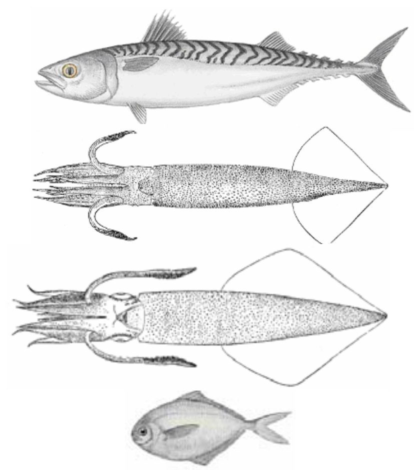
AMENDMENT 10
TO THE
ATLANTIC MACKEREL, SQUID, AND BUTTERFISH
FISHERY MANAGEMENT PLAN

(Includes Draft Supplemental Environmental Impact Statement and Essential Fish Habitat Assessment)



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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

1.1 INTRODUCTION

<u>Amendment Purposes</u>: The two purposes of Amendment 10 to the Atlantic Mackerel, Squid, and Atlantic Butterfish Fishery Management Plan (MSB FMP) are to:

1) develop a rebuilding program that allows the butterfish stock to rebuild in the shortest amount of time possible (but not to exceed ten years) and permanently protects the long-term health and stability of the rebuilt stock; and

2) generally minimize bycatch and the fishing mortality of unavoidable bycatch, to the extent practicable, in the squid, Atlantic mackerel, and butterfish (SMB) fisheries;

<u>Potential Management Actions</u>: Four proposed management measures (each of which is a set of alternatives) address the purposes of Amendment 10. Because the *Loligo* fishery accounts for the majority of butterfish mortality (mainly from discards), and because within the SMB fisheries *Loligo* has the most discards in general, most of the proposed management actions are focused on reducing discards in the *Loligo* fishery. Since discarding is the primary source of butterfish fishing mortality, the two Amendment 10 purposes, rebuilding butterfish and general discard reduction, are quite closely linked. The proposed management actions, all of which could affect both purposes, are:

- **<u>Measure 1</u>**: develop **a butterfish mortality cap program for the *Loligo* fishery** or institute a 3 inch minimum codend mesh requirement to allow the butterfish stock to rebuild to B_{MSY} and protect the long-term health and stability of the rebuilt stock. In this document, anytime the language "mortality cap" is used, it refers to a **butterfish mortality cap program for the *Loligo* fishery**.

- **<u>Measure 2</u>**: **increase *Loligo* minimum codend mesh size** to reduce discards of butterfish and other non-target fish;

- **<u>Measure 3</u>**: **eliminate some exemptions for *Illex* vessels from *Loligo* minimum codend mesh requirements** to reduce discards of butterfish and other fish;

- **<u>Measure 4</u>**: **establish seasonal gear restricted areas (GRAs)** to reduce the discarding of butterfish and other non-target fish.

The Executive Summary next addresses: the two purposes of Amendment 10 (butterfish rebuilding- 1.2, and bycatch/bycatch mortality minimization- 1.3); the general approach of Amendment 10 (1.4); the management measures and related alternatives, and their impacts (1.5); concise summaries of the effects of the alternatives (alone and in combination) as related to the two purposes of Amendment 10 (1.6); initial areas of controversy (1.7); a list of actions considered but rejected (1.8); and a discussion of the regulatory basis for this Amendment (1.9).

1.2 PURPOSE 1: BUTTERFISH REBUILDING

Purpose

The first purpose of Amendment 10 is to develop a rebuilding program that allows the butterfish stock to rebuild in the shortest amount of time possible (but not to exceed ten years) and permanently protects the long-term health and stability of the rebuilt stock. The Mid-Atlantic Fishery Management Council (Council) was notified by NOAA's National Marine Fisheries Service (NMFS) on February 11, 2005 that the butterfish stock was designated as overfished. Hence, the primary reason for the development of Amendment 10 is to establish a rebuilding program per the MSA rebuilding provisions, which will allow the butterfish stock to rebuild to B_{MSY} (22,798 mt, i.e. the rebuilding target) in as short a time period as possible (taking into account the status and biology of any overfished stocks, the needs of fishing communities, recommendations by international organizations in which the United States participates, and the interaction of the overfished stock of fish within the marine ecosystem), but not to exceed ten years.

