CT	249,289	4,499,005	6%
STONINGTON, CT	366,079	8,906,651	4%
BEAUFORT, NC	70,700	1,734,610	4%
WANCHESE, NC	131,368	4,138,772	3%
BAYBORO, NC	5,902	206,358	3%
MANASQUAN, NJ	860	34,948	2%
TIVERTON, RI	18,479	836,235	2%
CHINCOTEAGUE, VA	87,473	5,318,084	2%
ORIENTAL, NC	16,206	1,032,863	2%
CAPE MAY, NJ	740,010	49,007,943	2%
ENGELHARD, NC	19,770	1,473,680	1%
STONINGTON, ME	9,040	794,801	1%
MARSHFIELD, MA	430	37,856	1%
BOSTON, MA	24,647	2,529,340	1%
FALL RIVER, MA	7,214	848,574	1%
CHILMARK, MA	839	150,520	1%

The following discussion is based on interviews with industry representatives in order to understand their opinions on the impacts of the new area closures. These interviews were conducted prior to the 2005 modification of the southern scup GRA which was shifted three nautical miles to the west. As such their comments on the effects of "existing" area closures refer to the original scup GRA.

Alternative 5A (no action) According to interviews with harvesting and processing sector representatives in Rhode Island, New Jersey, and New York, the scup GRAs have resulted in significant declines in the volume of squid available and in revenues for many firms. One processor reported an 80% reduction in fresh fish between January and March, the period of scup GRA closure, and the loss of 15-20 positions. Another major processor reported a 20-30% reduction due to scup GRAs. A company that packs squid reported a two-thirds decline in revenues linked to the scup GRA closures, and a cooperative reported a 30% decline. Some processors said that they were still getting adequate product but the profits to vessels were down as they had to go farther to search for product. In other words, the industry is hurting and has little flexibility due to existing management measures, particularly the scup GRAs.

In the near future, under the status quo, the squid, Atlantic mackerel, and butterfish fisheries may also be affected by increased competition for fishing space and product from boats that are affected by further restrictions in the New England groundfish fisheries and turtle-related restrictions in fisheries of the South Atlantic.

Status quo conditions provide the background for assessing alternatives that involve changes in allowable fishing grounds. In this case, they suggest that any changes in allowable fishing grounds can have serious economic effects, and possible social effects, because of the cumulative effects of restrictions such as the additional area closures under consideration in Amendment 9.

Alternative 5B Head of Hudson Canyon Interviews highlight the importance of the head of the Hudson Canyon to the fisheries of the region. (These interviews did not always distinguish the precise boundaries of Alternative 5D, which as currently drawn exclude much of the year 2000 logbook fishing activity). The head of the Hudson Canyon is seen as one of the best areas left to fish, particularly for the fishermen of Rhode Island, New York, and northern New Jersey. It is known as a prolific *Loligo* squid, mackerel, and butterfish fishing ground, and with the establishment of the scup GRAs, many boats from Rhode Island and Massachusetts have begun focusing on the area, especially in the winter. "Some boats live there," according to one of the New York fishermen. Its use changes from year to year, as well, depending on the behavior of fish. For example, in 1997 Atlantic mackerel were particularly abundant there. It is often discussed as part and parcel of the tilefish HAPC, although it is distinct.

Alternative 5C Tilefish HAPC There are even greater potential impacts of a proposed prohibition on fishing with bottom otter trawl gear in the area known as the tilefish HAPC, statistical areas 616 and 537 between the 300-foot and 850-foot isobaths. Interviews highlighted the importance of the tilefish HAPC area to the otter trawl fisheries of the region, particularly Rhode Island, New York, and northern New Jersey. As one of the fishermen from Point

Pleasant remarked, this area is the source of their "winter money." Offshore *Loligo* squid fishing has become one of the few available winter fisheries for the multi-species otter trawl fisheries of the region. One of the cumulative effects of changes in the fisheries of the area is to increase reliance on the tilefish HAPC as well as the smaller head of the Hudson Canyon area that overlaps it. The creation of scup GRAs in 2001 had dramatic results for many boats, leading them to switch to other fisheries or to go farther in search of other squid fishing grounds, which increased reliance on this offshore area. Consequently, the alternative of closing the tilefish HAPC to bottom otter trawl fishing is treated as a major threat –"That's where we live," said one New York fisherman. Moreover, although the language of the FMP emphasizes benefits of such a closure to summer flounder, scup, and black sea bass, as well as tilefish, perceptions of people in the squid, mackerel, and butterfish fisheries are that the benefits of such a closure, if any (there is doubt about the scientific basis of this closure), will go disproportionately to the small handful of tilefish fishermen left, adding to the divisiveness that increasingly afflicts fishing communities under stress.

<u>Alternative 5D Lydonia and Oceanographer Canyons</u> No interviews were conducted that would characterize the reaction the fishing communities to the closures proposed under Alternative 5D. As stated above, it is not anticipated that any meaningful impacts would result from closure of these areas since vessel logbook data indicate minimal fishing activity in the areas delineated by the two canyons.

7.5.6 *Loligo* minimum mesh size requirements

- Alternative 6A: No Action (Maintain 1 $^{7/8}$ inch minimum codend mesh requirement)
- Alternative 6B: Increase minimum codend mesh size to $2^{1/8}$ inches
- Alternative 6C: Increase minimum codend mesh size to $2^{1/2}$ inches
- Alternative 6D: Increase minimum codend mesh size to 3 inches

Two major factors must be considered in determining the socio-economic impacts of the action alternatives (6B – 6D). The first of these is the cost for individual vessel owners of replacing codend webbing in order to comply with a revised minimum mesh. The second is the loss in gross revenue that may result from the need to increase harvest effort due to loss of *Loligo* through the larger mesh codends.

While the cost of replacing an entire trawl may be substantial, vessel owners routinely replace the codend mesh, and as such, the individual revenue loss associated with an increase in the minimum mesh requirement may not be significant. According to industry representatives, the range in cost of replacing a codend should be between $200.00 and $700.00 depending on the size of the trawl.

As to the loss in revenue caused by escapement of *Loligo* through the larger codend mesh, selectivity studies for *Loligo* are necessary for an accurate quantifiable answer. Unfortunately no such studies have been conducted. As noted in Appendix 3a, the majority of *Loligo* landings (87%) are reported to come from trawls using codend mesh sizes ≥ 2 inches (~50 mm), with 53 % of landings come from codend mesh sizes ≥ 2 $^{1/8}$ inches (Alternative 6B), 24% from codend mesh sizes ≥ 2 $^{1/2}$ inches (Alternative 6C), and 17 % from codend mesh sizes ≥ 3 inches (Alternative 6D). Because *Loligo* can be captured in these larger mesh sizes, it is likely that fishing would still be possible if either of the action alternatives is implemented. Industry representatives, however, have indicated repeatedly that the loss of *Loligo* would be substantial under either action alternative. Because no quantitative information exists that could be used to estimate the potential losses in revenue, the impacts from these actions are unknown. It is likely, however, that revenue loss will occur under Alternatives 6B, 6C, and 6D with the loss being greatest under Alternative 6D.

The no-action alternative (6A) is associated with a no impact on *Loligo* harvesters, processors and consumers. However, because maintaining the current codend mesh size would do nothing to reduce bycatch and discarding of the overfished butterfish stock and so there would be no benefit to the butterfish stock. Since there is only a very small commercial market for butterfish, the benefits that would accrue from butterfish stock enhancement would be non-market benefits. Types of non-market benefits could include the value of butterfish as forage for other species, biodiversity value, option value, and existence value, etc. There are no studies available that estimate these non-market values for butterfish. And so, it is difficult to make direct comparisons of costs and benefits among these alternatives. Therefore, in order to evaluate these alternatives, a qualitative comparison of the biological benefits to the butterfish stock as described in Section 7.1.6 must be made with the potential loss of *Loligo* under each mesh size increase as describe above and in Section 7.1.6

7.5.7 Exemptions from *Loligo* minimum mesh requirements for *Illex* vessels

- **Alternative 7A: No Action (*Illex* vessels are exempt from *Loligo* minimum mesh requirements in the months of June through September - Preferred Alternative)**
- Alternative 7B: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding month of September from current mesh exemption for *Illex* fishery
- Alternative 7C: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding months of August and September from current mesh exemption for *Illex* fishery
- Alternative 7D: Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels

As with Alternatives 6B – 6D above, the socio-economic impacts of action alternatives 7B through 7D are linked to the cost for individual vessel owners of replacing codend webbing in order to comply with revisions to the minimum mesh exemption, and any loss in revenue if escapement of *Illex* increases. As described in Section 7.1.7, the alternative that is most likely to achieve the goal of the alternatives (reducing finfish bycatch) without a corresponding increase in fishery effort is Alternative 7B. Alternatives 7C and 7D are associated with a greater probability of extra harvest effort, while Alternative 7A is not expected to increase harvest costs relative to baseline conditions. A 13% loss of *Illex* was observed in June by Amaratunga et al. (1979) when codend meshes of 60 mm (~ 2.4 inches) were used. As such, if Alternative 7D is adopted in combination with either Alternative 6B, 6C or 6D, an approximate maximum increase in harvest effort of 13% may be necessary to achieve *Illex* trip targets in June. This outcome would be associated with increased harvest costs during that part of the year. The potential impacts of Alternative 7C on fishery effort are more difficult to quantify for reasons given in Section 7.1.7, however they are expected to be more likely to generate negative socio-economic impacts that Alternatives 7A or 7B.

7.5.8 *Loligo* possession limit for the directed *Illex* fishery during closure of the directed *Loligo* fishery

- Alternative 8A: No Action (For *Illex* moratorium permitted vessels, the *Loligo* possession limit during closures of the directed *Loligo* fishery is consistent with the incidental catch allowance for all vessels – currently 2,500 pounds)
- Alternative 8B: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of retained squid catch onboard, with a maximum limit of up to 30,000 pounds of *Loligo*
- Alternative 8C: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 5% of the total weight of retained catch of squid onboard, with a maximum limit of up to 20,000 pounds of *Loligo*
- Alternative 8D: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of retained catch of squid onboard, with a maximum limit of up to 10,000 pounds of *Loligo*

The current trip limit during *Loligo* closure periods is 2,500 pounds. Potential trip-level revenue gains from any of the action alternatives (8B-8D) was calculated as the product of the additional possession allowance (in pounds) and the likely *Loligo* prices ($/lb) when the trip was made. Since the alternatives apply only to vessels participating in the directed *Illex* fishery (i.e., *Illex* moratorium-permitted vessels in possession of *Illex*), the price for *Loligo* is likely to be reflective of historic closure period prices.

According to the Dealer database, there were 1,205 trips made by 56 distinct *Illex* moratorium permitted vessels during *Loligo* closure periods in 2000-2004 that resulted in *Illex, Loligo,* or both squid species being caught. *Illex*, but no *Loligo* were retained on 23 trips (10 vessels) and a mix of *Illex* and *Loligo* were retained on 89 trips (18 vessels). The majority of the trips resulted in landings of *Loligo*, but no *Illex* (N = 1,093; 50 vessels).

Table 85 gives estimates of total revenue gains for the *Illex* fishery, from *Loligo* landings, by year if the various alternatives had been in effect during historic *Loligo* fishery closures. These estimates were generated using *Loligo* prices during the corresponding closure periods for the 112 closure-period trips in which *Illex* or mixed *Illex* and *Loligo* were retained, and represent a comparison to the no action alternative. The maximum trip-level gains, based the realized *Loligo* landings increased to the maximum landings that would have been allowed by these Alternatives had they been in effect (based on the greater of 2,500 lbs of *Loligo* or an amount not to exceed

10% of the total weight of retained catch of squid onboard) during *Loligo* fishery closures, were approximately $33,000, $21,000, and $10,000 for Alternatives 8B, 8C, and 8D, respectively.

Table 85. Estimates of gross revenue gains ($) by the *Illex* fishery moratorium vessels from *Loligo* landings, for each of the action alternatives, had they been in effect during historic *Loligo* closures. There were no closure landings (ncl) of *Loligo* by *Illex* vessels in 2003 and 2004.

Year	Alt 8B	Alt 8C	Alt 8D
2000	469,718	249,063	228,058
2001	46,387	27,924	24,454
2002	149,579	58,827	34,440
2003	ncl	ncl	ncl
2004	ncl	ncl	ncl

Because of the potential for a large increase in trip level and total revenue, increases in the number of trips in which *Loligo* are retained during closures would be expected under the any of the action alternatives. The alternative with the largest incentive for increasing *Loligo* retention is Alternative 8B. Any of these alternatives would increase revenues for vessel owners and crew associated with *Illex* moratorium-permitted vessels with Alternative 8B providing the greatest benefit. Increased harvest of *Loligo* during closure periods is likely to hasten the harvest of the overall quota. This would result in revenue losses for *Loligo* vessel owners and crew that do not possess an *Illex* permit, especially those that fish later in the year.

7.5.9 Electronic daily reporting requirement for the directed *Illex* fishery

- Alternative 9A: No Action (No requirement for electronic daily reporting in the directed *Illex* fishery)
- Alternative 9B: Require electronic daily reporting in the directed *Illex* fishery

The action alternative (9B) will result in the need for owners of *Illex* moratorium-permitted vessels to utilize vessel monitoring system (VMS) equipment. Any VMS unit selected for use must be approved by the Regional Administrator. Currently, there are two different VMS units approved by NMFS for VMS operations, Skymate and Boatracs. The costs associated with VMS would come from the initial purchase, as well as any activation fees and operating costs. Cost analysis for the two approved VMS providers was reported by the NEFMC in Framework Adjustment 17 to the Scallop FMP (NEFMC 2005; http://www.nefmc.org/scallops/index.html). This information is given in Table 86. The average gross revenues for active *Illex* moratorium-permitted vessels from 2002-2004 was approximately $1.4 million. The size of the vessel and/or amount of vessel revenue may influence the magnitude of costs associated with a VMS requirement.

Table 86. Costs reported by NEFMC (2005) for Boatracs and Skymate VMS operations.

Costs	Standard Boatracs VMS Unit	Skymate plus PC
Initial Investment (one-time costs)		
Equipment	$3,295.00	$2,268.00
Installation	$180.00	$500.00
Activation fee	$0.00	$149.00
Total one-time costs	$3,475.00	$2,917.00
Ongoing costs		
Monthly service costs	$105.00	$53.95
Annual service costs	$1,260.00	$647.40

7.5.10 Implementation of seasonal gear restricted areas (GRAs) to reduce butterfish discards

- **Alternative 10A: No Action (No butterfish GRAs - Preferred Alternative)**
- Alternative 10B: Minimum of 3 inch codend mesh size in Butterfish GRA1
- Alternative 10C: Minimum of 3 inch codend mesh size in Butterfish GRA2
- Alternative 10D: Minimum of 3 ¾ inch codend mesh size in Butterfish GRA1
- Alternative 10E: Minimum of 3 ¾ inch codend mesh size in Butterfish GRA2

Description of Impacted Vessels and Ports by Alternative

Logbook (VTR database), permit and dealer data (Weighout database), for 2001-2004, are used to describe vessels that fished in the gear restricted areas using bottom otter trawl gear with less than 3.0 or 3.75 inch mesh for at least one trip during the period January through April. Landing, value and effort from other gear types are not reported. This time period was chosen to provide information on the characteristics of recently active vessels since, over time, vessels move in and out of fisheries (and fishing) in response to changing regulations and business conditions. While subsequent port and GRA level analyses use longer time periods (1996 to 2004) to capture yearly variation in squid fisheries, using the pre 2001 years in the vessel level analyses would over-state the impacts.

Table 87 describes the vessels that would be impacted under each alternative. These alternatives would impact 105 (Alt. 10B) to 154 (Alt.10E) vessels. The average value per trip from fishing under the conditions described by these alternatives range from $11,413 under Alternative 10E to

$14,255 under Alternative 10B. The average number of affected trips per vessel ranges from 3.0 under Alternative 10B to 5.3 under Alternatives 10E. The average trip length was from 3.2 days (Alts 10C and 10E) to 3.7 days (Alts 10B and 10D).

As will be discussed below, the actual impact to these vessels will be based on the degree to which these vessels can: 1) make up catch in other areas or seasons, and the cost of altering their fishing patterns, or 2) maintain previous revenue (less costs) by changing the mesh size and fishing in the GRAs.

Tables 89 and 90 provide the value of the landings, by port landed, from the trips identified by each alternative. Here, data from 1996 through 2004 are used. Point Judith, RI is the port with the greatest potential impacts with a range of landed value from $709,709 under Alternative 10B to $3,115,854 under Alternative 10E. Shinnecock, NY is the next most significantly impacted port with a range of landed value from $455,854 (Alt 10B) to $577,545 (Alt 10E).

Landings and Value by Major Species Component

Description of Species Landed from the Region Including and Surrounding the GRAs

To help evaluate the impact of the butterfish GRA alternatives on lost fishing opportunities, a region that surrounds and includes the three GRAs was defined to provide context for the quantity and value of landed species. The region is defined by statistical areas 533, 534, 537, 539, 613, 615, 616, 621, 622, 623, and 624.

In order to focus on the important species affected by the restricted areas, data on the value of catch in the region from January through April (1996 through 2004) using otter trawl gear with mesh less than 3.0 inches and with mesh less than 3.75 inches was queried. Seven species make up approximately 86% to 87% of the landed value. These are *Loligo* squid, whiting, butterfish, fluke, mackerel, herring, and scup. Percentage composition is provided in Table 88.

Potential Reduction in Landings by Alternative

The landings attributed to each alternative represent the maximum potential reduction of the proposed regulations. These are upper-bound estimates because vessels will be able to make up a proportion of lost catch by fishing more intensively outside the GRA (seasonally or geographically) or fishing with the minimum mesh size inside the GRA.

Since *Loligo*, whiting, butterfish, mackerel, scup, herring and fluke are the most important species (by value) caught in the region during January through April, the pounds and value of landings (actual and percentage) attributable to each Alternative is reported in Tables 91 through 94. Tables 91, 92 describe the alternatives that require 3 inch minimum mesh size and Tables 93, 94 describe those with 3.75 inch minimum mesh size. Table 91 and 93 report averages from 1996 through 2004. However, since the Scup Southern GRA that existed from 2001 through 2004 changed fishing patterns in the region, Tables 92 and 94 report landings and value for that time period. Providing 2001 through 2004 information also reflects more recent market conditions. So the effect of the Scup Southern GRA can be evaluated, Tables 92 and 94 also provide separate regional landings for January through March 15 (the effective dates for the Scup Southern GRA) and through April.

Based on total value (all species landed on the affected trip), the rank of alternatives from most significant to least significant is: Alternative 10E, Alternative 10C, Alternative 10D, then Alternative 10B.

Potential Benefits of Alternatives

The primary benefit of these alternatives is the benefit to the butterfish stock for which these measures are intended to protect through reductions in discards. It is difficult to place an economic value on the butterfish saved from these measures since there is a limited market for the species and the majority of the catch is discarded. There are likely to be ecosystem/diversity benefits to the reduction of discards which are, again, difficult to estimate. To the extent that landings of other species are reduced, there will be benefits to those stocks as well which may ultimately result in benefits to fishing vessels.

The alternative that would provide the greatest biological benefit to butterfish is Alternative 10E which restricts catch in the largest area and requires the larger minimum mesh size. The alternative with the least biological benefit is Alternative 10B with a smaller area and minimum mesh size.

Potential Costs of Alternatives

Effect of Changes in Fishing Strategies on the Potential Costs of Alternatives

Strategy A: Fishing More Intensively Outside the GRAs

One strategy that fishing vessel captains could adopt if these measures are implemented is to maintain their current mesh size and fish more intensively outside the GRAs.

There are two primary ways in which this approach may impact vessels. The first is increased vessel operating costs (primarily increased fuel costs), related to longer steam times if a vessel's optimal fishing location is in a GRA and the vessel must choose a second best location that is beyond a GRA. The second is the cost of decreased net revenues (revenues less the cost of items that vary directly with the quantity of fish caught such as off-loading, refrigeration, and packaging costs) from choosing a second best fishing location. These two impacts are related in that the choice of fishing location depends on the cost of reaching a location and the expected abundance and quality of fish at that location. These choice factors, and others including business relationships with buyers (choice of market); the vessel's homeport; and the status of the quota, determine the selection of fishing locations.

If these GRAs are implemented and the best fishing location happens to be in one of the closed areas, then the captain is faced with balancing the additional costs of choosing a more distant location with the expected catch from the alternative area. It may be that due to the seasonal variation of the stock of interest at a particular time, the only choice is to transit a GRA in order to find fish. Given that the second best choice involves increased operating costs, the total impacts would include the increased vessel operating costs and the decreased net revenue.

Circumstances may dictate that the second best fishing location choice may be a location which is closer to port and results in a cost savings. The net impact in this situation is the loss of net revenue as offset by the decreased steaming costs. Presumably, the loss of net revenue is greater than the cost savings in this case or the fishing captain would have chosen the alternative location in the first place.

The discussion above assumes that a single fishing location is chosen. In many cases, the trip may include several different fishing locations. Each location choice then depends on the success of the previous choice and the interplay of the decision points described for the single location would occur as the trip unfolds.

With the provision that gear must be stowed while transiting a closed area, additional vessel operating costs may be incurred if a vessel captain decides to go around a GRA rather than stow the gear.