Status of Butterfish

In 2004 the 38th Northeast Regional Stock Assessment Workshop (38th SAW) Stock Assessment Review Committee (SARC) (available at: http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0403/) provided estimates of butterfish fishing mortality and stock biomass estimates through 2002, and determined that butterfish was overfished in 2002 (NEFSC 2004; see Appendix i). Although assessment stock size estimates are highly imprecise (80% confidence interval ranged from 2,600 mt to 10,900 mt), the overfished determination was based on the fact that the 2002 biomass estimate for butterfish (7,800 mt) fell below the threshold level defining the stock as overfished (1/2 Bmsy=11,400 mt). Butterfish discards are estimated to equal twice the annual landings (NEFSC 2004). Analyses have shown that the primary source of butterfish discards is the *Loligo* fishery because it uses small-mesh, diamond-mesh codends (as small as 1 $^{7/8}$ inches minimum mesh size) and because butterfish and *Loligo* co-occur year round. The truncated age distribution of the butterfish stock is also problematic. Historically, the stock was characterized by a broader age distribution and the maximum age was six years. The lifespan is now three years (NEFSC 2004). The truncated age structure results in reduced egg production and the reduced lifespan artificially reduces the mean generation time required to rebuild the stock. Because of the overfished determination, current federal law obligates the Council to develop and implement a stock rebuilding plan.

There is no peer reviewed information available on butterfish abundance in 2008. Recent, unpublished NEFSC survey indices suggest that butterfish relative abundance may have increased in 2006 and 2007. For example, the NEFSC 2007 spring survey indices for butterfish were the second highest by number and the third highest by weight in the 40 year history of the survey time series (but should be interpreted with caution due to the influence of a single very large tow). Also, while abundance indices are certainly one component of assessments, such indices alone do not provide a point estimate of stock size or status determination, and the assessment process is much more complex than just abundance indices. It should also be noted that, historically, the spring and fall survey indices have not tracked each other. Regardless, the 2004 SAW/SARC report is the authoritative reference for stock status and current federal law obligates the Council to develop and implement a stock rebuilding plan until a peer reviewed butterfish stock assessment determines the stock is rebuilt to the B_{msy} level (the next butterfish assessment is scheduled for 2010). Also, even if butterfish abundance levels increased after higher recruitment events, the expected level of discard mortality would also increase under the no action alternative. Therefore, while temporary stock recovery could theoretically occur, the stock could quickly return to an overfished status in the absence of measures to control fishing mortality due to discarding.

1.3 Purpose 2: General Bycatch/Bycatch Mortality Minimization

Purpose

The second purpose of Amendment 10 is to minimize bycatch and the fishing mortality of unavoidable bycatch, to the extent practicable, in SMB fisheries per National Standard 9. Amendment 8 to the Atlantic Mackerel, Squid and Butterfish Fishery Management Plan was found to be deficient relative to National Standard 9 and, a result, Amendment 9 to the FMP was developed (in part) to address these deficiencies. Amendment 10 has three measures that were transferred from Amendment 9 (i.e., *Loligo* minimum codend mesh size, eliminating exemptions from *Loligo* minimum mesh requirements for *Illex* vessels, seasonal gear restricted areas to reduce butterfish discards) which are intended to reduce bycatch and discarding of target and non-target species in the SMB fisheries and bring the FMP into compliance with MSA bycatch requirements. At its June 2007 meeting, the Council chose to remove these three measures from Amendment 9 and incorporate them into Amendment 10. Therefore, each of these measures is given full consideration in this action. Amendment 10 is expected to be implemented soon after Amendment 9 and, as such, no meaningful delay in addressing the bycatch deficiencies in the MSB FMP should occur.

National Standard 9 of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires that conservation and management measures, to the extent practicable, minimize bycatch, and to the extent that bycatch cannot be avoided, minimize the mortality of such bycatch. This of course begs the question of how to define "practicable."

Both NMFS online guide to the 1996 Amendments to the Magnuson-Stevens Act (available at: http://www.nmfs.noaa.gov/sfa/sfaguide/) and responses to comments in the National Standard Guidelines Final Rule published in the Federal Register in 1998 (available at: http://www.epa.gov/fedrgstr/EPA-GENERAL/1998/May/Day-01/g11471.htm) note that there is legislative history suggesting that for the sole purpose of bycatch/bycatch mortality minimization, this provision was intended so that Councils make reasonable efforts to reduce discards, but was neither intended to ban a type of fishing gear nor to ban a type of fishing nor to impose costs on fishermen and processors that cannot be reasonably met. **Note this "reasonable efforts" concept would only apply in relation to general discarding, <u>not</u> butterfish discarding, since butterfish are overfished and must be rebuilt, by current law (see Purpose 1 above).**

The meaning of "practicable" was also discussed in Conservation Law Foundation v. Evans, 360 F.3d 21, 27-28 (1st Cir. 2004). The court stated:

> *…the plaintiffs essentially call for an interpretation of the statute that equates "practicability" with "possibility," requiring NMFS to implement virtually any measure that addresses EFH and bycatch concerns so long as it is feasible. Although the distinction between the two may sometimes be fine, there is indeed a distinction. The closer one gets to the plaintiffs' interpretation, the less weighing and balancing is permitted. We think by using the term "practicable" Congress intended rather to allow for the application of agency expertise and discretion in determining how best to manage fishery resources.*

NMFS has provided additional information on "practicable" in relation to bycatch:

> *What does "to the extent practicable mean"? From a National perspective, there is too much bycatch mortality in a fishery if a reduction in bycatch mortality would increase the overall net benefit of that fishery to the Nation through alternative uses of the bycatch species. In this case, a reduction in bycatch mortality is practicable and the excess bycatch mortality is a wasteful use of living marine resources. In many cases, it may be possible but not practicable to eliminate all bycatch and bycatch mortality (NMFS 2008).*

While neither NMFS nor the Courts appear to have provided perfect clarity on how much bycatch reduction should take place, it seems clear that the biological and economic benefits and costs should be weighed. Unfortunately, it is difficult to precisely quantify many of the biological and economic benefits and costs of measures proposed in this Amendment with the available scientific information. However, from a qualitative perspective, the reader will find the information in Tables E0, E1, and E2 (below) helpful in weighing such benefits and costs. These tables summarize the impact information presented in section 7.

<u>Status of Discarding in the SMB Fisheries</u>

There is significant bycatch/discarding in the SMB fisheries, predominantly in the *Loligo* fishery for species of primary concern. For a summary, see tables 15a and 15b, which list for key species, the proportion of NMFS observer discards accounted for by the directed SMB fisheries. As examples, during 2001-2006, the *Loligo* fishery was responsible for the following in terms of the percentage of all Observer Program Discards: butterfish-68% , scup- 8% , silver hake- 56% , red hake- 31% , spiny dogfish- 10%, striped bass-8%, and summer flounder- 7%.

1.4 AMENDMENT 10 GENERAL APPROACH

This section describes several issues which effectively apply across all alternatives.

Adaptive/Mixed Species Management

Butterfish rebuilding is complicated in several ways. In terms of biology, butterfish natural mortality is high (M=0.8) and butterfish have a short lifespan. In terms of the fisheries involved, discards are estimated to equal twice the annual landings (NEFSC 2004). Analyses have shown that the primary source of butterfish discards is the *Loligo* fishery because it uses small-mesh, diamond-mesh codends (as small as 1 $^{7/8}$ inches minimum mesh size) and because butterfish and *Loligo* co-occur year round. So to rebuild the relatively low value butterfish fishery, management must primarily affect the relatively high value *Loligo* fishery.