While there are areas surrounding the proposed butterfish GRAs in which small mesh fishing has occurred, fishing in the Scup Southern GRA will not be allowed from January through March 15. The Scup Southern GRA was in effect in 2001 through 2004 so the landings data reported here account for that closure (note that the closure area shifts slightly in 2005).

Strategy B: Regain forgone revenue by fishing with small mesh in the GRAs from May to December

Since the GRA alternatives are seasonal, fishing vessel operators could attempt to make up for lost revenue by fishing with small mesh from May through December. To give an indication of the seasonal breakdown of the major small mesh in the region, Table 95 (1996 – 2004) and Table 96 (2001 – 2004) reports the landings by season. While about 24.2% to 28.7% of the number of trips are during January through April, the landings and value of *Loligo* (the primary species impacted by these alternatives) and whiting are evenly split between the Jan through Apr season and the May through December season. Butterfish, fluke and scup are not as evenly distributed between seasons and mackerel and herring fishing occurs primarily in the January through April period. Total landings and value are evenly split between time periods.

The fact that a significant portion of the landings are available to small mesh otter trawl vessels in the season not affected by these measures indicates that vessels may be able to supplement their loss in revenue from the GRAs. This is not true for vessels focusing on mackerel and herring.

There are costs associated with this strategy. For instance, there could be market factors and seasonal price variations that could affect revenues. Particularly, a large shift of landings from the January through April season could depress prices in the May through December season

Unlike Strategy A, there should not be any additional steaming costs since vessels can fish in the GRAs in the open season. However, depending on seasonal stock migration and abundance, vessels may have longer steam times over the course of the year than they would have without the measures.

A difficulty with adopting this strategy is that the *Loligo* quota is divided quarterly and the fluke quota is taken rapidly so waiting to fish later in the year may mean there is not enough quota left to be caught.

<u>Strategy C: Increasing Mesh Size to the Minimum and Continuing to Fish Inside the GRA</u>

Another strategy vessel owners could consider if one of these measures is selected is increasing the mesh size to meet the minimum and continue to fish inside the GRA. This strategy would involve incurring the cost of: 1) buying new gear if vessels don't already have nets with the appropriate mesh size, or 2) re-rigging the vessel with different nets.

The significant potential cost of this strategy is the reduction in catch and change in species composition from using larger mesh. There are no gear selectivity studies available to estimate the change in *Loligo*, whiting, butterfish, mackerel, scup, herring, and fluke catch at incremental changes in mesh size.

<u>Combination of Strategies</u>

Implementing one of the proposed measures is likely to result in vessel operators using a combination of the three strategies described above to offset revenue losses. Based on small mesh fishing patterns both outside the GRAs and during May through December, it is apparent that there is enough activity occurring outside the bounds of these alternatives for fishing vessels to continue fishing in a similar manner.

Conclusion

Based simply on actual revenue figures reported in Tables 91 through 94 there is the potential for losses up to $7.5 million (see Table 93, Alternative 10E – this represents 43.2% of the total value from fishing in the region during January through April using a minimum mesh size of 3.75"). However, given the availability for fishing vessels to employ a number of strategies, these losses will most likely not be fully realized. This is evidenced by the percentage figures which show that a large portion of the relevant landings occur outside the bounds (time and space) of the proposed butterfish GRAs – with the noted exceptions.

One thing to note regarding the whiting and mackerel fisheries is that a large percentage of the landings are with mesh between 3.0 inches and 3.75 than with mesh less than 3.0 inches. Therefore, the impact of choosing a 3.75 inch minimum mesh will have a much more significant impact than a 3.0 inch minimum.

Table 87. Average Vessel Characteristics, Landings, Value, and Effort of Vessels Impacted by Alternative - Otter Trawl Gear During January through April (2001-2004)

	Alternative 10B	Alternative 10C	Alternative 10D	Alternative 10E
Total Number of Vessels	105	123	133	154
Average Length	74	73	74	73
Average Gross Tons	122	119	126	122
Average Horsepower	616	603	634	619
Average Year Built	1978	1978	1963	1966
Average Number of Trips per Vessel	3.0	4.1	3.3	5.3
Average Crew Size per Trip	3.6	3.5	3.6	3.5
Average Total Lbs Landed per Trip	33,939	29,122	34,265	28,584
Average Total Value Landed per Trip	14,255	12,067	13,581	11,413
Average Number of Days-at-Sea per Trip	3.7	3.2	3.7	3.2

Table 88. Species Composition of Regional Landed Value – January through April (1996 – 2004)

	Less than 3.75 inch mesh	Less than 3 inch mesh
Loligo Value	31.4%	36.5%
Whiting Value	16.0%	14.1%
Butterfish Value	4.5%	5.4%
Fluke Value	10.1%	9.1%
Mackerel Value	15.3%	10.8%
Herring Value	6.0%	8.1%
Scup Value	2.9%	3.2%

Table 89. Average Landings by Port (1996 – 2004) for Alternatives using 3" Minimum Mesh Size

	Alternative 10B			Alternative 10C		
Port Landed	Landings (lbs)	Value ($)	Number of Trips	Landings (lbs)	Value ($)	Number of Trips
POINT JUDITH	1,321,504	709,709	48	3,278,436	1,834,180	174
SHINNECOCK	771,270	455,854	67	851,985	499,693	73
MONTAUK	415,843	262,166	17	584,841	366,345	28
GREENPORT	508,949	252,995	22	724,213	375,718	30
POINT PLEASANT	389,689	232,454	48	391,571	233,790	48
NORTH KINGSTOWN	1,052,594	224,435	4	2,025,641	464,356	7
NEW LONDON	343,171	179,134	11	769,606	396,686	22
HAMPTON BAY	312,218	163,364	11	425,116	225,228	16
CAPE MAY	312,744	142,530	8	312,744	142,530	8
POINT LOOKOUT	188,157	112,809	14	188,157	112,809	14
NEWPORT	169,683	109,860	9	361,631	249,644	28

Table 90. Average Landings by Port (1996 – 2004) for Alternatives using 3.75" Minimum Mesh Size

	Alternative 10D			Alternative 10E		
Port Landed	Landings (lbs)	Value ($)	Number of Trips	Landings (lbs)	Value ($)	Number of Trips
POINT JUDITH	1,995,696	1,118,926	77	5,281,581	3,115,854	327
SHINNECOCK	895,424	528,710	78	983,546	577,545	83
MONTAUK	717,895	445,267	30	1,416,615	858,800	59
POINT PLEASANT	448,180	273,148	54	450,062	274,484	54
GREENPORT	515,941	257,524	22	796,667	409,815	31
NORTH KINGSTOWN	1,133,098	230,946	4	2,098,332	471,469	7
CAPE MAY	618,429	197,173	10	618,429	197,173	10
NEWPORT	310,508	191,344	14	632,595	423,057	44
HAMPTON BAY	322,816	173,628	11	402,406	216,791	15
NEW LONDON	261,113	138,707	8	665,957	349,506	19
POINT LOOKOUT	209,218	124,910	16	209,218	124,910	16
NEWPORT	310,508	191,344	14	632,595	423,057	44

Table 91. Pounds and Value of Landings (1996 – 2004) for Alternatives using 3" Minimum Mesh Size

	Regional Landings	Alternative 10B		Alternative 10C	
	Jan thru Apr (<3" mesh)	Lbs/value/#	% of Regional Landings	Lbs/value/#	% of Regional Landings
Total Landings	41,626,376	5,573,624	13.4%	9,865,309	23.7%
Total Value	12,006,852	2,794,547	23.3%	4,970,204	41.4%
Number of Trips	1,155	265	22.9%	480	41.6%
Loligo Landings	7,529,061	2,048,028	27.2%	3,147,199	41.8%
Whiting Landings	3,396,643	1,252,081	36.9%	2,136,262	62.9%
Butterfish Landings	1,321,973	191,625	14.5%	803,608	60.8%
Fluke Landings	537,038	122,193	22.8%	298,465	55.6%
Mackerel Landings	9,317,620	1,072,192	11.5%	1,804,775	19.4%
Herring Landings	16,410,279	210,291	1.3%	465,705	2.8%
Scup Landings	417,916	127,033	30.4%	139,908	33.5%
Loligo Value	4,376,839	1,188,617	27.2%	1,851,465	42.3%
Whiting Value	1,690,081	607,287	35.9%	1,051,150	62.2%
Butterfish Value	649,120	102,377	15.8%	370,879	57.1%
Fluke Value	1,089,203	246,718	22.7%	597,666	54.9%
Mackerel Value	1,290,737	141,009	10.9%	244,326	18.9%
Herring Value	969,008	13,718	1.4%	29,501	3.0%
Scup Value	382,751	114,562	29.9%	130,633	34.1%

Table 92. Pounds and Value of Landings (2001 – 2004) for Alternatives using 3" Minimum Mesh Size

	Regional Landings		Alternative 10B		Alternative 10C	
	Jan thru Apr (<3" mesh)	Jan thru Mar 15 (<3" mesh)	Lbs/value/#	% of Regional Landings	Lbs/value/#	% of Regional Landings
Total Landings	25,435,525	18,711,009	4,073,087	16.0%	6,922,786	27.2%
Total Value	7,288,746	5,375,310	1,947,402	26.7%	3,427,172	47.0%
Number of Trips	679	473	182	26.8%	340	50.1%
Loligo Landings	5,702,359	4,299,475	1,957,278	34.3%	2,915,071	51.1%
Whiting Landings	709,596	448,472	277,576	39.1%	498,665	70.3%
Butterfish Landings	1,444,120	1,309,951	99,944	6.9%	1,064,568	73.7%
Fluke Landings	434,087	346,006	110,024	25.3%	281,391	64.8%
Mackerel Landings	8,378,837	5,251,370	1,108,078	13.2%	1,294,259	15.4%
Herring Landings	7,695,276	6,289,673	213,719	2.8%	400,020	5.2%
Scup Landings	366,846	278,338	136,032	37.1%	139,875	38.1%
Loligo Value	3,476,099	2,634,848	1,221,606	35.1%	1,819,763	52.4%
Whiting Value	394,340	245,527	155,445	39.4%	283,131	71.8%
Butterfish Value	576,399	520,621	44,307	7.7%	404,318	70.1%
Fluke Value	711,220	538,669	187,390	26.3%	464,712	65.3%
Mackerel Value	836,748	494,980	123,685	14.8%	146,030	17.5%
Herring Value	639,541	483,374	17,111	2.7%	31,730	5.0%
Scup Value	186,439	140,852	70,514	37.8%	73,545	39.4%

Table 93. Pounds and Value of Landings (1996 – 2004) for Alternatives using 3.75" Minimum Mesh Size

	Regional Landings	Alternative 10D		Alternative 10E	
	Jan thru Apr (<3.75" mesh)	Lbs/value/#	% of Regional Landings	Lbs/value/#	% of Regional Landings
Total Landings	57,756,316	7,423,463	12.9%	14,045,651	24.3%
Total Value	17,248,499	3,776,025	21.9%	7,449,301	43.2%
Number of Trips	1,616	341	21.1%	737	45.6%
Loligo Landings	9,286,674	2,600,274	28.0%	4,310,342	46.4%
Whiting Landings	5,428,870	1,785,533	32.9%	3,605,661	66.4%
Butterfish Landings	1,566,651	249,976	16.0%	981,262	62.6%
Fluke Landings	861,738	176,982	20.5%	525,113	60.9%
Mackerel Landings	18,898,701	1,404,101	7.4%	2,246,442	11.9%
Herring Landings	17,387,507	251,618	1.4%	516,928	3.0%
Scup Landings	552,785	160,205	29.0%	185,649	33.6%
Loligo Value	5,410,424	1,510,865	27.9%	2,539,204	46.9%
Whiting Value	2,768,372	888,986	32.1%	1,825,107	65.9%
Butterfish Value	782,848	136,650	17.5%	469,025	59.9%
Fluke Value	1,735,465	356,793	20.6%	1,049,625	60.5%
Mackerel Value	2,643,029	194,439	7.4%	313,040	11.8%
Herring Value	1,029,040	16,777	1.6%	33,296	3.2%
Scup Value	499,993	135,772	27.2%	164,595	32.9%

Table 94. Pounds and Value of Landings (2001 – 2004) for Alternatives using 3.75" Minimum Mesh Size

	Regional Landings		Alternative 10D		Alternative 10E	
	Jan thru Apr (<3.75" mesh)	Jan thru Mar 15 (<3.75" mesh)	Lbs/value/#	% of Regional Landings	Lbs/value/#	% of Regional Landings
Total Landings	48,796,364	34,545,159	6,776,260	13.9%	12,530,019	25.7%
Total Value	13,965,445	9,572,140	3,364,847	24.1%	6,657,793	47.7%
Number of Trips	1,171	775	284	24.2%	629	53.7%
Loligo Landings	8,123,977	5,842,215	2,822,897	34.7%	4,603,964	56.7%
Whiting Landings	3,937,920	2,547,746	1,277,574	32.4%	2,903,719	73.7%
Butterfish Landings	1,652,660	1,409,388	146,542	8.9%	1,215,812	73.6%
Fluke Landings	785,786	599,537	180,851	23.0%	527,677	67.2%
Mackerel Landings	22,896,787	15,397,508	1,474,736	6.4%	1,678,460	7.3%
Herring Landings	9,279,942	7,342,577	301,444	3.2%	507,261	5.5%
Scup Landings	462,534	333,023	171,839	37.2%	188,278	40.7%
Loligo Value	4,948,611	3,576,702	1,748,411	35.3%	2,852,762	57.6%
Whiting Value	2,164,111	1,384,596	695,612	32.1%	1,592,434	73.6%
Butterfish Value	673,453	569,822	66,102	9.8%	474,757	70.5%
Fluke Value	1,326,232	953,121	319,248	24.1%	895,082	67.5%
Mackerel Value	2,601,897	1,650,460	180,737	6.9%	205,715	7.9%
Herring Value	741,002	543,301	23,718	3.2%	39,840	5.4%
Scup Value	238,424	168,927	86,809	36.4%	97,309	40.8%

Table 95. Pounds and Value of Landings by Season (1996 – 2004)

	Regional Landings									
	All Year		January Through April				May Through December			
	Less than 3" mesh	Less than 3.75" mesh	Less than 3" mesh	%	Less than 3.75" mesh	%	Less than 3" mesh	%	Less than 3.75" mesh	%
Total Landings	80,752,980	103,591,183	41,626,376	51.5%	57,756,316	55.8%	39,126,604	48.5%	45,834,867	44.2%
Total Value	24,590,690	33,418,661	12,006,852	48.8%	17,248,499	51.6%	12,583,838	51.2%	16,170,162	48.4%
Number of Trips	3,968	5,321	1,155	29.1%	1,616	30.4%	2,813	70.9%	3,705	69.6%
Loligo Landings	16,846,236	20,177,806	7,529,061	44.7%	9,286,674	46.0%	9,317,175	55.3%	10,891,132	54.0%
Whiting Landings	6,285,090	10,803,838	3,396,643	54.0%	5,428,870	50.2%	2,888,447	46.0%	5,374,968	49.8%
Butterfish Landings	1,805,597	2,330,349	1,321,973	73.2%	1,566,651	67.2%	483,624	26.8%	763,698	32.8%
Fluke Landings	667,830	1,053,058	537,038	80.4%	861,738	81.8%	130,792	19.6%	191,320	18.2%
Mackerel Landings	9,883,084	19,704,198	9,317,620	94.3%	18,898,701	95.9%	565,464	5.7%	805,497	4.1%
Herring Landings	21,989,053	22,975,452	16,410,279	74.6%	17,387,507	75.7%	5,578,773	25.4%	5,587,944	24.3%
Scup Landings	622,939	835,742	417,916	67.1%	552,785	66.1%	205,023	32.9%	282,957	33.9%
Loligo Value	10,103,326	12,091,320	4,376,839	43.3%	5,410,424	44.7%	5,726,487	56.7%	6,680,896	55.3%
Whiting Value	2,924,008	5,068,102	1,690,081	57.8%	2,768,372	54.6%	1,233,928	42.2%	2,299,730	45.4%
Butterfish Value	896,827	1,167,909	649,120	72.4%	782,848	67.0%	247,707	27.6%	385,061	33.0%
Fluke Value	1,344,242	2,103,816	1,089,203	81.0%	1,735,465	82.5%	255,039	19.0%	368,351	17.5%
Mackerel Value	1,426,830	2,834,003	1,290,737	90.5%	2,643,029	93.3%	136,093	9.5%	190,973	6.7%
Herring Value	1,338,287	1,398,887	969,008	72.4%	1,029,040	73.6%	369,280	27.6%	369,847	26.4%
Scup Value	634,600	851,466	382,751	60.3%	499,993	58.7%	251,850	39.7%	351,472	41.3%

Table 96. Pounds and Value of Landings by Season (2001 – 2004).

	Regional Landings									
	All Year		January Through April				May Through December			
	Less than 3" mesh	Less than 3.75" mesh	Less than 3" mesh	%	Less than 3.75" mesh	%	Less than 3" mesh	%	Less than 3.75" mesh	%
Total Landings	53,169,317	83,208,637	25,435,525	47.8%	48,796,364	58.6%	27,733,793	52.2%	34,412,273	41.4%
Total Value	16,240,682	26,957,694	7,288,746	44.9%	13,965,445	51.8%	8,951,936	55.1%	12,992,249	48.2%
Number of Trips	2,812	4,082	679	24.2%	1,171	28.7%	2,133	75.8%	2,911	71.3%
Loligo Landings	14,299,213	18,837,702	5,702,359	39.9%	8,123,977	43.1%	8,596,854	60.1%	10,713,725	56.9%
Whiting Landings	1,244,244	6,911,630	709,596	57.0%	3,937,920	57.0%	534,648	43.0%	2,973,710	43.0%
Butterfish Landings	1,640,163	2,013,218	1,444,120	88.0%	1,652,660	82.1%	196,043	12.0%	360,558	17.9%
Fluke Landings	589,262	1,020,392	434,087	73.7%	785,786	77.0%	155,175	26.3%	234,606	23.0%
Mackerel Landings	8,869,927	23,657,847	8,378,837	94.5%	22,896,787	96.8%	491,090	5.5%	761,060	3.2%
Herring Landings	9,086,495	10,676,174	7,695,276	84.7%	9,279,942	86.9%	1,391,219	15.3%	1,396,232	13.1%
Scup Landings	486,071	623,671	366,846	75.5%	462,534	74.2%	119,226	24.5%	161,138	25.8%
Loligo Value	8,467,625	11,201,622	3,476,099	41.1%	4,948,611	44.2%	4,991,525	58.9%	6,253,011	55.8%
Whiting Value	656,187	3,577,454	394,340	60.1%	2,164,111	60.5%	261,847	39.9%	1,413,343	39.5%
Butterfish Value	664,939	837,003	576,399	86.7%	673,453	80.5%	88,540	13.3%	163,550	19.5%
Fluke Value	1,000,576	1,757,778	711,220	71.1%	1,326,232	75.4%	289,356	28.9%	431,546	24.6%
Mackerel Value	959,538	2,788,261	836,748	87.2%	2,601,897	93.3%	122,790	12.8%	186,364	6.7%
Herring Value	752,649	854,498	639,541	85.0%	741,002	86.7%	113,108	15.0%	113,496	13.3%
Scup Value	252,060	328,369	186,439	74.0%	238,424	72.6%	65,621	26.0%	89,946	27.4%

7.6 Practicability Analysis of Alternatives to Reduce Gear impacts on EFH

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 mean "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 difficult to evaluate. The benefits of specific actions to protect or restore habitat are not easily quantifiable in the same units as the costs (dollars). Therefore, it is very difficult to conduct a quantitative cost/benefit analyses in order to determine the practicability of the various options considered in this FMP to reduce gear impacts on EFH. This is due, in part, 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.

7.6.1 Description of Alternatives to Reduce Impacts on EFH

A full description of the management alternatives to reduce gear impacts on EFH can be found in section 5.5. Each area closure alternative is briefly identified below:

- Alternative 5A: No Action (No new areas closed to directed fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls)
- Alternative 5B: Prohibit directed fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in the area surrounding the head of the Hudson Canyon
- Alternative 5C: Prohibit directed fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in tilefish HAPC
- **Alternative 5D: Prohibit directed fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in Lydonia and Oceanographer Canyons (Preferred Alternative)**

7.6.2 Summary of Impacts of Area Closure Alternatives

A summary of the impacts expected from the management measures to reduce gear impacts on EFH can also be found in Table 70.

Impacts on the Managed Resource

As described in section 7.1.5, the area closures are expected to result in localized reductions in harvest of the managed resources, with a shift in fishing effort to open areas adjacent to the area closure boundaries. The closure of (particularly large) areas (5B, 5C) is expected to contribute to an overall reduction in fishing mortality for each of the managed resources.

Impacts on Non-target Species

As described in section 7.2.5, alternatives 5B through 5D are expected to directly and indirectly impact non-target species because any given alternative or combination of alternatives would result in some degree of spatial re-distribution of bottom otter trawl fishing effort. In general, for areas where bottom otter trawling effort decreases the capture of non-target species is expected to decrease, and for open areas where bottom otter trawl effort may increase, the opposite outcome is expected.

The list of species that should benefit from closure of the various EFH areas is discussed in Section 6.3.5, and is repeated in Table 76.