To address this complexity, an adaptive/mixed species approach will be used, in that it may make economic sense for the percentage of the ABC allocated to harvest versus discards to vary, perhaps using more butterfish as discards to allow the *Loligo* fishery to operate versus landing more butterfish given the relatively low value of the butterfish fishery. **Total fishing mortality will be constrained within biological limits that facilitate stock rebuilding and maintenance** (via harvest limits and the measures proposed by this Amendment). While the adaptive approach can be implemented through the current specifications process, the concept is important so it is noted in this DSEIS for the reader. The Magnuson-Stevens Act also mandates general minimization of bycatch and bycatch mortality bycatch to the extent practicable. In the case of *Loligo* and butterfish, to the extent practicable could mean that butterfish bycatch is capped at levels that facilitate rebuilding and maintenance of the stock, but most of the fishing mortality for butterfish is from bycatch. For example, currently the ABC is split 1/3 for harvest (500MT) and 2/3 for discards (1000MT) based on discard estimates. As butterfish rebuilds and the ABC increases, the Council, through the annual specifications process may keep this same ratio, or may keep landings low and allocate more of the ABC to discards (so as to allow the *Loligo* fishery to operate). In the annual specifications, analysis will describe the pros and cons of different allocation models and the Council will make a decision on this fundamentally allocative matter. The general goal would be to rationally maximize benefits from the combined use of sustainable *Loligo* and butterfish resources, simply acknowledging the tradeoff that may occur between butterfish DAH and *Loligo* DAH because of the butterfish bycatch in the *Loligo* fishery (i.e. use a mixed-species management approach). Strict limits on directed harvest currently available through the specifications process would control landings harvest and the measures proposed in Amendment 10 would control bycatch/discards.

Regardless of the allocation, in order to rebuild the butterfish stock and maintain it at B_{msy}, a reduction in the amount of butterfish bycatch (and associated discard mortality) and an increase in butterfish recruitment will both be necessary. Increased recruitment will be dependent on environmental conditions and on ensuring the survival of sufficient numbers of spawners. The long term key to success will be having controls in place to limit mortality once good recruitment events occur so as to sustain the butterfish biomass. The Council proposes to set conservative limits for overall butterfish mortality per the fishing mortality rate control rules specified below, and will stay within those limits by the measures proposed in this Amendment.

Determination of ABC

In the rebuilding period, through the current annual specifications process, the Council proposes to set the ABC and DAH at levels well below the level defined by the FMP fishing mortality control rule for when the stock is at or above B_{msy}. Once the stock is determined to be rebuilt, yields will be specified annually according to the fishing mortality control rule currently specified in the FMP (i.e., the yield associated with 75% F_{msy}; Max OY = MSY= 12,175MT). According to the butterfish FMP, ABC can be lower if necessary. The ABC for butterfish during rebuilding will be specified through the annual specification process based on the most recent estimates of stock biomass and the following control rule: ABC will equal **the yield associated with applying a fishing mortality rate of F=0.1 to the most current estimate of stock biomass**. An F of 0.1 facilitates rebuilding according to an auto-regressive (AR1) time-series model developed by the SMB FMAT and reviewed by the MAFMC SSC (see appendix ii). IOY, DAH, and DAP will be established through the same annual specification process as currently occurs. DAH will be the amount available for harvest after discards are accounted for. Stock biomass and overfishing/overfished status will be determined based on the outcome of the SAW/SARC process (next scheduled for 2010). In the absence of a current SAW/SARC stock estimate, butterfish stock biomass will be annually estimated in the specifications process using future NEFSC survey results, and other analyses (observer data, landings data, etc) in a fashion similar to summer flounder (see 5.2 below). The Science and Statistical Committee (SSC) will review the stock biomass estimate and annual quotas. It is anticipated that applying F=0.1 to the estimated biomass will result in ABC specifications in the range of the table below, but if stock was estimated to be lower than anticipated, applying F=0.1 could result in a lower ABC specification. Likewise, if stock was estimated to be higher than anticipated, applying F=0.1 could result in a higher ABC specification than is illustrated in the following table.

Year	ABC Specification (mt)
2009	1500-2000
2010	1500-2000
2011	1500-5000
2012	1500-7200
2013	1500-9000

Incidental limit setting and the process for closing directed butterfish fishing will generally remain the same as in the 2008 specifications. While not yet final, they will likely specify that closure occurs when 80% of the DAH is projected to be taken, at which point all vessels would be subject to a 600 or 250 pound limit depending on when the closure occurred. Incidental limits will likely be 600 or 250 pounds depending on when the directed fishery closes. Final regulations for the 2008 year will be published in the Federal Register.

As stated above, once the stock is determined to be rebuilt, yields will be specified annually according to the fishing mortality control rule currently specified in the FMP (i.e., the yield associated with 75% F_{msy}; Max OY = MSY= 12,175MT). The Council feels the current control rule can be successful in the future because A) there will be some mesh size increase and/or mortality cap program in place, and B) the directed fishery is and will be more strictly limited to account for discard mortality. Currently, when calculating DAH from ABC, it is assumed that 66% of ABC must be assigned to cover discard mortality. In 2001 and 2002 (the last two years we have SAW/SARC information on butterfish abundance) only about 18% of ABC was assigned to cover discard mortality. Future DAH assignments will take all available data into account.

<u>Proposed Rebuilding Timeframe</u>

The Council proposes a five-year butterfish rebuilding program. Time frames of seven and ten years were considered but rejected due to the biology of the butterfish stock (which facilitates relatively rapid rebuilding) and/or because those timeframes would lead to alternatives that are very similar to a five-year program. Time frames of less than five years were rejected due to the needs of fishing communities. A five year time frame balances the Magnuson Stevens Act requirements of rebuilding in a time frame as short as possible, taking into account the status and biology of butterfish, and taking into account the needs of fishing communities. While the rebuilding plan is described over 5 years because it is likely butterfish can be rebuilt in 5 years, some measures to control butterfish discarding will need to be permanent to ensure long term sustainability of the butterfish stock.

Year 1 (2009) of the rebuilding plan will maintain the 2008 annual ABC specification for butterfish at 1,500 mt (landings limited to 500 mt) and could include an increase in the minimum mesh size requirement in the *Loligo* fishery up to 2 3/8 inches (60 mm). In year 1, keeping landings low aids in butterfish rebuilding by restricting directed fishing, and as described below in section 7.1.2, a mesh increase up to 60mm could help to increase the butterfish stock size by increasing escapement of juveniles. However, the key provisions of this rebuilding plan occur in years 2-5.

Years 2-5 (2010-2013) of the rebuilding plan under measure 1 (see below) would institute and maintain either a mixed species management system with a butterfish mortality cap for the *Loligo* fishery that would track *Loligo* landings and butterfish mortality (landings and discards) simultaneously, or a 3 inch minimum mesh requirement. Under the mixed species management program, the directed *Loligo* fishery would be closed when either the *Loligo* quota or the butterfish mortality cap quota (landings + discards) for the *Loligo* fishery is reached, whichever comes first. In this document, anytime the language "mortality cap" is used, it is meant to reference a butterfish mortality cap program for the *Loligo* fishery. The butterfish mortality cap program for the *Loligo* fishery would control the sum of butterfish landings and discards (all sizes) in the *Loligo* fishery so as to facilitate rebuilding and protection of the butterfish stock after it rebuilds.

Also in years 2-5, as an alternative to or in addition to the mixed species approach, the Council could choose alternatives from measures 2-4 (mesh size increases, eliminations of the *Illex* fishery's exemptions to the current *Loligo* mesh requirements, and/or gear restricted areas, as summarized below and detailed in Sections 5 and 7). However, the analysis contained in this DSEIS suggests that as stand alone management actions, measure 1 alternatives (mortality cap or the 3 inch minimum codend mesh requirement) are most likely to be successful in the long run for rebuilding butterfish.

The reader will note that a 3 inch minimum codend mesh requirement for *Loligo* vessels appears twice, as Alternative 1E and Alternative 2E (codend mesh requirements). This is partly an artifact of how the Alternatives were developed though the Council process, and partly because the 3 inch minimum codend mesh requirement and the butterfish mortality cap programs for the *Loligo* fishery are most likely to be effective as stand-alone actions in terms of rebuilding. As such, it is useful to have the 3 inch minimum codend mesh requirement in both the Measure 1 group as well as the Measure 2 group to facilitate comparison with other related Alternatives.