Alternative 5B Head of Hudson Canyon In the head of Hudson Canyon area, the amount of EFH for a given species' life stage exceeds 5% for juvenile Atlantic scallops, juvenile rosette skate, and juvenile silver hake, but is 5% or less for all other species.

Alternative 5C Tilefish HAPC The closure of tilefish HAPC would be expected to generate substantial protection of tilefish EFH, both for juvenile and adult life stages (see Section 7.3.5). Other species' life stages that have greater than 10% EFH within tilefish HAPC include juvenile and adult rosette skates, juvenile silver hake, and adult summer flounder.

Alternative 5D Lydonia and Oceanographer Canyons Lydonia and Oceanographer Canyons comprise approximately 3% of EFH for juvenile tilefish, but no more than 2% for any other species.

Impacts on Habitat

As described in section 7.3.5, the action alternatives (Alternatives 5B-D) propose to protect habitat, especially EFH, from damage caused by the use of bottom otter trawls in the Atlantic mackerel, squid, and butterfish fisheries, through indefinite closure of the certain areas in the EEZ to this gear type.

Relative to the no action alternative (5A), the area closures would all be expected to have direct impacts of varying magnitude on EFH, and ecosystem function. These impacts are expected to vary spatially such that there is an improvement in habitat quality within the closed areas, while increased bottom otter trawl effort could increase habitat disturbance outside of the closed areas. If, however, harvest effort shifts to already highly-trawled areas, this is likely to result in minimal offsetting impacts such that the decrease in overall habitat disturbances will be approximately equivalent to the decreases in the closed area. This scenario is considered likely, since the basis for the concentration of effort in these areas is that they are the locations of productive fishing grounds. It is unlikely that bottom trawl effort will shift to unproductive area.

Alternative 5B Head of Hudson Canyon The Head of Hudson Canyon area is subject to a high level of fishing effort by SMB bottom otter trawl fisheries (Table 71). As indicated in Section 6.3.5 this area contains some portion of the overall designated EFH for 17 federally managed species. However, none of the given species' lifestage had more than 6% of their designated EFH located within this closure area.

Overlap analysis (Section 6.3.5.1) identified the Head of Hudson Canyon as an area with potentially important SMB fishery/habitat interactions. Nevertheless, the limited degree of dependence on this area by any species' lifestage suggests that a permanent closure would impart minor direct and indirect benefits to federally managed species.

Alternative 5C Tilefish HAPC The tilefish HAPC area is also subject to a high level of fishing effort by SMB bottom otter trawl fisheries (Table 71). The area contains designated EFH for 22 federally managed species. Since a significant portion of EFH for tilefish is encompassed by this potential area closure, 68% of either juvenile or adult tilefish habitat, this closure area would generate substantial habitat protection for both life stages. Other species' life stages that have greater than 10% EFH within tilefish HAPC include juvenile and adult rosette skates, juvenile silver hake, and adult summer flounder

Tilefish are unique among the species with high proportions of EFH in this area in that they are "shelter-seeking and habitat limited". This part of their EFH was designated as HAPC for tilefish because it has high ecological function, is sensitive to human-induced environmental degradation, and can be considered a rare habitat. The benefits of this closure to other species with a relatively high proportion of EFH in this area are expected to be of a lower magnitude.

Alternative 5D Lydonia and Oceanographer Canyons Lydonia and Oceanographer canyons are subject to minimal fishing effort by SMB bottom otter trawl fisheries (Table 71). The area contains designated EFH for six federally managed species. For all of these species the proportion of total EFH for a given lifestage is 3% or less. Nevertheless, the canyons contain sensitive habitat types, such as deep sea alcyonarian and scleractinian corals and their associated benthic communities. Damage to these corals, which are restricted to hard substrate areas, is considered permanent. Closure of these canyons to bottom otter trawls would afford protection of these sensitive habitats, although observable improvement from baseline conditions would likely take many years.

Impacts on Protected Resources
As described in section 7.4.5, alternatives 5B through D are expected to indirectly impact protected resources because any given alternative or combination of alternatives would result in some degree of spatial re-distribution of bottom otter trawl fishing effort. Because each of the action alternatives would produce year round permanent closures, patterns in fishery effort would be expected to shift. It is expected that effort would increase in areas in which a relatively high degree of fishing effort already occurs. The change in P.R. encounters could be a reduction, an increase, or offsetting reductions and increases, depending on where displaced effort is concentrated.

<u>Alternative 5B Head of Hudson Canyon</u> The closure of the head of Hudson Canyon would reduce the area in which marine mammal encounters might occur by a small amount in all seasons except the summer (Jun – Aug). In the fall (Sept-Nov), a fraction of the area in which turtle encounters have been documented would be closed (Fig. 7.4.1-7.4.4). Neither of these outcomes is expected to be significant since the overlap with the encounter areas is small.

<u>Alternative 5C Tilefish HAPC</u> The closure of Tilefish HAPC would have the most profound effect on marine mammal encounters since this large region overlaps much of the area (~50%) where documented encounters have occurred, except in the summer. The change in effort is expected to result in an overall reduction if marine mammal encounters. No impacts on turtle encounters are expected, however (Fig. 7.4.1-7.4.4).

<u>Alternative 5D Lydonia and Oceanographer Canyons</u> The closure of Lydonia and Oceanographer Canyons could reduce encounters with marine mammals in the winter and spring, but because of the small size of these closure areas, the magnitude of the change is not expected to be significant.

Social and Economic Impacts
<u>Alternative 5B Head of Hudson Canyon</u> Interviews discussed in Section 7.5.5 highlight the importance of the head of the Hudson Canyon to the fisheries of the region. The head of the Hudson Canyon is seen as one of the best areas left to fish, particularly for the fishermen of Rhode Island, New York, and northern New Jersey. It is known as a prolific *Loligo* squid, mackerel, and butterfish fishing ground, and with the establishment of the scup GRAs, many boats from Rhode Island and Massachusetts have begun focusing on the area, especially in the winter.

The vessel trip report data suggest that revenue losses associated with *Loligo* harvest are likely to be the greatest, on average in HH. However, in terms of dependence on HH for revenue, scup revenues may be the most greatly impacted. Closing HH to bottom otter trawling is likely to reduce revenue by 10% or more for about 65 bottom otter trawl vessels. Table 78 ranks the level of dependence on HH by vessels and Table 79 gives some of the characteristics of these 65 vessels.

Alternative 5C Tilefish HAPC Interviews discussed in Section 7.5.5 highlighted the economic importance of the tilefish HAPC area to the otter trawl fisheries of the region, particularly Rhode Island, New York, and northern New Jersey. This area is described as one providing one of the few available winter fisheries for the multi-species otter trawl fisheries of the region. The cumulative effects of changes in the fisheries management of the area, such as the creation of scup GRAs in 2001, have increased reliance on this offshore area. Consequently, the alternative of closing the tilefish HAPC to bottom otter trawl fishing is perceived as a major threat by fishermen, who doubt the scientific basis of this closure, and believe that it will disproportionately benefit the small tilefish fishery.

Table 81 indicates the relative importance of THAPC to the average vessel harvesting the top 16 commercially important species in this area. The data suggest that revenue losses associated with *Loligo,* and silver hake are likely to be the greatest, on average. In terms of dependence on THAPC for revenue, 14 out of 16 species show average vessel dependence greater than 10%. Closing THAPC to bottom otter trawling is likely to reduce revenue by 10% or more for about 201 bottom otter trawl vessels. Table 83 gives some of the characteristics of these 201 vessels. As such it is likely that the negative socio-economic impacts associated with this alternative are likely to be large and widespread.

Alternative 5D Lydonia and Oceanographer Canyons As stated in section 7.5.5, it is not anticipated that any meaningful impacts would result from closure of these areas since vessel logbook data indicate minimal fishing activity in the areas delineated by the two canyons.

7.6.3 Assessing Practicability

The habitat alternatives are analyzed primarily in a qualitative manner. This analysis synthesizes some of the conclusions from the habitat analysis, the social and economic impact analyses, the biological and ecological impacts, as well as issues such as compliance with National Standards.

Four primary components have been extracted from the full analysis to help determine the practicability of the alternatives. Each component is briefly described in Box 6.3.5.1. After public comment has been received and final measures have been chosen, a final practicability analysis will be completed.

This DSEIS uses specific practicability factors relevant to the EFH Final rule requirements to evaluate if the action is reasonable and capable of being done in light of available technology and economic considerations, and will not impose unreasonable burden on the fishery. The practicability factors used are discussed in the relevant consequence sections and summarized in the Summary of Practicability section.

Box 6.3.5.1 Factors considered in determining practicability of alternatives.

Practicability Factor	Relevance to 50CFR 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 Atlantic mackerel, squid, butterfish, 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

Assessing Environmental Consequences/Impacts and Practicability with Limited Information

According to information included and evaluated in this DSEIS, there is evidence for a relationship between fishing gear/effort 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 these links in terms of productivity and the specific effects of habitat degradation, past, present and future, on the productivity of managed species. Auster (2001) suggested that, in light of this uncertainty, the types of management measures needed for preventing, mitigating, or minimizing adverse effects of fishing on EFH are a mixture of preventative/corrective and the precautionary approaches. Auster (2001) suggested the following categories:

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.

7.6.4 Determination of Practicability

Alternative 5B Head of Hudson Canyon

Net economic change to fishery

This area closure would impose negative economic impacts on Atlantic mackerel, *Loligo* and *Illex* squid and butterfish fishery participants in both the short and long term. These losses would be suffered as a consequence of lost revenue and increased costs associated with fishing in different areas as a result of the EFH area closures proposed under this alternative.

Equity of potential costs among communities

The participants in the Atlantic mackerel, *Loligo* and *Illex* squid and butterfish fisheries would experience negative economic consequences while other bottom trawl fisheries would continue more or less unabated. Thus the negative economic consequences would be skewed towards the fishery participants active in the fisheries managed under this FMP. In addition, there are numerous other bottom trawl fisheries which occur in these same areas which may have a negative impact on the EFH in the proposed closed areas. Failure to restrict the use of bottom trawl gear in other fisheries not managed under this FMP, while at the same time prohibiting the use of trawls in these managed fisheries, would fail to protect EFH while placing an unfair and unnecessary burden on the Atlantic mackerel, squid and butterfish fisheries.

Differences in EFH value

The long term impacts of these alternatives are currently not known as quantifiable links between the gear used in these fisheries and habitat impacts is not clearly understood. In addition, a quantifiable link between habitat and productivity of the species listed in Table 19 has not been established. In fact, there is no evidence that fishing for the species managed under this FMP has any long term negative effect on EFH in the proposed closed areas. In addition, there are numerous other bottom trawl fisheries occurring in these same areas which may have a negative impact on the EFH in the proposed closed areas. Failure to restrict the use of bottom trawl gear in other fisheries not managed under this FMP, would fail to protect EFH.

Population effects and ecosystem changes

The longer term impact of this alternative is not known as quantifiable links between habitat and productivity of the species listed in Table 19 have not been established. Should these links prove to be significant, then taking no action could have a long term deleterious impact on the net value of the fisheries and ecosystems along the Continental shelf of the US.

Overall, the Council concluded that this alternative does not appear to be practicable.

Alternative 5C Tilefish HAPC

Net economic change to fishery

This area closure would impose negative economic impacts on Atlantic mackerel, *Loligo* and *Illex* squid and butterfish fishery participants in both the short and long term. These losses would be suffered as a consequence of lost revenue and increased costs associated with fishing in different areas as a result of the EFH area closures proposed under this alternative.

Equity of potential costs among communities

The participants in the Atlantic mackerel, *Loligo* and *Illex* squid and butterfish fisheries would experience negative economic consequences while other bottom trawl fisheries would continue more or less unabated. Thus the negative economic consequences would be skewed towards the fishery participants active in the fisheries managed under this FMP. In addition, there are numerous other bottom trawl fisheries which occur in these same areas which may have a negative impact on the EFH in the proposed closed areas. Failure to restrict the use of bottom trawl gear in other fisheries not managed under this FMP, while at the same time prohibiting the use of trawls in these managed fisheries, would fail to protect EFH while placing an unfair and unnecessary burden on the Atlantic mackerel, squid and butterfish fisheries.

Differences in EFH value

The long term impacts of these alternatives are currently not known as quantifiable links between the gear used in these fisheries and habitat impacts is not clearly understood. In addition, a quantifiable link between habitat and productivity of the species listed in Table 19 has not been established. In fact, there is no evidence that fishing for the species managed under this FMP has any long term negative effect on EFH in the proposed closed areas. In addition, there are numerous other bottom trawl fisheries which occur in these same areas which may have a negative impact on the EFH in the proposed closed areas. Failure to restrict the use of bottom trawl gear in other fisheries not managed under this FMP, would fail to protect EFH

Population effects and ecosystem changes

The longer term impact of this alternative is not known as quantifiable links between habitat and productivity of the species listed in Table 19 have not been established. Should these links prove to be significant, then taking no action could have a long term deleterious impact on the net value of the fisheries and ecosystems along the Continental shelf of the US.

Overall, the Council concluded that this alternative does not appear to be practicable.

Alternative 5D Lydonia and Oceanographer Canyons

Net economic change to fishery

Closing Lydonia and Oceanographer Canyons would impose no notable short-term economic impacts on fishery participants.

Equity of potential costs among communities

This closure alternative would make the Atlantic mackerel, *Loligo* and *Illex* squid and butterfish FMP consistent with the New England Fishery Management Council's monkfish FMP, which closed Lydonia and Oceanographer canyons to bottom trawl activity.

Differences in EFH value

This closure alternative would prevent expansion of the directed fishery into the canyons, and would provide protection to the sensitive structured habitats found within these canyons. However, directed fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls may be limited to the margins of Lydonia and Oceanographer canyons and not in the canyon centers (Section 6.5.1). In terms of Auster's (2001) classification scheme, this alternative would be the "preventative approach" to minimize effects of the directed Atlantic mackerel, squid and butterfish fisheries on vulnerable habitats. Additional advantages of this alternative is that it provides regulatory and enforcement agreement with the New England Fishery Management Council's monkfish FMP.

Population effects and ecosystem changes

The closure of Lydonia and Oceanographer canyons may protect deep sea corals and sponges by preventing the expansion of expansion of Atlantic mackerel, squid and butterfish fisheries into the deeper areas of these canyons.

Overall, the Council concluded that this alternative is practicable.

8.0 Cumulative Effects Assessment

A cumulative effects assessment (CEA) is required part of an EIS according to the Council on Environmental Quality (CEQ) (40 CFR part 1508.7). The purpose of the CEA is to integrate into the impact analyses, the combined effects of many actions over time that would be missed if each action were evaluated separately. CEQ guidelines recognize that it is not practical to analyze the cumulative effects of an action from every conceivable perspective but rather, the intent is to focus on those effects that are truly meaningful. This section serves to examine the potential direct and indirect effects of the alternatives in Amendment 9 together with past, present, and reasonably foreseeable future actions that affect the SMB environment. It may be noted that the predictions of potential synergistic effects from multiple actions, past, present and/or future will generally be qualitative in comparison to the analysis of the effects of individual actions given in Section 7.0.

The assessment presented here is explicitly structured upon the CEQ's 11-step CEA process that is described in their 1997 report, "Considering Cumulative Effects under the National Environmental Policy Act" (CEQ 1997). These eleven steps are itemized below:

The CEQ's eleven step CEA process. Taken from Table 1-5 in CEQ (1997).

1. Identify the significant cumulative effects issues associated with the proposed action and define the assessment goals.
2. Establish the geographic scope for the analysis.
3. Establish the timeframe for the analysis.
4. Identify other actions affecting the resources, ecosystems, and human communities of concern.
5. Characterize the resources, ecosystems, and human communities identified in scoping in terms of their response to change and capacity to withstand stresses.
6. Characterize the stresses affecting these resources, ecosystems, and human communities and their relation to regulatory thresholds.
7. Define a baseline condition for the resources, ecosystems, and human communities.
8. Identify the important cause-and-effect relationships between human activities and resources, ecosystems, and human communities.
9. Determine the magnitude and significance of cumulative effects.
10. Modify and add alternatives to avoid, minimize, or mitigate significant cumulative effects.
11. Monitor the cumulative effects of the selected alternative(s) and adapt management.

To a great extent, the descriptions and analyses presented in previous sections of this document have contributed to the completion of most of the CEQ's eleven steps, however; the purpose of this section of the document is to point out to the reader how these steps have been accomplished within the development of Amendment 9 and its accompanying EIS.

8.1 Significant cumulative effects issues associated with the proposed action and assessment goals

In Section 6.0 (Description of the Affected Environment) the valued ecosystem components (VECs) that exist within the SMB fishery environment are identified and the basis for their selection is established. This is associated with the completion of Step 1 in the CEQ's 11-Step process. The VECs are listed below.

6. Managed Resources
   - Atlantic mackerel stock
   - *Illex* stock
   - *Loligo* stock
   - Atlantic butterfish stock
7. Non-target species
8. Habitat including EFH for the managed resources and non-target species
9. Endangered and other protected resources
10. Human Communities

8.2 Geographic boundaries

The analysis of impacts focuses primarily on actions related to the harvest of the managed resources. Therefore, the geographic area used to define the core geographic scope for *managed resources*, *non-target species*, *habitat*, and *endangered and protected species* was the area within which the majority of harvest effort for the managed resources occurs (Figure 11 in Section 6.0). For *human communities*, the core geographic boundaries are defined as those U.S. fishing communities directly involved in the harvest of the managed resources. These communities were found to occur in coastal states from Maine to North Carolina.

8.3 Temporal boundaries

The temporal scope of past and present actions for *managed resources*, *non-target species*, *habitat and human communities* is primarily focused on actions that have occurred after FMP implementation (1979). For *endangered and other protected species*, the scope of past and present actions is on a species-by-species basis (Section 6.4) and is largely focused on the 1980s and 1990s through the present, when NMFS began generating stock assessments for marine mammals and turtles that inhabit waters of the U.S. EEZ. The temporal scope of future actions for all five VECs, which includes the measures proposed by this amendment, extends five years into the future following the expected implementation in 2007 (i.e., ~2012). This period was chosen because the dynamic nature of resource management and lack of information on projects that may occur in the future makes it difficult to predict impacts beyond this timeframe with any certainty.

8.4 Identify other actions affecting the resources, ecosystems, and human communities of concern

Table 97 accomplishes Step 4 of the CEQ process which calls for the identification of other actions that affect the VECs, i.e., actions *other* than those being developed in this document. These actions are presented in chronological order, and codes indicate whether an action relates to the past (**P**), present (**Pr**), or reasonably foreseeable future (**RFF**). When any of these abbreviations occur together, it indicates that some past actions are still relevant to the present and/or future. A brief explanation of the rationale for concluding what effect each action has (or will have) had on each of the VECs is provided in the table and is not repeated here.

Note that most of these *other* actions come from *fishery-related activities* (e.g., Federal fishery management actions). As expected, these activities have fairly straight-forward effects on environmental conditions, and were, are, or will be taken, in large part, to improve those conditions. The reason for this is the statutory basis for Federal fisheries management - the Magnuson-Stevens Act, as amended by the SFA in 1996. That legislation was enacted to promote long-term positive impacts on the environment in the context of fisheries activities. More specifically the act stipulates that management comply with a set of National Standards that collectively serve to optimize the conditions of the human environment. Under this regulatory regime, the cumulative impacts of past, present, and future Federal fishery management actions on the VECs should be expected to result in positive long-term outcomes. Nevertheless, these actions are often associated with offsetting impacts. For example, constraining fishing effort (e.g., minimum mesh size for *Loligo* in Amendment 5) may result in negative short-term socio-economic impacts for fishery participants (added cost of modifying gear). However, these impacts are usually necessary to bring about long-term sustainability of a given resource (in this case, increasing butterfish escapement, albeit marginally), and as such, should, in the long-term, promote positive effects on human communities, especially those that are economically dependent upon the managed resource.

Non-fishing activities that have meaningful effects on the VECs include the introduction of chemical pollutants, sewage, changes in water temperature, salinity, dissolved oxygen, and suspended sediment into the marine environment. These activities pose a risk to the all of the identified VECs in the long term. Human induced non-fishing activities that affect the VECs under consideration in this document are those that tend to be concentrated in nearshore areas. Examples of these activities include, but are not limited to agriculture, port maintenance, beach nourishment, coastal development, marine transportation, marine mining, dredging and the disposal of dredged material. Wherever these activities co-occur, they are likely to work additively or synergistically to decrease habitat quality and, as such, may indirectly constrain the sustainability of the managed resources, non-target species, and protected resources. Decreased habitat suitability would tend to reduce the tolerance of these VECs to the impacts of fishing effort. Mitigation of this outcome through regulations that would reduce fishing effort could then negatively impact human communities.

The overall impacts of these *other* (past, present, and reasonably foreseeable) actions are summarized in Table 98 and discussed below. These impacts, in addition to the impacts of the management actions being developed in this document (Table 70 in Section 7.0), comprise the total cumulative effects that will contribute to the significance determination for each of the VECs exhibited later in Table 101 (Section 8.9).

Table 97. Impacts of Past, Present and Reasonably Foreseeable Future Actions on the five VECs.Table 97. Impacts of Past, Present and Reasonably Foreseeable Future Actions on the five VECs. These actions do not include those under consideration in this Amendment.