1.5 Summary of Management Measures and Related Alternatives and Their Impacts

Measure 1 **Alternatives Primarily Considered for Implementing a Butterfish Stock Rebuilding Program**

Alternatives:

1A: No action (maintain 2008 butterfish management measures)
1B: Rebuilding program with a permanent butterfish mortality cap and bycatch monitoring of the *Loligo* fishery with the mortality cap distributed to the directed *Loligo* fishery by trimester as follows: trimester 1= 43%; trimester 2=17% and trimester 3=40% (based on the current *Loligo* quota allocation by trimester)
1C: Rebuilding program with a permanent butterfish mortality cap and bycatch monitoring of the *Loligo* fishery with the mortality cap distributed to the directed *Loligo* fishery by trimester as follows: trimester 1= 50%; trimester2=17% and trimester 3=33% (based on recent *Loligo* landings distribution by trimester)
1D: Rebuilding program with a permanent butterfish mortality cap and bycatch monitoring of the *Loligo* fishery with the mortality cap distributed to the directed *Loligo* fishery by trimester as follows: trimester 1= 65.0%; trimester2=3.3% and trimester 3=31.7% (based on bycatch rate method)
1E: Rebuilding program with permanent 3 inches minimum codend mesh requirement for *Loligo* vessels with no butterfish mortality cap implemented in the directed *Loligo* fishery

<u>Problem statement</u>

These actions are being considered primarily to reduce the bycatch and discarding of butterfish and other finfish species in the *Loligo pealeii* fishery, as part of the Magnuson-Stevens Act requirements to rebuild butterfish. This management action is being considered in order to bring the FMP into compliance with the MSRA, which requires the rebuilding of overfished stocks in as short a time period as possible, and under normal circumstances, not to exceed a period of ten years. Rebuilding of the butterfish stock will be dependent upon increases in recruitment (which recently has been poor to intermediate), and reducing discards. Rebuilding is further complicated because the natural mortality of butterfish is high, butterfish have a short lifespan, and fishing mortality is primarily attributed to discards. Results from the most recent stock assessment (NEFSC 2004) indicate that butterfish discards are the primary reason the stock is overfished.

Due to the lack of a market for butterfish and/or low butterfish abundance, there has not been a directed butterfish fishery beginning in 2002 (recent annual landings have been 437 - 544 mt), resulting in the discarding of both butterfish juveniles and adults. In recent years, butterfish recruitment and spawning stock biomass has been below average and age truncation of the stock has also occurred (the oldest butterfish observed in the stock are now three years of age instead of six years of age).

Initial butterfish stock projections (which, like the stock assessment estimates, are likely highly imprecise and are further described in 5.1 and Appendix ii) indicated that with long-term average historical recruitment, the butterfish stock could have rebuilt to slightly above B_{msy} in 2007, but actual recruitment is unknown and has been generally low in recent years. The projections do not represent stock status. Because of the biology of butterfish, average biomass could exceed the B_{msy} level relatively quickly. However, if butterfish abundance levels increase after higher recruitment events, the expected level of discard mortality would also increase under the no action alternative. Therefore, while temporary stock recovery could theoretically occur, the stock could quickly return to an overfished status in the absence of measures to control fishing mortality due to discarding.

Proposed Management Actions

Under Alternatives 1B-D, the directed fishery for butterfish would be limited per the fishing mortality rates specified, and a butterfish mortality cap program for the *Loligo* fishery would be implemented. Since NMFS Observer data show that the majority of butterfish bycatch occurs in the *Loligo* fishery, the Council is only proposing a mortality cap program for the *Loligo* fishery and the cap amount would be 75% of the rebuilding ABC (allocated by *Loligo* trimesters- see appendix v for details). The remaining 25% of the ABC would cover harvest and discard mortality in other fisheries. Excepting a paradigm shift in fishing, controlling butterfish mortality in the *Loligo* fishery will control overall butterfish mortality. The process for closing directed butterfish fishing will generally remain the same as in the 2008 specifications. If the directed butterfish fishery is closed, *Loligo* moratorium vessels and all other vessels would be subject to the closure-related incidental trip limits set in the annual specifications. Council staff, in coordination with the SMB Monitoring Committee will analyze NMFS dealer weighout data and observer program data on an ongoing basis during the annual specification process to determine if the rebuilding program constrains overall mortality. If problems are detected, the SMB Committee will request further analysis and management recommendations through the annual specification process or an amendment or framework as necessary and appropriate.

Since *Loligo* is allocated by trimester, the butterfish mortality cap would also be allocated by trimester. The butterfish mortality cap for the *Loligo* fishery could be allocated based on: the current seasonal allocation of the *Loligo* quota (1B), recent *Loligo* landings (1C), or an alternative butterfish bycatch allocation which takes into account the seasonal allocation of the *Loligo* quota and expected butterfish discard rates by trimester (1D). The directed *Loligo* fishery would close when the pre-specified closure trigger (80%-90% set during the annual specifications process- see **5.3.1**) for the butterfish mortality cap for the *Loligo* fishery for each trimester is harvested. The three mortality cap alternatives would have the same annual quota, so the differences between them are primarily economic- they would primarily affect *when* the directed *Loligo* fishery would close, not overall butterfish mortality.

Tracking of the butterfish mortality cap would parallel tracking of DAH, however butterfish landed **or discarded** by vessels landing more than 2,500 pounds of *Loligo* would count against the butterfish mortality cap for the *Loligo* fishery. Mortality cap landings will be tracked by NMFS Fishery Statistics Office and its quota monitoring program. Discard rates generated though a new observer program (detailed in later sections) will be applied to mortality cap landings of *Loligo* to estimate mortality cap discards. For example, consider we knew that on average, **1** pound of butterfish was discarded per **20** pounds of *Loligo* kept. If **4000** pounds of *Loligo* were kept on a trip, one could estimate that 200 pounds of butterfish were discarded (**4000/20*1 =** 200). When the sum of mortality cap butterfish landings plus mortality cap estimated butterfish discards reaches a specified trigger (described below) in each *Loligo* trimester, the directed *Loligo* fishery would be closed.

Alternatives 1B-D would require the development of a completely new system to monitor and regulate the mortality levels of butterfish in the directed *Loligo* fishery that include: substantially increased observer coverage levels (industry-funded); possible additional vessel trip and catch reporting; and possible changes to dealer catch reporting. A description of the level of sea sampling required to achieve acceptable levels of precision of estimates of total butterfish mortality (landings and discards) in the *Loligo* fishery is given in Appendix iii and the *Loligo* sea sampling protocol is described in Appendix iv. In summary, vessels which intend to participate in the directed *Loligo* fishery would be required to notify NMFS of their intention to make a directed *Loligo* trip and could be required to carry an observer. Vessels that do not notify for a specific trip would not be permitted to possess more than 2,500 pounds of *Loligo* for that trip.

Industry would be required to pay the at-sea portion of this program. The level of coverage necessary to estimate the butterfish bycatch rate in the directed *Loligo* fishery with an acceptable level of precision (30% CV) would require a roughly 5-6 fold increase in observer coverage relative to recent levels of sea sampling by NMFS. In addition to the greatly increased cost to industry, the increased level of observer coverage would substantially increase NMFS administrative costs associated with implementation of the new management system. Another consideration is that regulation of the *Loligo* fishery under this system would be additionally based on a statistical estimate of total butterfish mortality (calculated by NMFS in cooperation with Council staff) in that fishery rather than just the current relatively simple accounting of *Loligo* landings. The statistical estimation procedure would be accompanied by an associated statistical risk that the resulting butterfish mortality estimates are either too high or too low.

Under Alternative 1E, the directed fishery for butterfish would be limited per the fishing mortality rates specified above and in the FMP, and a permanent minimum codend mesh size requirement of 3 inches would be implemented in the *Loligo* fishery (would not include a mortality cap for the *Loligo* fishery feature). The details of a 3-inch codend mesh size measure are described below in measure 2 (codend mesh requirements), but a codend mesh size of 3 inches will likely reduce the discard of most butterfish juveniles and some spawners, thereby increasing spawning stock biomass (assuming effort did not increase in the future so as to offset the effect of the greater rate of escapement of butterfish spawners).