Action	Description	Impacts on Managed Resources	Impacts on Non-target Species	Impacts on Habitat and EFH	Impacts on Protected Species	Impacts on Human Communities
FISHERY-RELATED ACTIONS						
[P] Prosecution of the SMB fisheries by foreign fleets in the area that would become the U.S. EEZ (prior to implementation of the MSA)	Foreign fishing pressure peaked in the 1960s and slowly declined until passage of the MSA and implementation of the FMPs	**Direct High Negative** Foreign fishing depleted Atl. Mackerel stock below biomass threshold	**Potentially Direct High Negative** Limited information on discarding, but fishing effort was very high	**Potentially Direct High Negative** Limited information on discarding, but fishing effort was very high	**Potentially Direct High Negative** Limited information on protected resource encounters, but fishing effort was very high	**Potentially Indirect Negative** Revenue from fishing benefited foreign businesses
[P] Original FMPs (3) implemented (1978 and 1979)	Established management of the SMB fisheries	**Indirect Positive** Regulatory tool available to rebuild and manage stocks	**Indirect Positive** Reduced fishing effort	**Indirect Positive** Reduced fishing effort	**Indirect Positive** Reduced fishing effort	**Indirect Positive** Benefited domestic businesses
[P, Pr] Original FMPs merged (1983)	Consolidated management of the SMB fisheries under one FMP	**No Impact** Administrative procedure	**No Impact** Administrative procedure	**No Impact** Administrative procedure	**No Impact** Administrative procedure	**No Impact** Administrative procedure
[P, Pr] Amendment 2 to the SMB FMP (1986)	Revised squid bycatch TALFF allowances	**Indirect Positive** Reduced squid mortality	**Indirect Positive** Reduced fishing effort	**Indirect Positive** Reduced fishing effort	**Indirect Positive** Reduced fishing effort	**Indirect Positive** Benefited domestic businesses
[P] Amendment 3 to the SMB FMP (1991)	Established overfishing definitions for all four species	**Indirect Positive** Provided basis for sustainable management	**Indirect Low Positive** Reduced fishing effort	**Indirect Low Positive** Reduced fishing effort	**Indirect Low Positive** Reduced fishing effort	**Indirect Positive** Increased probability of long term sustainability
[P] Amendment 4 to the SMB FMP (1991)	Limited activity of directed foreign fishing and JV transfers to foreign vessels	**Indirect Low Positive** Reduced fishing effort	**Indirect Low Positive** Reduced fishing effort	**Indirect Low Positive** Reduced fishing effort	**Indirect Low Positive** Reduced fishing effort	**Indirect Positive** Benefited domestic businesses

Table 97 (continued)

Action	Description	Impacts on Managed Resources	Impacts on Non-target Species	Impacts on Habitat and EFH	Impacts on Protected Species	Impacts on Human Communities
P, Pr Amendment 5 to the SMB FMP (1996)	Eliminated foreign fisheries for squids and butterfish	**Potentially Indirect Positive** Reduced fishing effort	**Potentially Indirect Positive** Reduced fishing effort	**Potentially Indirect Positive** Reduced fishing effort	**Potentially Indirect Positive** Reduced fishing effort	**Indirect Positive** Benefited domestic businesses
	Implemented limited access for squids and butterfish	**Indirect Positive** Constrained fishing effort	**Indirect Positive** Constrained fishing effort	**Indirect Positive** Constrained fishing effort	**Indirect Positive** Constrained fishing effort	**Indirect Positive** Reduced overcapacity
	Expanded management unit for all four species	**No Impact** Administrative	**No Impact** Administrative	**No Impact** Administrative	**No Impact** Administrative	**No Impact** Administrative
	Establish *Loligo* minimum mesh size (included exemption for *Illex* fishery)	**Low Positive** Marginal increase in butterfish escapement	**Direct Positive** Increased finfish escapement	**Unknown** Changes in fishing effort unknown	**Unknown** Changes in fishing effort unknown	**Indirect Negative (short term)** Cost of modifying gear
P, Pr Amendment 8 to the SMB FMP (1998)	Brought FMP into compliance with new and revised National Standards	**Indirect Positive** Improved regulatory tool for ensuring sustainability	**Indirect Positive** Strengthened mandate to reduce bycatch	**Indirect Positive** Strengthened mandate to protect habitat	**Indirect Positive**	**Indirect Positive (long term)**
P, Pr Summer Flounder, Scup and Black Sea Bass Specifications (2000)	Established scup small mesh gear restricted areas	**Potentially Indirect Positive** Reduced fishing effort locally	**Potentially Indirect Positive** Reduced fishing effort locally	**Potentially Indirect Positive** Reduced fishing effort locally	**Potentially Indirect Positive** Reduced fishing effort locally	**Indirect Negative (short term)** Cost associated with shifting effort for some participants
P, Pr Framework 2 to the SMB FMP (2002)	Extended moratorium on entry into limited access *Illex* fishery	**Indirect Positive** Constrain harvest capacity	**Indirect Positive** Constrain fishing effort	**Indirect Positive** Constrain fishing effort	**Indirect Positive** Constrain fishing effort	**Potentially Indirect Positive** Prevented increases in capacity
P Framework 3 to the SMB FMP (2003)	Extended by one year moratorium on entry into limited access *Illex* fishery	**Indirect Positive** Constrain harvest capacity	**Indirect Positive** Constrain fishing effort	**Indirect Positive** Constrain fishing effort	**Indirect Positive** Constrain fishing effort	**Potentially Indirect Positive** Prevented increases in capacity
P, Pr Framework 4 to the SMB FMP (2004)	Extended by five years moratorium on entry into limited access *Illex* fishery	**Indirect Positive** Constrain harvest capacity	**Indirect Positive** Constrain fishing effort	**Indirect Positive** Constrain fishing effort	**Indirect Positive** Constrain fishing effort	**Potentially Indirect Positive** Prevented increases in capacity

Table 97 (continued)

Action	Description	Impacts on Managed Resources	Impacts on Non-target Species	Impacts on Habitat and EFH	Impacts on Protected Species	Impacts on Human Communities
RFFA Amendment 10 to the SMB FMP (~ 2007/2008)	Establish rebuilding strategy for butterfish	**Positive** Increase butterfish biomass to sustainable level	**Indirect Positive** Measures to reduce butterfish discards would reduce bycatch of other species; Constrain fishing effort	**Indirect Positive** Constrain fishing effort	**Indirect Positive** Constrain fishing effort	**Unknown** Pending economic analysis
RFFA Amendment 11 to the SMB FMP (~ 2008/2009)	Establish limited access Atlantic mackerel fishery	**Indirect Positive** Constrain harvest capacity	**Indirect Positive** Constrain fishing effort	**Indirect Positive** Constrain fishing effort	**Indirect Positive** Constrain fishing effort	**Unknown** Pending economic analysis
RFFA Convene Atlantic Trawl Gear Take Reduction Team (2006)	Recommend measures to reduce mortality and injury to the common dolphin and long fin pilot whale	**Indirect Positive** Will improve data quality for monitoring total removals	**Indirect Positive** Reducing availability of gear could reduce bycatch	**Indirect Positive** Reducing availability of gear could reduce gear impacts	**Indirect Positive** Reducing availability of gear could reduce encounters	**Indirect Negative** Reducing availability of gear could reduce revenues
RFFA Develop Standardized Bycatch Reporting Methodology (2006/2007)	Recommend measures to monitor bycatch at an acceptable level of precision and accuracy	**Indirect Positive** Will improve data quality for monitoring total removals of managed resources	**Indirect Positive** Will improve data quality for monitoring removals of non-target species	**Neutral** Will not affect distribution of effort	**Indirect Positive** Will increase observer coverage	**Potentially Indirect Negative** May impose an inconvenience on vessel operations
RFFA National Offshore Aquaculture Act of 2005 (currently proposed)	Proposed bill that would grant DOC authority to issue permits for offshore aquaculture in Federal waters	**Potentially Indirect Negative** Localized decreases in habitat quality possible	**Potentially Indirect Negative** Localized decreases in habitat quality possible	**Direct Negative** Localized decreases in habitat quality possible	**Potentially Indirect Negative** Localized decreases in habitat quality possible	**Unknown** Costs/benefits remain unanalyzed
RFFA Strategy for Sea Turtle Conservation for the Atlantic Ocean and the Gulf of Mexico Fisheries (w/in next 5 years)	May recommend strategies to prevent the bycatch of sea turtles in commercial fisheries operations	**Indirect Positive** Will improve data quality for monitoring total removals	**Indirect Positive** Reducing availability of gear could reduce bycatch	**Indirect Positive** Reducing availability of gear could reduce gear impacts	**Indirect Positive** Reducing availability of gear could reduce encounters	**Indirect Negative** Reducing availability of gear could reduce revenues

Table 97 (continued)

NON –FISHERY RELATED ACTIONS						
Action	**Description**	**Impacts on Managed Resources**	**Impacts on Non-target Species**	**Impacts on Habitat and EFH**	**Impacts on Protected Species**	**Impacts on Human Communities**
P, Pr, RFFA Agriculture runoff	Nutrients applied to agriculture land are introduced into aquatic systems	**Indirect Negative** Reduced habitat quality in the immediate project area	**Indirect Negative** Reduced habitat quality in the immediate project area	**Direct Negative** Reduced habitat quality in the immediate project area	**Indirect Negative** Reduced habitat quality in the immediate project area	**Indirect Negative** Reduced habitat quality negatively affects resource viability in the immediate project area
P, Pr, RFFA Port maintenance	Dredging of wetlands, coastal, port and harbor areas for port maintenance	**Indirect Negative** Localized decreases in habitat quality	**Indirect Negative** Localized decreases in habitat quality	**Direct Negative** Reduced habitat quality in the immediate project area	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Indirect Negative** Reduced habitat quality negatively affects resource viability in the immediate project area
P, Pr, RFFA Offshore disposal of dredged materials	Disposal of dredged materials	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Direct Negative** Reduced habitat quality in the immediate project area	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Indirect Negative** Reduced habitat quality negatively affects resource viability in the immediate project area
P, Pr, RFFA Beach nourishment	Offshore mining of sand for beaches	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Direct Negative** Reduced habitat quality in the immediate project area	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Mixed** Positive for mining companies, possibly negative for fisheries
	Placement of sand to nourish beach shorelines	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Direct Negative** Reduced habitat quality in the immediate project area	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Positive** Beachgoers generally like sand
P, Pr, RFFA Marine transportation	Expansion of port facilities, vessel operations and recreational marinas	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Direct Negative** Reduced habitat quality in the immediate project area	**Indirect Negative** Localized decreases in habitat quality in the immediate project area	**Mixed** Positive for some interests, potential displacement for others

Table 97 (continued)

Action	Description	Impacts on Managed Resources	Impacts on Non-target Species	Impacts on Habitat and EFH	Impacts on Protected Species	Impacts on Human Communities
P, Pr, RFFA Installation of pipelines, utility lines and cables	Transportation of oil, gas and energy through pipelines, utility lines and cables	**Unknown** Dependent on mitigation effects	**Unknown** Dependent on mitigation effects	**Potentially Direct Negative** Reduced habitat quality in the immediate project area	**Unknown** Dependent on mitigation effects	**Unknown** Dependent on mitigation effects
RFFA Liquefied Natural Gas (LNG) terminals (w/in 5 years)	Transportation of natural gas via tanker to terminals located offshore and onshore (Several LNG terminals are proposed, including MA, RI, NY, NJ and DE)	**Unknown** Dependent on mitigation effects	**Unknown** Dependent on mitigation effects	**Potentially Direct Negative** Localized decreases in habitat quality possible in the immediate project area	**Unknown** Dependent on mitigation effects	**Unknown** Dependent on mitigation effects
RFFA Offshore Wind Energy Facilities (w/in 5 years)	Construction of wind turbines to harness electrical power (Several facilities proposed from ME through NC, including off the coast of MA, NY/NJ and VA)	**Unknown** Dependent on mitigation effects	**Unknown** Dependent on mitigation effects	**Potentially Direct Negative** Localized decreases in habitat quality possible in the immediate project area	**Unknown** Dependent on mitigation effects	**Unknown** Dependent on mitigation effects

Summary of Non-Fishing Effects Though largely unquantifiable, it is likely that the non-fishing activities noted above would have negative impacts on habitat quality from disturbance and construction activities in the area immediately around the affected area. This would be a direct impact on habitat and an indirect effect to planktonic, juvenile, and adult life stages of fish and protected species in the project areas due to habitat degradation. Given the wide distribution of the affected species, minor overall negative effects to habitat are anticipated since the affected areas are localized to the project sites, which involve a small percentage of the fish populations and their habitat.

Summary Effects of Past and Present Actions The present conditions of the VECs are empirical indicators of the summary effects of past actions since, independent of natural processes, and these present conditions are largely the product of these past actions. The combined effects of these actions are described in the VEC-by-VEC discussion below and are summarized in Table 98.

Managed species: With the exception of butterfish, the managed resources are currently considered to be above threshold criteria, and as such, the summary effects of past actions and present action on these resources are considered to be a net positive. Clearly, the well intended past actions have not been enough to effectively rebuild this fishery. However, the fishery may have been in worse condition today without those actions. The poor condition of the butterfish stock is attributed primarily to discarding by small mesh trawl fisheries, especially squid fisheries. This discarding problem is not the direct result of past or present management actions, but instead, management inaction, which will be addressed through this amendment and/or future management actions (e.g., Amendment 10). While the negative effects of past and present actions associated with non-fishing activities (Table 97) may have increase negative effects, it is likely that those actions were minor due to the limited scale of the habitat impact compared with the populations at large. Therefore, the sum effects of past and present actions on butterfish are considered to be negative in the short term, but positive in the long term since future actions are anticipated to rebuild the stock.

Non-target species: The summary effects of past and present actions are less clear than for the managed resources. This is because, as stated in throughout this document (Sections 6.2, 7.2, 8.6 and 8.7) the information needed to quantitatively measure the impacts on these species of SMB fishery activities and non-fishing activities is generally lacking. The future implementation of the omnibus SBRM Amendment is expected to provide more data to allow regulators more information to better manage the species. The summary effects of past and present actions on non-target species are considered to be a mixed set of offsetting positive effects through fishery effort reduction and negative effects through bycatch mortality and non-fishing activities. The prosecution of fishing activities in general will necessarily reduce the abundance of various non-target species. As such, effort reduction or gear modifications will, in effect, reduce the magnitude of the negative impact of fishing in general. Again, although the negative effects of past and present actions associated with non-fishing activities (Table 97) may have increase negative effects, it is likely that those actions were minor due to the limited scale of the habitat impact compared with the populations at large. Thus, the resultant impact of past and present actions on non-target species is a net negative sum effect. Again this would likely improve with future actions to reduce bycatch.

Habitat and Protected Species: For the habitat and protected resource VECs, the summary effects of past and present actions are also considered to be negative. This follows the same logic presented under the discussion of impacts on non-target species: effort reduction or gear modifications will, in effect, reduce the magnitude of the negative impact on these VECs that results from fishing activities.

Again, although the negative effects of past and present actions associated with non-fishing activities (Table 97) may have increased negative effects, it is likely that those actions were minor due to the limited scale of the habitat impact compared with the populations at large. Thus, the resultant impact of past and present actions on non-target species is a net negative sum effect on these VECs.

Human communities: The summary effect of past and present actions is complex since the effects have varied among fishery participants, consumers, and communities. Nevertheless, the net effect is considered to be positive in that the fisheries managed under the SMB FMP currently support viable domestic and international market demand. While some short-term economic costs have been associated with effort reductions and gear modifications (see Table 97), economic returns have generally been positive and as such, have tended to make a positive contribution to the communities associated with harvest of these species.

<u>Summary Effects of Future Actions</u> As with past and present actions, the list of reasonably foreseeable future actions is provided in Table 97. Additionally, the same general trends will be noted with regard to the expected outcomes of fishery-related actions and non-fishing actions; to wit, the summary effects of fishery related actions tend to be positive with respect to natural resources although short-term negative or mixed effects are expected for human communities. Conversely, for the non-fishing actions listed in Table 97, the general outcome remains negative in the immediate project area, but minor for all VECs, again due to the difference in scale of exposure of the habitat perturbation and the population.

The directionality of the impacts of future actions on the VECs will necessarily be a function of the offsetting negative vs. positive impacts of each of the actions. Since the magnitude and significance of the impacts of these future actions, especially non-fishing impacts, is poorly understood, conclusions as to the summary effects will essentially consist of an educated guess.

Recall that the future temporal boundary for this CEA is five years after implementation of the amendment (~2012; Section 8.3). Within that timeframe, the summary effects of future actions on managed resources, non-target species, habitat, and protected resources are all expected to be positive, notwithstanding the immeasurable localized nearshore negative effects of non-fishing actions. The optimization of the conditions of the resources is the primary objective of the management of these natural resources. Additionally, it is unknown, but expected that technology to allow for mitigation of the negative impacts of non-fishing activities will improve. Future actions (Amendment 10) are anticipated to decrease butterfish discards and bycatch, thus, providing for a positive future impact for this and non-target species. Also noteworthy is the forthcoming Trawl Take Reduction Plan (TRP), which would reduce the take of marine mammals and other species in the trawl gear used in these fisheries.

For human communities, short-term (i.e., within the temporal scope of this CEA) costs may occur. This negative impact is expected to be the byproduct of an adjustment to the improved management of the natural resources. In the longer term, positive impacts on human communities should come about as sustainability of natural resources is attained.

Table 98. Summary effects of past, present and reasonably foreseeable future actions on the VECs identified for Amendment 9 (based on actions listed in Table 97).

VEC	Past Actions	Present Actions	Reasonably Foreseeable Future Actions	Combined Effects of Past, Present, Future Actions
Managed Resources	Butterfish – **negative** stock was allowed to become overfished	Butterfish – **negative** overfishing is occurring	Butterfish – **positive** rebuilding of the stock is expected after Amendment 10	Butterfish – **short term negative;** **long term positive -** when rebuilt stock is anticipated
	Other SMB – **positive** stocks have not been overfished	Other SMB – **positive** overfishing is not occurring	Other SMB – **positive** stock health is expected to be maintained	Other SMB – **positive** sustainable stock sizes
Non-Target Species	**negative** combined effects of bycatch mortality and non-fishing actions that reduce habitat quality	**negative or somewhat less negative than past** combined effects of reduced bycatch mortality and non-fishing actions that reduce habitat quality	**positive** reductions in bycatch incidence, improved bycatch estimation, improved habitat quality are expected (measures to reduce Butterfish bycatch in Amendment 10 would also benefit other species)	**Negative in short term** bycatch will continue until reduction measures are implemented **Long term positive** Amendment 10 measures would benefit other species, improved bycatch accounting, improved habitat quality
Habitat	**negative** combined effects of disturbance by fishing gear and non-fishing actions have reduced habitat quality	**negative or somewhat less negative than past** continued combined effects of disturbance by fishing gear and non-fishing actions have reduced habitat quality	**positive** reduction in effects of disturbance by fishing gear are expected	**positive** reduced habitat disturbance by fishing gear
Protected Resources	**negative** combined effects of gear encounters and non-fishing actions that reduce habitat quality	**Negative or somewhat less negative than past** combined effects of gear encounters and non-fishing actions that reduce habitat quality	**positive** reduced gear encounters through effort reduction, Trawl TRP and Sea Turtle Strategy; improved habitat quality are expected	**Negative in short term** until Trawl TRP is implemented, improved habitat quality are expected **long term positive** reduced gear encounters through effort reduction and Trawl TRP/Sea Turtle Strategy; improved habitat quality are expected
Human Communities	**positive** fisheries have supported profitable industries and viable fishing communities	**positive** fisheries continue to support profitable industries and viable fishing communities	**short-term negative** some revenue loss may occur if management results in effort reduction	**short-term negative** lower revenues would continue until stocks are fully rebuilt **long-term positive** sustainable resources should support viable communities and economies

8.5 Resources, ecosystems, and human communities identified in scoping in terms of their response to change and capacity to withstand stresses

See 8.6, below.

8.6 Stresses affecting the resources, ecosystems, and human communities and their relation to regulatory thresholds

CEQ Steps 5 and 6 were accomplished either explicitly or implicitly in this document for each VEC in Section 6.0. A summary of that information is provided in Table 98. It is suggested that the reader refer to the appropriate subsections to obtain details regarding this information.

Table 99. Summary of information related to CEQ steps 5 and 6 that were addressed in Section 6.0.
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VEC	CEQ Step 5 (Response to change and ability to withstand stress – i.e., significance criteria)	CEQ Step 6 (Stresses affecting the resources)
Managed Resource	• Biomass drops below threshold (e.g., ½ B_{MSY}) • Fishing mortality exceeds threshold (e.g., F_{MAX}) (these thresholds are defined for each managed resource in Section 6.1)	• Directed harvest • Discarding • Non-fishing activities
Non-target species	• Largely unquantifiable, but implementation of development of omnibus SBRM FMP should improve.	• Encounters with fishing gear • Non-fishing activities
Habitat	See EFH overlap analysis – Section 6.3.4.1	• Encounters with fishing gear • Non-fishing activities
Protected Resources	• Marine mammals - mortalities exceed potential biological removal (PBR) which is defined for each species in Section 6.4. • Sea Turtles – nest counts, or estimated number of nesting females below target levels	• Encounters with fishing gear • Non-fishing activities
Human Communities	In general, the significance of impacts is measured by the potential for revenue loss. The standards established under E.O. 12866 or RFA may be candidates.	• Short term: revenue losses from changes in current fishing practices (e.g., gear modifications, area closures). • Short term and long term: revenue losses from resource depletion

For the purposes of providing a conceptual context for this discussion of the affect the human environment, some general categories of the environmental influences on the VECs are provided in Figure 99. Most of the time, influences of actions on the population size of a managed resource can, by and large, be extended to populations of non-target species or protected species, and vice versa, especially with regard to increases and decreases in fishing effort. The effects of actions on habitat quality can come from a wide variety of fishing and non-fishing activities. In turn, habitat quality factors into the condition of the managed resource, non-target species, and protected resource VECs.

The condition of the human communities VEC is generally associated with increases and decreases in revenue from fishing operations. Operating costs tend to increase when availability of the managed resource decreases either through scarcity or through regulatory restrictions on harvest. The availability of the managed resource also affects competition among fishing entities for resources and consumer demand. These factors influence product price which feeds back to the economic and social well-being of the human communities.

Optimizing the future condition of a given VEC can have offsetting impacts on other VECs. Figure 100 illustrates the complex pathways by which a given action may directly or indirectly, specifically with regard to the potential EFH closures considered in this document (Alternatives 5B-5D). In this example, closing areas to bottom otter trawling will directly improve habitat quality, and be expected to indirectly improve the conditions of managed resources, non-target species, and protected resources. This action, however, would negatively impact human communities dependent on revenue from otter trawling in that area, at least in the short term. Additionally, the indirect benefits to managed resources, non-target species, and protected resources may be localized, and increased bottom trawl effort in other areas may offset these benefits to some degree.

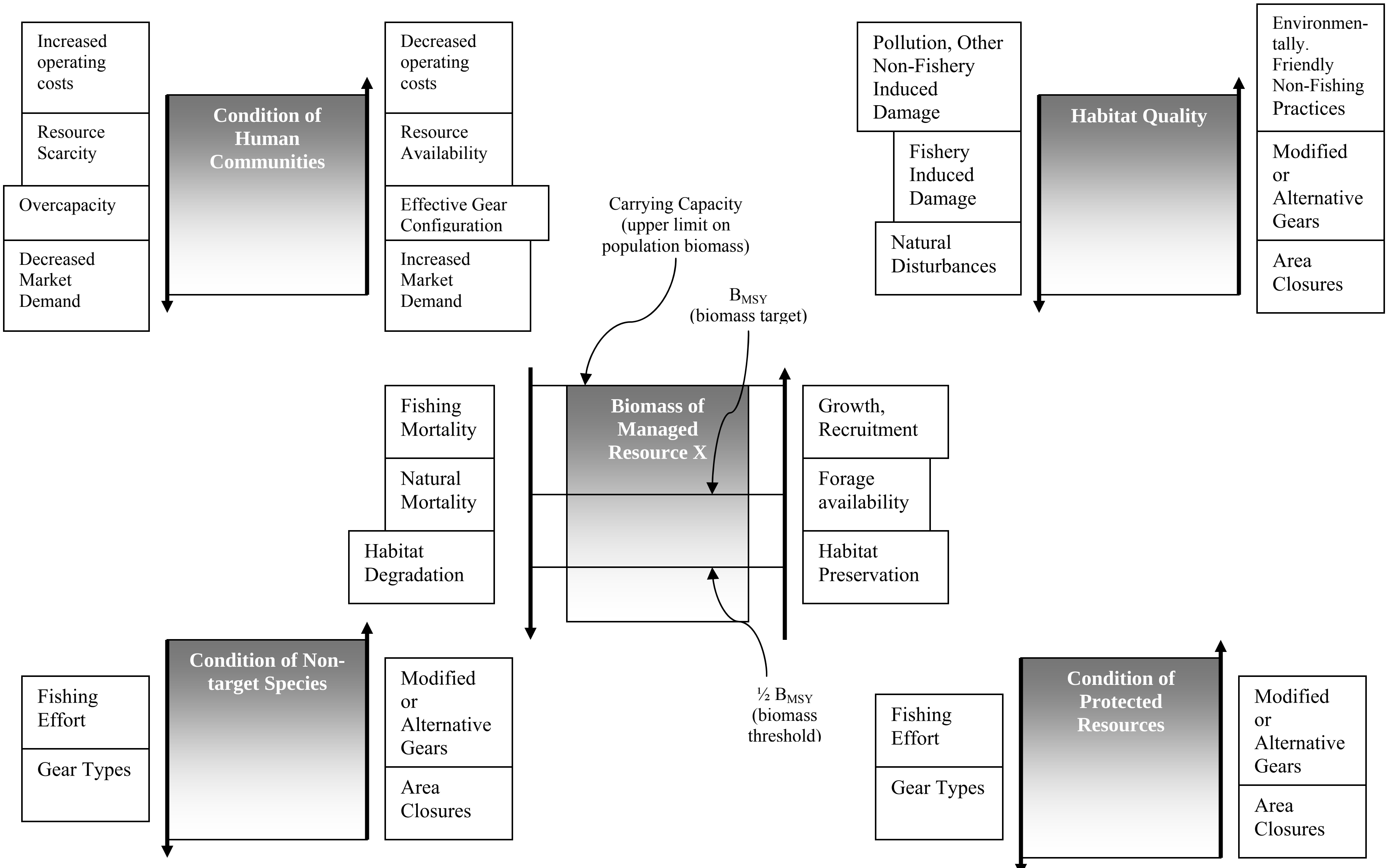

Figure 99. Examples of environmental sources of positive impacts (up arrows) and negative impacts (down arrows) for the five VECs.

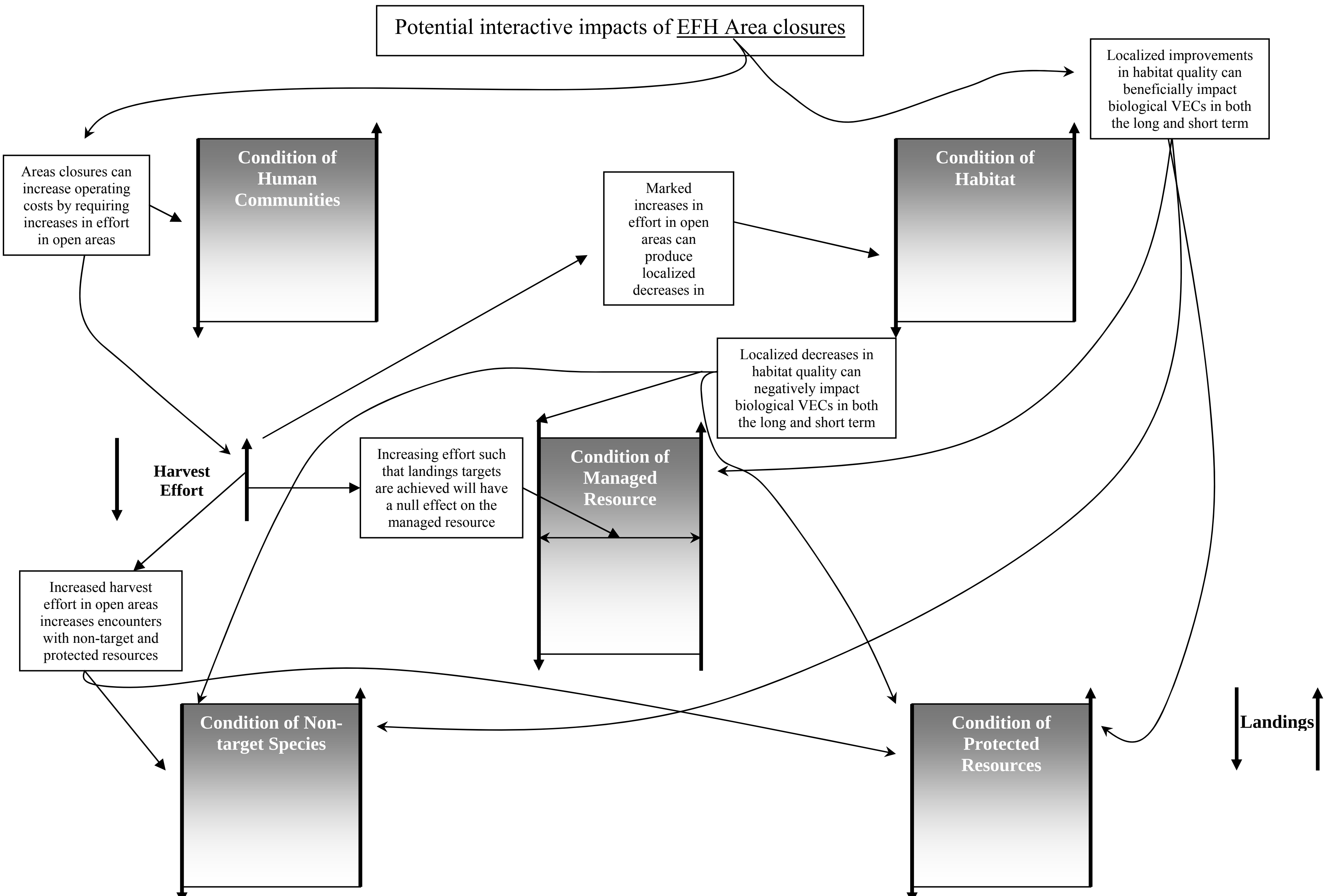

Figure 100. Examples of environmental sources of positive impacts (up arrows) and negative impacts (down arrows) for the five VECs.

8.7 Baseline condition for the resources, ecosystems, and human communities

The CEQ's step 7 calls for a characterization of the baseline conditions for the VECs. For the purposes of this CEA, the baseline condition is considered as the present condition of the VECs plus the combined effects of the past, present and reasonably foreseeable future actions. Table 100 summarizes the added effects of the condition of the VECs (i.e., status/trends/stresses from Section 6 and Table 99) and the sum effect of the past, present and reasonably foreseeable future actions (from Table 98). The resulting CEA baseline for each VEC is exhibited in the last column (shaded). In general, straight-forward quantitative metrics of the baseline conditions are only available for the managed resources and protected resources. For non-target species, the constraints of data quality preclude a quantitative baseline. The conditions of the habitat and human communities VECS are complex and varied. As such, the reader should refer to the characterizations given in Sections 6.3 and 6.5, respectively. As mentioned above, this CEA Baseline is then used to assess cumulative effects of the proposed management actions below in Table 101.

Table 100. CEA baseline conditions of the VECs.

VEC		Status/Trends/Stresses	Combined Effects of Past, Present Reasonably Foreseeable Future Actions (Table 98)	Combined CEA Baseline Conditions
Managed Resource	**Atl. Mackerel**	Stock size above biomass target, overfishing not occurring; landings variable but at sustainable levels	**Positive** sustainable stock sizes	**Positive** - sustainable stock sizes
	Illex	Stock size unknown, but overfishing not occurring; landings variable but at sustainable levels		
	Loligo	Stock size unknown, but overfishing not occurring; landings variable but at sustainable levels		
	Butterfish	Overfished; commercial discarding is a major factor; stock size is now below ½ Bmsy threshold	**Negative** -- short term; **Positive --** long term when rebuilt stock is anticipated with Amendment 10	**Negative --** short term; **Positive –** long term with rebuilt stock in future
Non-target Species (principle species listed in Table 11A for each fishery)		Quantitative characterization of bycatch in SMB fisheries is poor to unknown, with the exception of butterfish; Bycatch mortality, in general, continues to be elevated	**Negative in short term** bycatch will continue until reduction measures are implemented; **Long term positive** Amendment 10 measures would benefit other species, improved bycatch accounting, improved habitat quality	**Negative in short term** - Increased bycatch rates would continue until reduction measures are implemented **Positive** – Long term reduced bycatch, improved bycatch accounting, improved habitat quality
Habitat		Complex and variable - See Section 6.3.4.1; Non-fishing activities had historically negative but site-specific effects on habitat quality; Mouth of Hudson Canyon/Tilefish HAPC among the areas most ecologically sensitive	**Positive** reduced habitat disturbance by fishing gear	**Positive** - reduced habitat disturbance by fishing gear and non-fishing actions
Protected Resources	Common dolphin	Unknown status, but takes are below PBR; taken by *Loligo*, mackerel and other fisheries;	**Negative or somewhat less negative than past in short term** until Trawl TRP is implemented, improved habitat quality **Long term positive** reduced gear encounters through effort reduction and Trawl TRP/Sea Turtle Strategy; improved habitat quality are expected	**Negative or low negative in short term** -- Until Trawl TRP is implemented **Positive** – reduced gear encounters through effort reduction and Trawl TRP, Sea Turtle Strategy; improved habitat quality
	White-sided dolphin	Unknown status, but takes are below PBR; historically taken by foreign mackerel vessels;		
	Pilot whales	Unknown status, but takes are below PBR; taken by *Illex* and *Loligo*		
	Leatherback sea turtle	ESA classification: Endangered, number of nesting females below sustainable level; taken by *Loligo* trawl		
	Loggerhead sea turtle	ESA classification: Threatened, nest counts (~6,200 in 1998) below goal (12,800); taken by *Illex* and *Loligo* trawl		

Table 100 (continued)

VEC	Status/Trends/Stresses	Combined Effects of Past, Present Reasonably Foreseeable Future Actions (Table 98)	Combined CEA Baseline Conditions
Human Communities	Complex and variable - See Section 6.5	**Positive** - Long-term sustainable resources should support viable communities and economies	**Negative --** short-term lower revenues would continue until all stocks are sustainable **Long-term positive** sustainable resources should support viable communities and economies

8.8 Cause-and-effect relationships between human activities and resources, ecosystems, and human communities

CEQ's step 8 has been accomplished through the analyses of impacts presented in Section 7.0, as well as the summary of past, present, and reasonably foreseeable future actions presented in Table 97, and the relationships between the VECs illustrated in Figure 99 and its accompanying text.

8.9 Magnitude and Significance of Cumulative Effects

According to CEQ guidance, determining the magnitude of the cumulative effects consists of determining the separate effects of past actions, present actions, the proposed action (and reasonable alternatives), and other future actions. Once that is done, cumulative effects can be calculated. The significance of the effects is related to the magnitude, but also takes into account context and intensity. Table 97 in Section 8.4 lists the effects of individual past, present, and future actions and is organized in chronological order so that review of that table will assist the reader in understanding the conclusions presented below regarding the summary effects of these separate actions. Note that fishery-related activities consist almost entirely of positive effects (with the exception of some short-term negative effects on human communities) while non-fishing activities are generally associated with negative effects. The basis for this general outcome is explained in the text provided in Section 8.4. Table 100 lists the summary effects of the past, present and future actions on the VECs and Table 101 incorporates these effects into categories of impacts that may come about through the implementation of certain suites of alternatives that are under consideration. The additive effects of all of these environmental influences determine the total cumulative effects for this amendment.

<u>Summary Effects of the Proposed (Amendment 9) Actions</u> The summary effects of the proposed actions are dependent on which combinations of actions are ultimately implemented. The Council has identified seven preferred alternatives; however, this amendment includes a total of 33 alternatives within 10 suites of management issues. This equates to 92,160 unique combinations of alternatives. Because a comprehensive analysis of all of these combinations is unreasonable, a more general approach is presented here.

The individual impacts of each of the alternatives is presented in detail Section 7.0 and summarized in Table 70 at the beginning of that section. The managed resource VEC is generally limited to impacts that either increase or decrease fishing mortality, which in turn affects population size. As such, if the total suite of actions taken under this amendment has a net result of decreasing the ability of fisheries to harvest the managed resources, then the summary effects will be positive. Decreased harvest effort would also tend to reduce fishing mortality on non-target species and protected resources and reduce disturbance of bottom habitat. On the other hand reducing the ability of harvesters to acquire catch generally corresponds with reduced revenue, at least in the short term. Table 101 provides examples of alternatives that, if implemented, would correspond to positive, negative, or null impacts on the different VECs. For explanation of the rationale for the expected effects of each alternative, refer back to Table 70. Table 101 also includes the total cumulative effects expected through the CEA Baseline (which includes the combined impacts of the past, present, and future actions) presented in Table 100 added with the direct/indirect effects conditional on implementation of alternatives with positive or negative directionality on a given VEC. If null effects on a given VEC are expected under a given alternative, then no additive cumulative effects (additions to other past, present or future cumulative effects) apply and the cumulative effects in the column taken from Table 100 would apply (1st shaded column). Note that the summary cumulative effects apply to individual proposed actions. In other words, if one is interested in determining the cumulative effects on each VEC of Alternative 5D (close Lydonia and Oceanographer Canyons to bottom otter trawl fishing), observe that Alternative 5D is associated with positive impacts on all VECs and no impacts on human communities. The summary cumulative effects of that alternative, therefore, are in the "positive" cumulative effects column for all VECs except human communities. Because there are no additive effects on human communities from that alternative, the cumulative effects for human communities come from the past, present or future cumulative effects column. Further discussion on the total cumulative effects on each VEC follows the table.

Analysis of Total Cumulative Effects Regardless of the uncertainty regarding which actions will be implemented through this amendment, it is expected that the overall long-term cumulative effects should be positive for all VECs (see Table 101). This is because, barring some unexpected natural or human-induced catastrophe, the regulatory atmosphere within which Federal fishery management operates requires that management actions be taken in a manner that will optimize the conditions of resources, habitat, and human communities. Consistent with NEPA, the SFA requires that management actions be taken only after consideration of impacts to the biological, physical, economic, and social dimensions of the human environment. This document functions to identify the likely outcomes of various management alternatives. Identification of alternatives that would compromise resource sustainability should make implementation of those alternatives unlikely. Additional scrutiny of the management alternatives during the upcoming Public Hearing Process will serve to further characterize the potential costs and benefits associated with these alternatives.

Table 101 exhibits the cumulative impacts on each VEC for each of the evaluated alternatives. Impacts are listed as neutral, positive or negative. Impacts listed as neutral include those alternatives that have no impact or have a neutral impact (neither positive nor negative). The resultant cumulative effect is the CEA baseline that exhibited in the first shaded column that, as described above) represents the sum of the past, present and reasonably foreseeable future (identified hereafter as "other") actions and conditions of each VEC. When an alternative has a positive effect on a VEC, for example, reduce fishing mortality on a managed species, it has a positive cumulative effect on the stock size of the species when combined with the "other" actions that were also designed to increase stock size. In contrast, when an alternative has a negative effect on a VEC, such as increased mortality, the cumulative effect on the VEC would be negative and tend to reduce the positive effects of the "other" actions. The resultant positive and negative cumulative effects are described below for each VEC and are exhibited in Table 101 in the 2nd and 3rd shaded columns, respectively. The preferred alternatives are listed in the table as **bolded**.

A summary comparison of all the resultant cumulative effects for each set alternatives and each VEC are displayed at the end of this section in Table 102.

Managed Resource Impacts

Summary of CEA Baseline: With the exception of butterfish, the managed resources are currently considered to be above threshold criteria, and as such, the summary effects of past actions and present actions on these resources are considered to be a net positive. The poor condition of the butterfish stock is attributed primarily to discarding by small mesh trawl fisheries, especially squid fisheries. This discarding problem is not the direct result of past or present management actions, but instead, management inaction, which will be addressed through this amendment and/or future management actions (e.g., Amendment 10). Therefore, the sum effects of past and present actions on butterfish are considered to be negative in the short term, but positive in the long term since future actions are anticipated to rebuild the stock. Within that timeframe, future actions on managed resources are expected to be positive, notwithstanding the immeasurable localized nearshore negative effects of non-fishing actions.

As mentioned above in Section 8.4, non-fishing effects, although potentially negative to all marine species, are likely not exerting much negative effects on managed species. While the negative effects of past and present actions associated with non-fishing activities (Table 97) may have increased negative effects, it is likely that those actions were minor due to the limited scale of the habitat impact compared with the populations at large. In addition, the non-fishing effects in the offshore habitats where the fishery is prosecuted are likely not cumulative with fishing gear effects that are occurring there.

Summary of Alternatives with No Effects or Neutral Effects: The alternatives to implement multiyear specifications (Alternative1A-C) and electronic dealer reporting (9A, B) are primarily administrative with no direct/indirect impact to the managed species and thus would not have any cumulative effects on the species. As well, the alternatives to address overcapacity have neutral effects on the four species. For the alternatives to not extend or terminate the moratorium on the *Illex* fishery (2A and 2C), any anticipated increases in effort would not impact the *Illex* stock because the quota controls harvest levels and discards of *Illex* are very low. In addition, the alternatives to extend the moratorium (2B, D) would maintain status quo discard levels and thus not impact non-target species. Thus, the generally positive cumulative effects on *Illex* would likely be unaffected by these measures. Not adopting the closed areas to protect habitat (5A) would not impact the intensity or distribution of fishing effort and also would not to contribute cumulative effects of these species. Alternatives which modify *Loligo* minimum mesh size (6A-D) and exempt *Loligo* minimum mesh size requirements for *Illex* vessels (7A-D) and not adopt Gear Restricted Areas (GRAs) (10A) would not impact fishing mortality on three managed species other than butterfish and therefore would not have cumulative impacts on these species. (It should be noted that without alternatives 6B-D, 7B-D and 10B-E, the resultant positive impact on butterfish would be reduced, since these alternatives would have a more positive effect on this species -- see below). Further, it is anticipated that the *Loligo* possession limit for directed *Illex* fishery (8A-D) would not have any effect on the other managed species since this set of measures also would not affect mortality of the other species. The effects implementing the GRAs

Table 101. Summary cumulative effects for the management actions proposed in Amendment 9. The cumulative effects (shaded columns) are the sum of the Refer to Table 70 for the rationale behind the positive, negative, or neutral impacts from the proposed actions.

	Management actions with neutral or no impacts		**Management actions with positive impacts**		**Management actions with negative impacts**	
VEC	**Alternatives with No Direct/ Indirect Effects (see Table 70)**	**Combined Baseline Effects (independent of proposed actions - see Table 100) Cumulative effects of No Action or Proposed Action with neutral or no impacts**	**Alternatives with Positive Direct/Indirect Effects (see Table 70)**	**Resultant Cumulative Effects (conditioned on implementation of Proposed Actions with positive effects)**	**Alternatives with Negative Direct/Indirect Effects (see Table 70)**	**Resultant Cumulative Effects (conditioned on implementation of Proposed Actions with negative effects)**
Managed Resources	1A, **1B**, 1C 2A, **2B**, 2C, 2D 5A 6A[A], 6B[A], 6C[A], 6D[A] **7A[A]**, 7B[A], 7C[A], 7D[A] 8A[A], 8B[A], 8C[A], 8D[A] 9A, 9B **10A[A],**10B[A], 10C[A], 10D[A], 10E[A]	**Negative in short term** for Butterfish; **Positive** in long term - sustainable stock sizes for all SMB species are anticipated; (Butterfish would be addressed in Amendment 10)	**3B** 4B 5B, 5C, **5D[<]** 6B[B<], 6C[B<], 6D[B>] 7B[B<], 7C[B<], 7D[B<] 8B[L<], 8C[L<], 8D[L<] 10B[B], 10C[B], 10D[B], 10E[B]	**More Positive than baseline** – measures to control fishing effort would further stabilize stocks for SMB species and improve habitat quality (Butterfish measures would be further addressed in Amendment 10)	3A 4A 6A[B] **7A[B <]**, 7C[I <], 7D [I <] 8A[L] **10A[B]**	**Negative** - decreased stock biomass, increased risk of overfishing
Non-Target Species	1A, **1B**, 1C **2B**, 2D 3A, **3B** 5A 6A 8A 9A, 9B **10A**	**Negative in short term** - Increased bycatch rates would continue until reduction measures are implemented **Positive** – Long term reduced bycatch, improved bycatch accounting, improved habitat quality	4B 5B, 5C, **5D[<]** 6B, 6C, 6D 7B[<], 7C[<], 7D[<] 8B[<], 8C[<], 8D[<] 10B, 10C, 10D, 10E	**Positive** – measures to control fishing effort would reduce bycatch mortality and improve habitat quality	2A, 2C 4A **7A[<]**	**Negative short term** –elevated bycatch rates would continue until Amendment 10 reduce bycatch **More Positive in long term** after Amendment 10 is implemented

Table 101 (continued). Summary cumulative effects for the management actions proposed in Amendment 9. The cumulative effects (shaded columns) are the sum of the Refer to Table 70 for the rationale behind the positive, negative, or neutral impacts from the proposed actions.

Habitat	1A, **1B**, 1C **2B**, 2D 3A, **3B** 5A 6A **7A**, 7B 8A 9A, 9B **10A**	**Positive** - reduced habitat disturbance by fishing gear and non-fishing actions	4B 5B, 5C, **5D**[<] 8B[<], 8C[<], 8D[<] 10B[<+], 10C[<+], 10D[<+], 10E[+<]	**Positive** - measures to control fishing effort and closed areas would further reduce habitat disturbance by fishing gear	2A, 2C 4A 6B[<], 6C[<], 6D[<] 7C[<], 7D[<] 10B [< --], 10C[< --] , 10D[< --], 10E[< --]	**Negative** - increased habitat disturbance by fishing gear and non-fishing actions
Protected Resources	1A, **1B**, 1C **2B**, 2D 3A, **3B** 5A 6A **7A**, 7B 8A 9A, 9B **10**[a]	**Negative or low negative in short term** -- Until Trawl TRP is implemented **Positive** – reduced gear encounters through effort reduction and Trawl TRP, Sea Turtle Strategy; improved habitat quality	4B 5B[<], 5C, **5D**[<] 8B[<], 8C[<], 8D[<] 10B[<+], 10C[<+], 10D[<+], 10E [<+]	**Positive** - measures to control fishing effort and closed areas would reduce gear encounters, improve habitat quality; anticipated Trawl PRP should further reduce takes	2A, 2C 4A 6B[<], 6C[<], 6D[<] 7C[<], 7D[<] 10B[< --], 10C[< --], 10D[< --], 10E[< --]	**Negative in short term** - increased gear encounters would continue **Positive in long term** – anticipated Trawl TRP should reduce the negative impact of encounters
Human Commun-ities	1A **2B**, 2D 3A, **3B** 5A, **5D** 6A **7A** 8A 9A **10**[a]	**Short-term negative** lower revenues would continue until stocks are fully rebuilt **Long-term positive** sustainable resources should support viable communities and economies	**1B**, 1C 4B 8B[I], 8C[I], 8D[I<]	**Negative** revenues in short term due to effort reductions to reduce fishing mortality **Positive** revenues in long term – sustainable resources should support viable communities and economies	2A, 2C 4A, 4B 5B[>], 5C[>] 6B[<], 6C[<], 6D 7B[<], 7C, 7D 8B[L], 8C[L], 8D[L<] 9B[<] 10B, 10C, 10D[>], 10E[>]	**Negative** – short term revenue losses pose a threat to the economic viability of fishing communities; **Long-term positive** are likely positive as sustainability in all stocks is achieved

Table 101 (continued). Summary cumulative effects for the management actions proposed in Amendment 9. The cumulative effects (shaded columns) are the sum of the Refer to Table 70 for the rationale behind the positive, negative, or neutral impacts from the proposed actions.

Bolded Items are Preferred Alternatives
^{B} = Effect on Butterfish only
^{L} = Effect on *Loligo* or *Loligo* fishery only
^{I} = Effect on *Illex* or *Illex* fishery only
^{A} = Effect on all other SMB species

$^{+}$ = Positive effect inside GRA
-- = Negative effect outside GRA
< = low positive or low negative effect
> = high positive or negative effect

Note: Positive and negative cumulative impact (in the 2nd or 3rd shaded columns, respectively) is derived from the sum of the CEA baseline (1st shaded column) with the positive or negative direct/indirect effects for the listed alternatives in the unshaded columns. For explanation of the rationale for the expected direct/indirect effects of each alternative, refer back to Table 70.

(10B-E) on three other managed species (exclusive of butterfish) is not clear. A shift in fishing effort may result from the restrictions. However, since landings are controlled by quotas, the overall effect on these species is potentially neutral. With these neutral effects, it is anticipated that the "other" past, present and future actions described above would continue to exhibit positive impacts to the stock sizes of the four species.

Summary of Alternatives with Positive Effects: Implementation of alternatives to: extend the *Illex* moratorium (2B,D), designate EFH for *Loligo* eggs (4B), implement closed areas to protect habitat (5B-D) would have positive cumulative impacts to the four species since these alternatives would have the positive effects of reducing fishing mortality of these species. Revision of the biological reference points for *Loligo* (3B) is also positive since a new F target definition would help better achieve sustainable yield of this species. As mentioned above, measures to modify *Loligo* minimum mesh size (6B-D), exemptions from *Loligo* minimum mesh size requirements for *Illex* vessels (7B-D) and GRAs (10B-E) would have positive cumulative impacts on butterfish due to the reduced catches, but not for the other three species. It is noteworthy here mention the positive cumulative effects of the GRAs to butterfish apply to inside the GRAs. It is anticipated that this might translate to a negative effect outside the GRAs if the fishing effort is shifted in those areas. In addition, implementation of the *Loligo* possession limit for directed *Illex* fishery (8B-D) would have positive cumulative effects on *Loligo*. In all these cases except 4B, the above alternatives, in effect, would further reduce fishing mortality of these species adding to the positive effects of the "other" actions (i.e., CEA baseline). It should be noted here that the incremental benefits (reduced mortality) of closing the Lydonian and Oceanographer Canyons to protect deep coral habitat would be lower due to the low catches in that area.

Summary of Alternatives with Negative Effects: Relative to negative effects to the four species, not extending (2A) or terminating (2C) the *Illex* moratorium would have the effect of reduced ability to monitor quota and constrain fishing effort, reducing the positive effects of the CEA baseline. In addition, not adopting the revised biological reference points (3A) would be negative as the less reliable F target could hinder achieving a long term sustainable fishery. Not designating *Loligo* egg EFH (4A) would provide less oversight over the adverse impact of fishing activities on this life stage, again, reducing the positive effects of the "other" actions. Negative cumulative effects on butterfish would be the result of not adopting the following: modifying *Loligo* minimum mesh size (6A), exemptions from minimum mesh size for *Illex* vessels (7A) and GRAs (10A). In all cases, the latter would increase fishing mortality for this species reducing the positive effects that otherwise continue. In addition, Alternative 7C and 7D would potentially have low negative effects on *Illex* due to slightly increased mortality of the larger mesh sizes. Not implementing the *Loligo* possession limit for directed *Illex* fishery (8A) would have an additional negative cumulative effect on *Loligo* since regulatory discarding would continue without this action.

Of the four species managed through this FMP, butterfish is the only one considered, at present, to be overfished. Recovery of the butterfish stock is currently being constrained by discarding through small mesh bottom otter trawl fishing, primarily in the *Loligo* fishery. Several management options cited above are proposed in this amendment that could improve the condition of the butterfish stock. It is expected that at least one of these measures will be implemented. This should result in improvement of stock status in the short term. Amendment 10 to the FMP is being developed in order to directly address recovery of the butterfish stock. As such, the combination of any management measure in this amendment with those taken through Amendment 10 should promote improvement and long-term sustainability of the butterfish stock and result in positive cumulative impacts.

Management measures in this amendment also have the potential to affect the status of the *Loligo* and *Illex* stocks. For the *Illex* stock, perpetuation of the moratorium on entry into the directed fishery should diminish the potential for overharvest. For *Loligo*, reasonable increases in the closure period possession limit for the *Illex* fishery is expected to decrease regulatory discarding and allow for more accurate accounting of total removals. These actions should produce positive cumulative impacts for these stocks.

The Atlantic mackerel stock is not expected to be greatly impacted by any of the management measures in this amendment. However, the development of Amendment 11, which is currently underway, may establish a moratorium on entry into that fishery. It is unknown at present whether sustainability of the Atlantic mackerel stock is threatened by the capacity of the fleet; however, a moratorium on entry is not expected to negatively impact the stock. The quota monitoring system, already in place, is an effective tool in preventing overfishing. Continued sound management of the Atlantic mackerel stock is associated with positive cumulative impacts.

<u>Non-target Species Impacts</u>

Summary of CEA Baseline: Fishery encounters with non-target species (listed in Table 11A), and the subsequent bycatch mortality remains a ubiquitous fishery management problem. At present, the nature and extent of non-target species discarding by the SMB fisheries, as well as many others operating in the U.S. Atlantic remains difficult to characterize. The sum effect of the “other” actions on non-target species, as described above, are negative in the short term as the bycatch rates would likely continue but generally positive in the long term when future measures are anticipated (e.g., Amendment 10) to reduce such mortality. As mentioned above, non-fishing effects, although potentially negative to all fish species, are likely not exerting much negative effects on non-target species, due to the small scale of the habitat perturbation relative to the populations at large.

Summary of Alternatives with No Effects or Neutral Effects: The proposed alternatives have neutral, positive and negative cumulative effects on these species. It is unlikely that the implementation of multiyear specifications (1A-C), electronic dealer reporting, or the revision of the biological reference points (3A, B) would an effect on the non-target species since the first two are administrative in nature and latter would not impact mortality of these species. Implementing extension of the *Illex* moratorium (2B, D) would also not have any effects on non-target species since the extension would maintain existing discard levels. It is also likely that not implementing the following: closed areas (5A), modifying *Loligo* minimum mesh size (6A), and changing the *Loligo* possession limit for directed *Illex* fishery (8A) and GRAs (!0A) would also not have any effect (positive or negative) on the non-target species. As such, implementation of these alternatives would not change the short term negative and long term positive cumulative effects to these species.

Summary of Alternatives with Positive Effects: A number of alternatives that have positive cumulative effects on managed species would also have positive cumulative effects on non-target species. These include alternatives that would: designate of EFH for *Loligo* eggs (4B), implement closed areas to protect habitat (5B-D), modify *Loligo* minimum mesh size (6B-D), exempt *Loligo* minimum mesh size requirements for *Illex* vessels (7B-D), implement the *Loligo* possession limit for directed *Illex* fishery (8B-D) and develop GRAs (10B-E) would reduce bycatch and thus have positive cumulative impacts to the non-target species. As mentioned above, the positive cumulative effects of the GRA alternatives to these species apply to inside the GRAs since fishing effort would be reduced in these areas. Again, it is anticipated that this might translate to a negative effect outside the GRAs if the fishing effort is shifted in those areas. In all these cases except 4B, the above alternatives, in effect, would further reduce bycatch of these species adding to the positive effects of the "other" actions (i.e., CEA baseline). It should be noted here that the incremental benefits (reduced mortality) of closing the Lydonian and Oceanographer Canyons to protect deep coral habitat would be lower due to the low catches in that area

Summary of Alternatives with Negative Effects: Not extending (2A) or terminating the *Illex* moratorium (2C) would increase fishing effort and thus discards of non-target species. Other alternatives that would have negative cumulative effects include: not modifying the *Loligo* mesh size requirements for *Illex* vessels (7A) would have a minor negative effect on these species since it would not allow for increased escapement of butterfish or other bycatch species. In addition, not designating EFH habitat for would have the potentially negative effects related of less oversight of fishing effects on habitat. These in general would reduce the long term positive benefits to these species that result from the "other" actions.

As mentioned above, it is anticipated that measures to be developed in Amendment 10 to reduce butterfish bycatch and discards also would have indirect benefits of reducing the bycatch of other species. Before these future actions are implemented, measures from this Amendment, such as general effort controls, such as area closures (5D) and the modification of *Loligo* mesh size (6B-6D) would have a positive cumulative effect on these species in the interim period. However, these positive effects may be countered with some preferred measures that have negative effects on butterfish and may apply to some non-target species.

In addition, the development of an omnibus FMP that details standardized bycatch reporting methodology (SBRM) by NOAA Fisheries is expected to occur within the next year or so. Central to the development of the SBRM FMP will be improving the quality and usefulness of the data used in estimating fishery discards and thus provides fishery managers more consistent information for them to base future management measures.

Habitat Impacts

Summary of CEA Baseline: For habitat, the summary effects of past and present actions assessed above in Section 8.4 were considered to be negative. Effort reduction or gear modifications will, in effect, reduce the magnitude of the negative impact on this VEC that results from fishing activities. Again, although the negative effects of past and present actions associated with non-fishing activities (Table 97) may have increased negative effects, it is likely that those actions were minor due to the limited scale of the habitat impact compared with the populations at large. Considering fishing effort reductions over the next 5 years will likely be reduced, a resultant positive impact on habitat of "other" actions is anticipated.

Summary of Alternatives with No Effects or Neutral Effects: The proposed alternatives also have varying levels of cumulative effects on habitat. As with the previous VECs, the alternatives to implement multiyear specifications (Alternative1A-C) and electronic dealer reporting (9A, B) are primarily administrative with no direct/indirect impact to the managed species and therefore would not have any cumulative effects on habitat or the environment. The impacts of extending the *Illex* moratorium (2B, D) would not likely result in changes to bottom disturbance since current trawling effort is maintained and is therefore not likely to contribute to cumulative effects. Likewise, revised biological reference points for *Loligo* (3A, B) would not likely result in changes to bottom disturbance and thus would not have any cumulative effects. If the closure areas to reduce gear impact (5A) were not implemented, fishing activities would continue as they have in the past. Thus, impact with the closures would be neutral and should not contribute cumulative effects. Not implementing an increased *Loligo* minimum mesh size (6A), exemptions from *Loligo* minimum mesh size requirements for *Illex* vessels (7A), implementing the *Loligo* possession limit for directed *Illex* fishery (8A) and the GRAs (10A) would not also have any effects since the lack of these actions would not change fishing effort and thus disturbance to the bottom. Thus, implementation of the above alternatives would not likely have positive or negative cumulative effects on the generally positive cumulative impacts to habitat expected over that timeframe.

Summary of Alternatives with Positive Effects: Several management alternatives exist within this amendment that could protect habitat, including EFH, from the adverse effects of fishing practices. The implementation of any or all of these management alternatives would be expected to have positive localized impacts. Designation of EFH for *Loligo* eggs (4B) would permit use of regulatory tools that could reduce fishing effort and protect habitat. Likewise, closure of the areas to reduce gear impact (5B, C, D) would also protect habitat and positively be reinforced by other measures that reduce fishing effort to have a greater positive cumulative effect. The protection afforded by closure of the preferred Lydonian and Oceanographer Canyons (5D) would contribute less positive cumulative effects than Hudson Canyon (5B) or Tilefish HAPC (5C) since the area in 5D is smaller, only protecting deep corals and other associated species in this habitat, and is not usually fished. Modifying the *Loligo* possession limit for directed *Illex* fishery (8B-D) has potentially low positive impacts since may decrease effort if vessels achieve their harvesting target more quickly. The butterfish GRAs (10 B-E) would have the effect of decreasing fishing effort inside the GRAs and thus reduce bottom disturbance in these areas.

Summary of Alternatives with Negative Effects: In contrast, a number of alternatives would have negative direct/indirect effects to habitat that would reduce the generally positive outlook for habitat over the next few years. Not extending or terminating the Illex moratorium (2A, C) would likely increase effort and bottom disturbances. Not designating EFH for *Loligo* (4A) would also not provide the regulatory tools used by managers to better minimize impacts to habitat. The alternatives that implement an increased *Loligo* minimum mesh size (6B, C, D) also have a low negative contribution to the generally positive cumulative effect since a larger mesh would reduce *Loligo* retention and may, in turn, increase harvest efforts to make up for that reduction. Likewise, alternatives to provide exemptions from *Loligo* minimum mesh size requirements for *Illex* vessels (7C, D) may also increase effort and habitat disturbance for that species.

The implementation of the GRAs (10B-E) may have low negative impacts to habitat outside the GRAs since gear restrictions may shift effort there. This increase may have a minor effect and thus pose only a minor negative contribution to cumulative effects since these outside are already being fished by other fisheries. It remains unclear how much additional effort would be expended outside of any potential area closures if they were to be implemented. The negative economic impacts of area closures may provide a significant incentive to fish more intensively in open areas. If positive habitat impacts are generated through management actions taken through this amendment, it is expected that for some habitat types, sufficient latency in the restoration of habitat quality, even through area closures, may result in a prolonged recovery period.

Overall, the incremental cumulative impacts on habitat provided with this Amendment, although uncertain, generally may be considered positive within the temporal scope of this CEA.

Protected Resource Impacts

Summary of CEA Baseline: For the protected species affected by this Amendment (listed in Section 6.4), the summary effects of the "other" past and present actions assessed above were considered to be negative in the short term but positive in the long term due to future effort reduction or gear modifications. The latter would, in effect, reduce the magnitude of the negative impact on this VEC that results from fishing activities. Future actions are being developed that would directly address reducing the mortality of protected resources that have historic encounters with SMB fisheries. These actions include the formation of the Atlantic Trawl Gear Take Reduction Team and the Strategy for Sea Turtle Conservation for the Atlantic Ocean and the Gulf of Mexico

Fisheries. These actions and the current protection under MMPA and ESA are expected to result in positive cumulative impacts for these protected resources
As with the previous VECs, the proposed alternatives also have varying levels of cumulative effects on protected species. No actions are being taken in this amendment to directly address protected resource issues within the SMB fisheries. A number of the proposed alternatives have no effects, while other alternatives have the potential to indirectly improve or negatively impact, however slightly, the condition of the affected protected species.

Summary of Alternatives with No Effects or Neutral Effects: The alternatives to implement multiyear specifications (Alternative1A-C) and electronic dealer reporting (9A, B) are primarily administrative with no direct/indirect impact to the protected species and therefore would not have any cumulative effects on these species or their habitats. The impacts of extending the *Illex* moratorium (2B, D) would not result in an increase of gear interactions since current trawling effort constraints are maintained and are therefore not likely to contribute to cumulative effects. Revised biological reference points for *Loligo* (3A, B) would not likely result in changes to protected species interactions and thus would not have any cumulative effects. However, it should be noted that, if this alternative increases *Loligo* abundance over the long term, then more species interactions are likely increasing negative cumulative effects. If the closure area to reduce gear impact (5A) were not implemented, fishing activities and thus species interactions would continue as they have in the past. Thus, impact is neutral and should not contribute cumulative effects. Not implementing an increased *Loligo* minimum mesh size (6A), exemptions from *Loligo* minimum mesh size requirements for Illex vessels (7A), implementing the *Loligo* possession limit for directed *Illex* fishery (8A) and the GRAs (10A) also would not have any effects since the lack of these actions would not change fishing effort and thus the potential for species interactions. In general, implementation of the above alternatives would not like have positive or negative cumulative effects on the short term negative and generally positive long term cumulative impacts to protected species.

Summary of Alternatives with Positive Effects: The designation of EFH for *Loligo* eggs (4B) would permit use of regulatory tools that could reduce fishing effort and improve conditions for protected species. Likewise, closure of the areas to reduce gear impact (5B, C, D) would also reduce species interactions within the area. This would positively reinforce other measures that reduce fishing effort to have a greater resultant positive cumulative effect. The protection afforded by closure of the preferred Lydonian and Oceanographer Canyons (5D) would have less positive cumulative effects than Hudson Canyon (5B) or Tilefish HAPC (5C) areas since the area in 5D is smaller in size and little fishing occurs within these areas. Modifying the *Loligo* possession limit for directed *Illex* fishery (8B-D) has potentially low positive impacts since this may decrease effort if vessels achieve their harvesting target more quickly and thus reduce the potential for species interactions. The butterfish GRAs (10 B-E) would have the positive effect of decreasing fishing effort inside the GRAs and thus species interactions in these areas. However, the positive impact would be countered by the potential increase in fishing effort outside the GRAs as a result of the restrictions that may result in increased interaction in those areas (see below).

Summary of Alternatives with Negative Effects: A number of alternatives would have negative direct/indirect effects to protected species that would tend to reduce the generally positive cumulative effects for this VEC over the next few years. Not extending or terminating the *Illex* moratorium (2A, C) would likely increase effort and hence, species interactions. If the EFH for *Loligo* (4A) was not designated, the resulting less oversight of fishing activities could have indirect negative effects on protected species. The alternatives that implement increased *Loligo* minimum mesh size (6B, C, D) also have low negative contributions to the cumulative effect since a larger mesh would reduce *Loligo* retention and may, in turn, increase harvest efforts to make up for that reduction. The increases would potentially increase interactions and counter the positive effects of the reduced interactions. In addition, alternatives to provide exemptions from *Loligo* minimum mesh size requirements for *Illex* vessels (7C, D) may also increase effort and interactions for protected species and add to a negative cumulative effect.

Again, in addition to the positive effects inside the GRAs (10B-E) described above, implementation of the GRAs would have low negative impacts to protected species outside the GRAs since gear restrictions may shift effort there. It remains unclear how much additional effort would be expended outside of any potential area closures if they were to be implemented. The negative economic impacts of area closures may provide a significant incentive to fish more intensively in open areas and thus potentially increase interactions.

<u>Human Communities Impacts</u>

Summary of CEA Baseline: The net effect of past and present "other" actions is considered to be positive in that the fisheries managed under the SMB FMP currently support viable domestic and international market demand. While some short-term economic costs have been associated with effort reductions and gear modifications (see Table 97), economic returns have generally been positive and as such, have tended to make a positive contribution to the communities associated with harvest of these species. In the short-term future (i.e., within the temporal scope of this CEA), costs may occur. This negative impact is expected to be the byproduct of an adjustment to the improved management of the natural resources. In the longer term, positive impacts on human communities should come about as sustainability of natural resources is attained.

Summary of Alternatives with No Effects or Neutral Effects: A number of the proposed alternatives have no effect on the human communities and therefore have no cumulative effect. Not adopting the multiyear specifications (1A) would have no impact since, without this proposal, the specification process would continue as it has in the past. If the alternatives to extend the *Illex* moratorium (2B, D) are implemented, the extensions would help maintain benefits to the fleet and communities that depend on the Illex resource. In addition, the revised biological reference points (3A, B) are not expected to have any effect, since it would not result in a short term change to the *Loligo* quota.

(However, if a reliable F target results in an increased stock, then increased revenues would add positive effects of the community.) In addition, not adopting the closed areas to protect habitat (5A), modification of *Loligo* minimum mesh size (6A), exemptions from *Loligo* minimum mesh size requirements for Illex vessels (7A), *Loligo* possession limit for directed *Illex* fishery (8A) and the butterfish GRAs (10) also would not contribute any cumulative effects, since it would not impact the intensity or distribution of fishing effort and hence revenues. Implementing the Lydonian and Oceanographer Canyons closures (5D) would not have any effects on fishing revenues since very few fishermen fish this area. Thus, revenues should not be affected. The alternatives to implement electronic dealer reporting (9A) would not have any cumulative effects on the human communities since fishermen are not required to purchase vessel monitoring equipment.

Summary of Alternatives with Positive Effects: Relative to positive cumulative effects, implementation of the multiyear specifications (1B, C) would have low positive effect to industry members who could better plan for future operations and lead to better long term revenues. The designation of EFH for *Loligo* eggs (4B) would improve sustainability of the *Loligo* fishery and thus enhance future revenues contributing the positive cumulative effects. (It should be noted that there may be some short term negative effects that result from management actions initiated for the protection of habitat.) In addition, implementation of the *Loligo* possession limit for the directed Illex fishery (8B-D) would have positive cumulative effects on *Illex* fishery with a corresponding negative effect on *Loligo* vessels owners that do not possess a Illex permit (if the quota is prematurely harvested). In general, these alternatives would increase revenues for fishermen and associated businesses in the long term and thus contribute positive cumulative effects to these communities.

Summary of Alternatives with Negative Effects: In contrast, there are a number of alternative that exhibit negative cumulative effects. The alternatives to not extend or terminate the Illex moratorium (2A, C) would have potential negative effects because, if more vessels would land *Illex* at a faster rate, the *Illex* quota could be reached sooner causing an earlier fishing closure and flooding the market which could drive down landing values. This would eventually reduce revenues for the fishermen and associated businesses that depend on the Illex fishery. Not designating EFH for *Loligo* eggs (4A) would provide less oversight of fishing and possibly reduce the long term sustainability of this species. In addition, the designation of this EFH (4B) may have shorter term negative effects on revenues if future measures are implemented to protect this habitat. The implementation of closed areas to protect habitat Hudson Canyon (5B) and the Tilefish HAPC (5C) would have high revenue losses and thus would contribute negative cumulative impacts to communities. The negative effects of Alternative 5C would be more severe than 5B based on the number of affected boats. Alternatives to modifying *Loligo* minimum mesh size (6B-D), exemptions from minimum mesh size for Illex vessels 7B-D, implementing the *Loligo* possession limit for directed Illex fishery 8 B-D and the butterfish GRAs (10B-E) would, in effect, reduce revenues and contribute to negative effects on human communities. The loss of revenue impacts of 6D, 7C, D and 10 D, E are generally more severe than their respective counterparts. These are based on larger mesh sizes for Alternative 6, more time excluded or the discontinued exemption for *Loligo* mesh requirement for Illex fishery (7), and the number of vessels that use the GRAs in Alternatives 10 D and E. Relative to Alternatives 8 B-D, lost revenues are anticipated for *Loligo* vessels who do not possess an *Illex* permit if the quota is prematurely harvested. In these cases, the lost revenues would contribute to lowering the revenues of fishermen and the associated businesses of the affected fisheries. Finally, implementation of the electronic daily reporting (9B) would require vessels owners to purchase and maintain new electronic systems and thus would have a short term low negative impact. The costs relative to gross revenues are minor although the impact would vary with vessel size and revenue. Thus smaller vessels would potentially experience greater impacts in the short term. In the long term, the added costs would contribute little to the overall positive cumulative effect to the fishermen.

In general, the above mentioned alternatives that would increase operating costs or reduce access to a given managed resource would be expected to result in negative short term impacts on human communities. Nevertheless, the long term sustainability of the managed resources and the habitats and ecosystem processes upon which they depend is inextricably connected to the long term sustainability of each of the fisheries. Total cumulative effects on human communities are difficult to characterize because of the complexity of social and economic relationships with the resources, the uncertainty in future market conditions, and the number of choices available to fishery participants. Impacts are not expected to exceed $100 million annually on the economy (significance criteria under E.O. 12866) or $3.5 million on small entities (significance criteria under RFA). Nevertheless, from the perspective of individual stakeholders, the threshold for significance may be much lower, and some individuals may be significantly negatively impacted in the short term. As such, cumulative effects on human communities are expected to be mixed, with potentially negative short term cumulative impacts, but potentially positive cumulative long term impacts.

8.10 Modify and/or and add alternatives that avoid, minimize, or mitigate significant cumulative effects.

This will be done through the Public Hearing Process.

8.11 Monitor the cumulative effects of the selected alternative(s) and adapting management

Monitoring the status of the VECs is an ongoing function of Federal fisheries management. Likewise, adapting management to accommodate changes in future conditions of the VECs will be done through the development of future amendments, or framework adjustments to the FMP.

Table 102. Summary comparison of cumulative effects for Amendment 9 alternatives.

Valued Ecosystem Components (VEC)		Managed Resources	Non-Target Species	Habitat	Protected Species	Human Communities
Baseline Effects without Amendment 9 (includes effects of past, present and reasonably foreseeable future actions)		**Negative in short term** for Butterfish; **Positive** in long term - sustainable stock sizes for all SMB species are anticipated; (Butterfish would be addressed in Amendment 10)	**Negative in short term** - Increased bycatch rates would continue until reduction measures are implemented **Positive** – Long term reduced bycatch, improved bycatch accounting, improved habitat quality	**Positive** - reduced habitat disturbance by fishing gear and non-fishing actions	**Negative or low negative in short term** -- Until Trawl TRP is implemented **Positive** – reduced gear encounters through effort reduction and Trawl TRP, Sea Turtle Strategy; improved habitat quality	**Short-term negative** lower revenues would continue until stocks are fully rebuilt **Long-term positive** sustainable resources should support viable communities and economies
Alt #	**Management Measure/Alternative**	**Relative Incremental Effect Contribution of Amendment 9 Alternatives to Overall Cumulative Effect of Baseline**				
Multi-Year Specifications for Managed Species						
1A	No Action	0	0	0	0	0
1B*	**Allow for specifications for all species up to 3 years**	0	0	0	0	+
1C	Allow for specifications for all species up to 5 years	0	0	0	0	+
Measures to Address Overcapacity of the Directed *Illex* fishery						
2A	No Action	0	--	--	--	--
2B*	**Extend entry moratorium to *Illex* fishery without sunset provision**	0	0	0	0	0
2C	Terminate entry moratorium to *Illex* Fishery	0	--	--	--	--
2D	Extend moratorium without sunset and allow entry through permit transfer	0	0	0	0	0

Table 102 (continued)

Revised Biological Reference Points for *Loligo*						
3A	No Action	--	0	0	0	0
3B*	**Adopt SARC 34 Recommendation**	+	0	0	0	0
Designation of EFH for *Loligo* eggs						
4A	No action	--	--	--	--	--
4B	EFH designation based on documented observations of egg mops	+	+	+	+	+/--
Area Closures to Reduce Gear Impacts to EFH						
5A	No action	0	0	0	0	0
5B	Prohibit fishing with bottom otter trawls in head of Hudson Canyon	+	+	+	+	> --
5C	Prohibit fishing with bottom otter trawls in tilefish HAPC	+	+	+	+	> --
5D*	**Prohibit fishing with bottom otter trawls in Lydonia and Oceanographer Canyons**	< +	< +	< +	< +	0
Modify *Loligo* Minimum Mesh Size						
6A	No Action	--B 0 A	0	0	0	0
6B	Increase minimum codend mesh size to $2^{1/8}$ inches	< + B 0 A	< +	< --	< --	< --
6C	Increase minimum codend mesh size to $2^{1/2}$ inches	< + B 0 A	< +	< --	< --	< --
6D	Increase minimum codend mesh size to 3 inches	>+B 0 A	+	< --	< --	--
Exemptions from *Loligo* Minimum Mesh Size Requirements for *Illex* Vessels						
7A*	**No Action**	< -- B 0 A	< --	0	0	0

Table 102 (continued)

7B	Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding September from current mesh exemption	< + B 0 A	< +	0	0	< --
7C	Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding August and September from current mesh exemption	< + B 0 A < -- I	< +	< --	< --	--
7D	Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels	< + B 0 A < -- I	< +	< --	< --	--
***Loligo* Possession Limit for the Directed *Illex* Fishery during Closure of Directed *Loligo* Fishery**						
8A	No Action – For *Illex* moratorium permitted vessels *Loligo* possession limit is 2500 lb = existing incidental catch allowance	-- L 0 A	0	0	0	0
8B	Possession limit is the greater of 2500 lbs or amount not to exceed 10% of total weight of retained squid to a maximum of 30,000 lbs	< + L 0 A	< +	< +	< +	+ I -- L
8C	Possession limit is the greater of 2500 lbs or amount not to exceed 5% of total weight of retained squid to a maximum of 20,000 lbs	< + L 0 A	< +	< +	< +	+ I -- L
8D	Possession limit is the greater of 2500 lbs or amount not to exceed 10% of total weight of retained squid to a maximum of 10,000 lbs	< + L 0 A	< +	< +	< +	< + I < -- L
Electronic Daily Reporting Requirement for the Directed *Illex* Fishery						
9A	No action	0	0	0	0	0
9B	Require electronic daily reporting in directed *Illex* fishery	0	0	0	0	< --

Table 102 (continued)						
Implementation of Seasonal Gear Restricted Areas (GRA) to Reduce Butterfish Discards						
10A*	**No action**	-- B 0 A	0	0	0	0
10B	Minimum of 3 inch codend mesh size in Butterfish GRA 1	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	--
10C	Minimum of 3 inch codend mesh size in Butterfish GRA 2	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	--
10D	Minimum of $3^{3/4}$ inch codend mesh size in Butterfish GRA 1	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	> --
10E	Minimum of $3^{3/4}$ inch codend mesh size in Butterfish GRA 2	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	> --

Bolded * = Preferred Alternative
0 = No Cumulative Impact
+ = Positive Cumulative Impact
>+ = High Positive; < + = low positive
-- = Negative Cumulative Impact
> -- = High Negative; < -- = low negative
L = *Loligo* only;
B = Butterfish only
I = *Illex* only
A = All other Managed Species

Impact Definitions:
Managed Species, Non-Target species, Protected Species:
Positive: actions that increase stock size
Negative: actions that decrease stock size
Habitat:
Positive: actions that improve or reduce disturbance of habitat

Negative: actions that degrade or increase disturbance of habitat

Human Communities:

Positive: actions that increase revenue and well being of fishermen and/or associated businesses

Negative: actions that decrease revenue and well being of fishermen and/or associated businesses

9.0 CONSISTENCY WITH THE MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT (MSFCMA)

[*TO BE COMPLETED FOR FINAL AMENDMENT 9 DOCUMENT*]

9.1 NATIONAL STANDARDS

Section 301 of the Magnuson-Stevens Fishery Conservation and Management Act requires that fishery management plans (FMPs) contain conservation and management measures that are consistent with the ten National Standards:

In General. – Any fishery management plan prepared, and any regulation promulgated to implement any such plan, pursuant to this title shall be consistent with the…national standards for fishery conservation and management.

(1) Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.

(2) Conservation and management measures shall be based upon the best scientific information available.

(3) To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.

(4) Conservation and management measures shall not discriminate between residents of different States. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.

(5) Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.

(6) Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.

(7) Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

(8) Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.

(9) Conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

(10) Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

9.2 OTHER REQUIRED PROVISIONS OF THE MAGNUSON-STEVENS ACT

[*TO BE COMPLETED FOR FINAL AMENDMENT 9 DOCUMENT*]

Section 303 of the Magnuson-Stevens Fishery Conservation and Management Act contains 14 additional required provisions for FMPs, which are discussed below. Any FMP prepared by any Council, or by the Secretary, with respect to any fishery, shall:

(1) contain the conservation and management measures, applicable to foreign fishing and fishing by vessels of the United States, which are-- (A) necessary and appropriate for the conservation and management of the fishery to prevent overfishing and rebuild overfished stocks, and to protect, restore, and promote the long-term health and stability of the fishery; (B) described in this subsection or subsection (b), or both; and (C) consistent with the National Standards, the other provisions of this Act, regulations implementing recommendations by international organizations in which the United States participates (including but not limited to closed areas, quotas, and size limits), and any other applicable law;

(2) contain a description of the fishery, including, but not limited to, the number of vessels involved, the type and quantity of fishing gear used, the species of fish involved and their location, the cost likely to be incurred in management, actual and potential revenues from the fishery, any recreational interest in the fishery, and the nature and extent of foreign fishing and Indian treaty fishing rights, if any;

(3) assess and specify the present and probable future condition of, and the maximum sustainable yield and optimum yield from, the fishery, and include a summary of the information utilized in making such specification;

(4) assess and specify-- (A) the capacity and the extent to which fishing vessels of the United States, on an annual basis, will harvest the optimum yield specified under paragraph (3); (B) the portion of such optimum yield which, on an annual basis, will not be harvested by fishing vessels of the United States and can be made available for foreign fishing; and (C) the capacity and extent to which United States fish processors, on an annual basis, will process that portion of such optimum yield that will be harvested by fishing vessels of the United States;

(5) specify the pertinent data which shall be submitted to the Secretary with respect to commercial, recreational, and charter fishing in the fishery, including, but not limited to, information regarding the type and quantity of fishing gear used, catch by species in numbers of fish or weight thereof, areas in which fishing was engaged in, time of fishing, number of hauls, and the estimated processing capacity of, and the actual processing capacity utilized by, United States fish processors;

(6) consider and provide for temporary adjustments, after consultation with the Coast Guard and persons utilizing the fishery, regarding access to the fishery for vessels otherwise prevented from harvesting because of weather or other ocean conditions affecting the safe conduct of the fishery;

except that the adjustment shall not adversely affect conservation efforts in other fisheries or discriminate among participants in the affected fishery;

(7) describe and identify essential fish habitat for the fishery based on the guidelines established by the Secretary under section 305(b)(1)(A), minimize to the extent practicable adverse effects on such habitat caused by fishing, and identify other actions to encourage the conservation and enhancement of such habitat;
(8) in the case of a fishery management plan that, after January 1, 1991, is submitted to the Secretary for review under section 304(a) (including any plan for which an amendment is submitted to the Secretary for such review) or is prepared by the Secretary, assess and specify the nature and extent of scientific data which is needed for effective implementation of the plan;

(9) include a fishery impact statement for the plan or amendment (in the case of a plan or amendment thereto submitted to or prepared by the Secretary after October 1, 1990) which shall assess, specify, and describe the likely effects, if any, of the conservation and management measures on-- (A) participants in the fisheries and fishing communities affected by the plan or amendment; and (B) participants in the fisheries conducted in adjacent areas under the authority of another Council, after consultation with such Council and representatives of those participants;

(10) specify objective and measurable criteria for identifying when the fishery to which the plan applies is overfished (with an analysis of how the criteria were determined and the relationship of the criteria to the reproductive potential of stocks of fish in that fishery) and, in the case of a fishery which the Council or the Secretary has determined is approaching an overfished condition or is overfished, contain conservation and management measures to prevent overfishing or end overfishing and rebuild the fishery;

(11) establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery, and include conservation and management measures that, to the extent practicable and in the following priority-- (A) minimize bycatch; and (B) minimize the mortality of bycatch which cannot be avoided;

(12) assess the type and amount of fish caught and released alive during recreational fishing under catch and release fishery management programs and the mortality of such fish, and include conservation and management measures that, to the extent practicable, minimize mortality and ensure the extended survival of such fish;

(13) include a description of the commercial, recreational, and charter fishing sectors which participate in the fishery and, to the extent practicable, quantify trends in landings of the managed fishery resource by the commercial, recreational, and charter fishing sectors;

(14) to the extent that rebuilding plans or other conservation and management measures which reduce the overall harvest in a fishery are necessary, allocate any harvest restrictions or recovery benefits fairly and equitably among the commercial, recreational, and charter fishing sectors in the fishery.

9.3 Essential Fish Habitat Assessment

[*TO BE COMPLETED FOR FINAL AMENDMENT 9 DOCUMENT*]

The Magnuson Stevens Act / EFH Provisions (50 CFR 600.920(e)(3)) requires that any Federal action which may adversely affect EFH must include a written assessment of the affects of that action on EFH. The following EFH Assessment satisfies this requirement.

9.3.1 Description of Proposed Action

This section will summarize the purpose of the proposed action and the principal management measures included in it, with emphasis on those measures that have the potential to affect EFH for managed species

9.3.2 Determination of Habitat Impacts for Selected Measures

This section will summarize the conclusions made regarding the potential of each selected management measure to affect EFH positively, negatively, or not at all.

Non-habitat measures

A summary of the potential habitat benefits of the non-habitat measures considered in this Amendment are listed below in Box 9.3.2.

Box 9.3.2. Summary of non-habitat measures and their expected impacts on EFH.

Management Measure	Impact	Explanation
Multiple year management measures (Alts 1A - 1C)	0	Specifying management measure for one, three or five years should not affect fishing effort.
Illex moratorium (Alts 2A, 2C)	-	Termination of moratorium could result in increased fishing effort.
Illex moratorium (Alts 2A, 2C)	+	Extension of moratorium could constrain expansion of fishing effort.
Loligo overfishing definition (Alts 3A - 3B)	0	Adopting new overfishing definition (or not) will result no change in fishing effort.
Loligo minimum mesh size - no action (Alt 6A)	0	No change in mesh size should result in no change in effort.
Loligo minimum mesh size increase (Alts 6B - 6D)	-	Increase in mesh size could result in no change or slight effort increase.
Illex mesh exemption (Alts 7A - 7B)	0	Alternatives 7A, 7B should not affect effort in *Illex* fishery.
Illex mesh exemption (Alts 7C - 7D)	-	Alternatives 7C, 7D may increase effort in *Illex* fishery.
Loligo possession limit for *Illex* vessels - no action (Alt 8A)	0	Should be neutral with respect to habitat.
Increased *Loligo* possession limit for *Illex* vessels (Alts 8BG - 8D)	+	Alternatives 8B-8D may decrease effort in *Illex* fishery.
Electronic daily reporting for *Illex* vessels (Alts 9A - 9B)	0	No change in effort in *Illex* fishery.
Butterfish gear restricted areas - no action (Alt 10A)	0	No change in effort in fishery effort.
Butterfish gear restricted areas(Alts 10B - 10E)	+/-	Mixture of decreased effort within GRAs and increased effort outside GRAs

9.3.3 Measures to Avoid, Minimize, or Mitigate Adverse Impacts of this Action

This section will highlight selected management measures which are specifically designed to avoid, minimize or mitigate adverse impacts on EFH (EFH measures). This section will also make conclusions regarding weather or not these measures minimize or continue to minimize the adverse habitat impacts of the fishery to the extent practicable.

Habitat measures

A summary of the potential habitat benefits of the habitat measures considered in this Amendment are listed in Box 9.3.3.

Box 9.3.3. Summary of habitat measures and their expected impacts on EFH.

Management Measure	Impact	Explanation
Loligo Egg EFH Designation, EFH Area Closures - no action (Alts 4A, 5A respectively)	-	Would not directly or indirectly provide a means for reducing damage to habitat
Loligo egg EFH designation (Alt 4B)	+	Would permit use of regulatory tools to protect areas from non-fishing impacts
EFH closure - head of Hudson Canyon (Alt 5B)	+	Reduction of fishing effort in area closed to SMB bottom trawls should reduce localized damage to EFH
EFH closure - Tilefish HAPC (Alt 5C)	+	Reduction of fishing effort in area closed to SMB bottom trawls should reduce localized damage to EFH
EFH closure - Lydonia and Oceanographer Canyons (Alt 5D)	+	Reduction of fishing effort in area closed to SMB bottom trawls should reduce localized damage to EFH

9.3.4 Determination of Habitat Impacts of this Action

This section will state the expected overall effect of the proposed action on EFH. Conclusions will be made regarding the impact of the action as a whole, or the net effect of all management measures together on EFH. This section will conclude that the proposed action: 1) has no adverse impact, or 2) has an adverse impact that is only minimal and temporary in nature, or 3) has an adverse impact that is more than minimal and not temporary in nature.

10.0 RELATIONSHIP TO OTHER APPLICABLE LAW

10.1 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

10.1.1 Introduction

[*TO BE COMPLETED FOR FINAL AMENDMENT 9 AND FSEIS DOCUMENT*]

10.1.2 Determination of Significance

[*TO BE COMPLETED FOR FINAL AMENDMENT 9 AND FSEIS DOCUMENT*]

10.1.3 List of Preparers

This document was prepared by the Mid-Atlantic Fishery Management Council staff and other members of the Amendment 9 Fishery Management Action Team.

SMB Amendment 9 Fishery Management Action Team
James Armstrong, MAFMC Staff, Chair
Jessica Coakley, MAFMC Staff
Dr Chris Moore, formerly MAFMC Staff, currently NMFS HQ
Lisa Hendrickson, NEFSC Population Dynamics
Drew Kitts, NEFSC Social Sciences
Patricia Pinto da Silva, NEFSC Social Sciences
Carrie Nordeen, Eric Dolin, Jen Anderson, Peter Kelliher, Marcy Scott, NMFS NERO

MAFMC SMB Committee
Pete Jensen, Stevensville, MD (Chair)
James Ruhle, Wanchese, NC (Vice-Chair)
Tony Bogan, Brielle, NJ
Laurie Nolan, Montauk, NY
Michelle Peabody, Newport News, VA
Fran Puskas, Barnegat Light, NJ
Phil Ruhle, N. Kingston, RI

10.2 Marine Mammal Protection Act (MMPA)

The MAFMC has reviewed the impacts of Amendment 9 on marine mammals and has concluded that the proposed management actions are consistent with the provisions of the MMPA, and will not alter existing measures to protect the species likely to inhabit the management unit. For further information on the potential impacts of the fishery and the proposed management action on marine mammals, see Section 7.4 of this document.

10.3 Endangered Species Act (ESA)

Section 7 of the Endangered Species Act requires federal agencies conducting, authorizing, or funding activities that affect threatened or endangered species to ensure that those effects do not jeopardize the continued existence of listed species. Using information available at this writing, the MAFMC has concluded that the proposed measures in Amendment 9 are not likely to jeopardize any ESA-listed species or alter or modify any critical habitat, based on the discussion of impacts in this document (Section 7.4).

10.4 Coastal Zone Management Act

[*TO BE COMPLETED FOR FINAL AMENDMENT 9 AND FSEIS DOCUMENT*]

10.5 Administrative Procedures Act

Sections 551-553 of the Federal Administrative Procedure Act establish procedural requirements applicable to informal rulemaking by federal agencies. The purpose is to ensure public access to the federal rulemaking process and to give the public notice and an opportunity to comment before the agency promulgates new regulations.

The Administrative Procedure Act requires solicitation and review of public comments on actions taken in the development of a fishery management plan and subsequent amendments and framework adjustments. Development of this specifications document provided many opportunities for public review, input, and access to the rulemaking process. This document is being developed as part of a multi-stage process that involves review amendment document by affected members of the public. The public has had the opportunity to review and comment on management measures during the SMB Committee Meeting held on March 16, 2005 in Kill Devil Hills, NC and during the MAFMC meeting held on March 15, 2006 in Cape May, NJ. In addition, the public will have further opportunity to comment on this amendment through the 45-day public hearing process, and an additional MAFMC meeting, and again after the NMFS publishes a request for comments notice in the Federal Register (FR).

10.6 Data Quality Act

Utility of Information Product

The proposed document includes: A description of the management issues, a description of the alternatives considered, and the reasons for selecting the preferred management measures, to the extent that this has been done. These actions propose modifications to the existing FMP. These proposed modifications implement the FMP's conservation and management goals consistent with the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) as well as all other existing applicable laws.

This proposed amendment is being developed as part of a multi-stage process that involves review amendment document by affected members of the public. The public has had the opportunity to review and comment on management measures during the SMB Committee Meeting held on March 16, 2005 in Kill Devil Hills, NC and during the MAFMC meeting held on March 15, 2006 in Cape May, NJ. In addition, the public will have further opportunity to comment on this amendment through the 45-day public hearing process, and an additional MAFMC meeting, and again after the NMFS publishes a request for comments notice in the Federal Register (FR)

The Federal Register notice that announces the proposed rule and the implementing regulations will be made available in printed publication and on the website for the Northeast Regional Office. The notice provides metric conversions for all measurements.

Integrity of Information Product

The information product meets the standards for integrity under the following types of documents:

Other/Discussion (e.g., Confidentiality of Statistics of the Magnuson-Stevens Fishery Conservation and Management Act; NOAA Administrative Order 216-100, Protection of Confidential Fisheries Statistics; 50 CFR 229.11, Confidentiality of information collected under the Marine Mammal Protection Act.)

Objectivity of Information Product

The category of information product that applies for this product is “Natural Resource Plans.”

In preparing specifications documents, the Council must comply with the requirements of the Magnuson-Stevens Act, the National Environmental Policy Act, the Regulatory Flexibility Act, the Administrative Procedure Act, the Paperwork Reduction Act, the Coastal Zone Management Act, the Endangered Species Act, the Marine Mammal Protection Act, the Data Quality Act, and Executive Orders 12630 (Property Rights), 12866 (Regulatory Planning), 13132 (Federalism), and 13158 (Marine Protected Areas).

This amendment is being developed to comply with all applicable National Standards, including National Standard 2. National Standard 2 states that the FMP's conservation and management measures shall be based upon the best scientific information available. Despite current data limitations, the conservation and management measures proposed to be implemented under this amendment are based upon the best scientific information available. This information includes NMFS dealer weighout data for 2004, which was used to characterize the economic impacts of the management proposals. These data, as well as the NMFS Observer program database, were used to characterize historic landings, species co-occurrence in the SMB catch, and discarding. The specialists who worked with these data are familiar with the most recent analytical techniques and with the available data and information relevant to the spiny dogfish fishery. Marine Recreational Fisheries Statistical Survey (MRFSS) data were used to characterize the recreational fishery for this species.

The policy choices (i.e., management measures) proposed to be implemented by this specifications document are supported by the available scientific information and, in cases where information was unavailable, proxy reference points are based on observed trends in survey data. The management measures contained in the specifications document are being designed to meet the conservation goals and objectives of the FMP, and prevent overfishing and rebuild overfished resources, while maintaining sustainable levels of fishing effort to ensure a minimal impact on fishing communities.

The supporting materials and analyses used to develop the measures in the amendment are contained in the amendment document and to some degree in previous amendments and/or FMPs as specified in this document.

The review process for this amendment involves the Mid-Atlantic Fishery Management Council, the Northeast Fisheries Science Center, the Northeast Regional Office, and NOAA Fisheries headquarters. The Center's technical review is conducted by senior level scientists with specialties in population dynamics, stock assessment methods, demersal resources, population biology, and the social sciences. The Council review process involves public meetings at which affected stakeholders have opportunity to provide comments on the specifications document. Review by staff at the Regional Office is conducted by those with expertise in fisheries management and policy, habitat conservation, protected species, and compliance with the applicable law. Final approval of the specifications document and clearance of the rule is conducted by staff at NOAA Fisheries Headquarters, the Department of Commerce, and the U.S. Office of Management and Budget.

10.7 Paperwork Reduction Act

The Paperwork Reduction Act (PRA) concerns the collection of information. The intent of the PRA is to minimize the Federal paperwork burden for individuals, small businesses, state and local governments, and other persons as well as to maximize the usefulness of information collected by the Federal government. There are no changes to the existing reporting requirements previously approved under this FMP for dealer reporting, however, electronic daily reporting is proposed for *Illex* moratorium permitted vessels under alternative 9A. Nevertheless, this amendment does not contain a collection-of-information requirement for purposes of the Paperwork Reduction Act.

10.8 Impacts Relative to Federalism/E.O. 13132

This amendment does not contain policies with federalism implications sufficient to warrant preparation of a federalism assessment under Executive Order (EO) 13132.

10.9 Environmental Justice/E.O. 12898

This EO provides that “each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.” EO 12898 directs each Federal agency to analyze the environmental effects, including human health, economic, and social effects of Federal actions on minority populations, low-income populations, and Indian tribes, when such analysis is required by NEPA. Agencies are further directed to "identify potential effects and mitigation measures in consultation with affected communities, and improve the accessibility of meetings, crucial documents, and notices."

The alternatives in this amendment are not expected to significantly affect participation in the SMB fisheries. Since the amendment represents no changes relative to the current level of participation in this fishery, no negative economic or social effects are anticipated as a result (section 7.5). Therefore, the proposed action under the preferred alternatives is not expected to cause disproportionately high and adverse human health, environmental or economic effects on minority populations, low-income populations, or Indian tribes.

10.10 Regulatory Flexibility Act/E.O. 12866

10.10.1 Regulatory Impact Review and Initial Regulatory Flexibility Analysis (IRFA)

This section provides the analysis and conclusions to address the requirements of Executive Order 12866 and the Regulatory Flexibility Act (RFA). Since many of the requirements of these mandates duplicate those required under the Magnuson-Stevens Act and NEPA, this section contains references to other sections of this document. The following sections provide the basis for concluding that the proposed actions are not significant under E.O. 12866 and will not have a significant economic impact on a substantial number of small entities under the RFA.

10.10.2 Description of Management Objectives

The goals and objectives of the management plan for the SMB resources are stated in Section 4.3 of this document. The proposed actions are consistent with, and do not modify those goals and objectives.

10.10.3 Description of the Fisheries

Section 6.1 of this document contains a detailed description of the fisheries managed under this FMP.

10.10.4 Statement of the Problem

The purpose and need for this action is identified in Section 4.1 of this document. The need for this amendment is to address problems and issues that have arisen since, or as a result of the latest amendment to the FMP (Amendment 8). The purpose of this amendment is to achieve the management objectives of the Atlantic mackerel, squid and butterfish FMP as outlined in Section 4.2, as well as to evaluate measures that would protect EFH and reduce bycatch and discards, incorporate new scientific advice from the *Loligo* stock assessment, consider a multi-year specification setting process and the moratorium on entry into the directed *Illex* fishery.

10.10.5 Description of the Alternatives

There are 33 alternatives being considered in this amendment. These are fully described in Section 5.0 of this document, and are also listed below.

Multi-year specifications for all species managed under the FMP

Alternative 1A: No action (Specify management measures for *Illex*, Atlantic mackerel and butterfish annually, and specify management measures for *Loligo* for up to three years)

Alternative 1B: Allow for specification of management measures (including quota specifications) for all four species in the management unit for a period of up to three years (Council's Preferred Alternative)

Alternative 1C: Allow for specification of management measures (including quota specifications) for all four species in the management unit for a period of up to five years

Expiration of the moratorium on entry to the directed *Illex* fishery

Alternative 2A: No action (The moratorium on the issuance of *Illex* permits expires July 1, 2009)

Alternative 2B: Extend the moratorium on entry to the *Illex* fishery without sunset provision (Council's Preferred Alternative)

Alternative 2C: Terminate the moratorium on entry to the *Illex* fishery

Alternative 2D: Extend the moratorium on entry to the *Illex* fishery without sunset provision and allow new entry into fishery through permit transfer system

Revised biological reference points for *Loligo pealeii*

Alternative 3A: No action (Maintain the status quo definitions for the F_{target} and $F_{threshold}$ biological reference points for *Loligo pealeii*)

Alternative 3B: Adopt SARC 34 Recommendation for the F_{target} and $F_{threshold}$ biological reference points for *Loligo pealeii* (Council's Preferred Alternative)

Designation of EFH for *Loligo* eggs

Alternative 4A: No action (No designation of *Loligo* EFH)

Alternative 4B: EFH designation based on documented observations of egg mops

Area closures to reduce gear impacts on EFH

Alternative 5A: No Action (No new areas closed to fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls)

Alternative 5B: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in the area surrounding the head of the Hudson Canyon

Alternative 5C: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in tilefish HAPC

Alternative 5D: Prohibit fishing for Atlantic mackerel, squid, and butterfish with bottom otter trawls in Lydonia and Oceanographer Canyon (Council's Preferred Alternative)

***Loligo* minimum mesh size requirements**

Alternative 6A: No Action (Maintain 1 $^{7/8}$ inch minimum codend mesh requirement)

Alternative 6B: Increase minimum codend mesh size to 2$^{1/8}$ inches

Alternative 6C: Increase minimum codend mesh size to 2$^{1/2}$ inches

Alternative 6D: Increase minimum codend mesh size to 3 inches

Exemptions from *Loligo* minimum mesh requirements for *Illex* vessels

Alternative 7A: No Action (*Illex* vessels are exempt from *Loligo* minimum mesh requirements in the months of June – September - Council's Preferred Alternative)

Alternative 7B: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding month of September from current mesh exemption for *Illex* fishery

Alternative 7C: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding months of August and September from current mesh exemption for *Illex* fishery

Alternative 7D: Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels

***Loligo* possession limit for the directed *Illex* fishery during closure of the directed *Loligo* fishery**

Alternative 8A: No Action (For *Illex* moratorium permitted vessels, the *Loligo* possession limit during closures of the directed *Loligo* fishery is consistent with the incidental catch allowance for all vessels – currently 2,500 pounds)

Alternative 8B: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of retained squid catch onboard, with a maximum limit of up to 30,000 pounds of *Loligo*

Alternative 8C: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 5% of the total weight of retained squid catch onboard, with a maximum limit of up to 20,000 pounds of *Loligo*

Alternative 8D: For *Illex* moratorium permitted vessels, the *Loligo* possession during closures of the directed *Loligo* fishery is the greater of either 2,500 pounds of *Loligo* or an amount not to exceed 10% of the total weight of retained squid catch onboard, with a maximum limit of up to 10,000 pounds of *Loligo*

Requirement for electronic daily reporting in the directed *Illex* fishery

Alternative 9A: No Action (No requirement for electronic daily reporting in the directed *Illex* fishery)

Alternative 9B: Require electronic daily reporting in the directed *Illex* fishery

Seasonal gear restricted areas (GRAs) to reduce butterfish discards

No Action (No butterfish GRAs - Council's Preferred Alternative)

Alternative 10B: Minimum of 3 inch codend mesh size in Butterfish GRA1

Alternative 10C: Minimum of 3 inch codend mesh size in Butterfish GRA2

Alternative 10D: Minimum of $3^{3/4}$ inch codend mesh size in Butterfish GRA1

Alternative 10E: Minimum of $3^{3/4}$ inch codend mesh size in Butterfish GRA2

10.10.6 Economic Analysis

The economic impacts of the alternatives in this amendment are discussed in Section 7.5 of this document. For the most part, no significant economic impacts are expected because the alternatives are consistent with the goals of the FMP. Based simply on actual revenue figures there is the potential for total losses up to $7.5 million under Alternatives 10B - 10E. However, given the availability for fishing vessels to employ a number of strategies, these losses will most likely not be fully realized. The economic impacts of Alternative 10B, 10C, 10D, and 10E are discussed in Section 7.5 of this document.

10.10.7 Determination of Significance under E.O. 12866

NMFS Guidelines provide criteria to be used to evaluate whether a proposed action is significant. A significant regulatory action means any regulatory action that is likely to result in a rule that may:

1. *Have an annual effect on the economy of $100 million or more, or adversely effect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local or tribal governments or communities.*

The proposed actions are not expected to have an effect on the economy in excess of $100 million. The proposed actions are not expected to have any adverse impacts on the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local or tribal governments or communities.

2. *Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency.*

The proposed actions will not create a serious inconsistency with or otherwise interfere with an action taken or planned by another agency. No other agency has indicated that it plans an action that will interfere with the SMB fisheries in the EEZ.

3. *Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof.*

The proposed action will not materially alter the budgetary impact of entitlements, grants, user fees or loan programs, or the rights and obligations of their participants.

4. *Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.*

The proposed action does not raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in E.O. 12866.

10.10.8 Initial Regulatory Flexibility Analysis

The following sections contain analyses of the effect of the proposed action on small entities. Under Section 603(b) of the RFA, each initial regulatory flexibility analysis is required to address:

1. Reasons why the agency is considering the action,
2. The objectives and legal basis for the proposed rule,
3. The kind and number of small entities to which the proposed rule will apply,
4. The projected reporting, record-keeping and other compliance requirements of the proposed rule, and
5. All Federal rules that may duplicate, overlap, or conflict with the proposed rule.

10.10.9 Reasons for Considering the Action

The purpose and need for this action is identified in Section 4.1 of this document. The need for this amendment is to address problems and issues that have arisen since, or as a result of the latest amendment to the FMP (Amendment 8). The purpose of this amendment is to achieve the management objectives of the Atlantic mackerel, squid and butterfish FMP as outlined in Section 4.2, as well as to evaluate measures that would protect EFH and reduce bycatch and discards, incorporate new scientific advice from the *Loligo* stock assessment, consider a multi-year specification setting process and the moratorium on entry into the directed *Illex* fishery.

10.10.10 Objectives and Legal Basis for the Action

Amendment 9 is being developed in accordance with the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) and the National Environmental Policy Act (NEPA), the former being the primary domestic legislation governing fisheries management in the U.S. Exclusive Economic Zone (EEZ). In 1996, Congress passed the Sustainable Fisheries Act (SFA), which amended and reauthorized the MSFCMA and included a new emphasis on precautionary fisheries management. New provisions mandated by the SFA require managers to end overfishing and rebuild overfished stocks within specified time frames, minimize bycatch and bycatch mortality to the extent practicable, and identify and protect essential fish habitat (EFH). This draft amendment and draft supplemental environmental impact statement (DSEIS) presents and evaluates management alternatives and measures to achieve specific goals and objectives for the Atlantic mackerel, squid and butterfish fisheries (Section 4.0). The associated document was prepared by the Mid-Atlantic Fishery Management Council (Council) in consultation with the National Marine Fisheries Service (NMFS, NOAA Fisheries).

10.10.11 Description and Number of Small Entities to Which the Rule Applies

Most of the potentially affected businesses are considered small entities under the standards described in NOAA Fisheries guidelines because they have gross receipts that do not exceed $3.5 million annually. A discussion of vessel characteristics is given in Section 7.5 of this document.

10.10.12 Recordkeeping and Reporting Requirements

Most of the proposed actions do not introduce any new reporting, recordkeeping, or other compliance requirements. Alternative 9B would establish a requirement for electronic daily reporting by *Illex*-moratorium permitted vessels. The economic impacts of that alternative are discussed in Section 7.5.9.

10.10.13 Duplication, Overlap, or Conflict with Other Federal Rules

The proposed action does not duplicate, overlap or conflict with any other Federal rules.

10.10.14 Economic Impacts on Small Entities

Section 7.5 of this document contains the economic analysis of the alternatives that are being considered in this amendment.

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