Biological Impact Analysis

As a result of currently unavoidable, year-round butterfish bycatch in the *Loligo* fishery, year-round management measures (i.e., Alternatives 1B-E) would reduce year-round fishing mortality on spawners and juveniles so as to improve the likelihood of increasing recruitment and rebuilding and maintaining the butterfish stock. In the absence of novel bycatch reduction measures, Alternatives 1B-E would need to be permanent so as to protect the long-term health and stability of the butterfish stock. Alternative A, the no action alternative, would not address the discard-related fishing mortality on butterfish.

Butterfish landings are and will be limited by closing the directed fishery once an annual harvest limit is reached. Because the mortality cap program for the *Loligo* fishery places a cap on total mortality in that fishery, it caps discards of butterfish by that fleet which accounts for most butterfish discards. With landings capped, and with discards by the fleet which accounts for most of the discards capped, the most significant sources of human-related butterfish (**all sizes**) mortality will be controlled. This will help increase the spawning stock biomass of butterfish, increasing the probability of high recruitment, and in turn protect future age classes entering the fishery to help perpetuate healthy butterfish populations. Reducing fishing mortality means that when better recruitment occurs, those fish will be protected, which will add to the butterfish stock size. Most of the stock recovery will likely come from increased survival and growth due to discard reductions.

Alternatives 1B-D (butterfish mortality cap for the *Loligo* fishery) are expected to be more effective at rebuilding the butterfish stock than Alternative 1E (increase in minimum mesh requirement to 3 inches) because 1B-D are output based and would control butterfish fishing mortality directly, whereas the effects of the minimum mesh size increases are effort-based and will reduce only a fraction of the butterfish fishing mortality. Effort based restrictions may become relatively ineffective over time (i.e. are "elastic") as fishermen adapt to the new requirements. Under Alternatives 1B-D, butterfish discard mortality in the *Loligo* fishery ceases entirely in the directed *Loligo* fishery once its butterfish mortality cap for the *Loligo* fishery is reached (discard mortality of the other species caught in the *Loligo* fishery also ceases) because directed *Loligo* fishing would be halted. *Loligo* fishery closures during trimester 2 will decrease fishing mortality on mature butterfish during the spawning season. Under Alternative 1E, butterfish discard mortality continues to occur throughout the year.   However, the effectiveness of Alternatives 1B-D is dependent upon the accuracy of the discard monitoring program and may exacerbate the "derby fishery" for *Loligo* (related to the race by individual vessels to maximize *Loligo* catch before the butterfish mortality cap for the *Loligo* fishery is reached - the Coast guard has identified this as a possible vessel safety issue). Since Alternatives 1B-D would close the *Loligo* fishery when a certain amount of butterfish has been discarded, these alternatives limit discards and conserve both butterfish SSB and butterfish juveniles.

Social/Economic Impact Analysis:

The primary reason the mortality cap program for the *Loligo* fishery proposed under alternatives 1B-1D was developed was to give the *Loligo* industry the opportunity to find innovative ways to reduce discards of butterfish that are based on their own initiatives. Industry advisors have indicated on numerous occasions that they are able to prosecute the *Loligo* fishery cleanly with minimal associated bycatch of butterfish. The mortality cap program for the *Loligo* fishery would allow the directed *Loligo* fishery to continue to operate so long as the fishery collectively does not exceed the butterfish mortality cap allocated to it. So the primary benefit to the *Loligo* industry under alternatives 1B-1D is to give the industry the opportunity to find their own solutions to the problems associated with staying within the collective butterfish mortality cap for the *Loligo* fishery. On the other hand however, it is possible that a race to catch *Loligo* before the butterfish mortality cap is reached could in fact exacerbate the derby nature of the *Loligo* fishery.

Economic impacts to the *directed butterfish fishery* in the near term are expected to be minimal because directed fishing for butterfish has been minimal in recent years. The type and number of vessels engaged in the *Loligo* fishery vary by season and any potential economic impacts from implementation of Alternatives 1B-D will vary depending on the amount of butterfish allocated to the mortality cap. The *Loligo* fishery is managed by trimester, so a butterfish mortality cap for the *Loligo* fishery needs to be managed by trimester as well. In comparison to Alternatives 1B-D, implementation of a minimum mesh size increase (Alternative 1E) would affect all *Loligo* fishery participants throughout each trimester. When considering potential economic losses in the *Loligo* fishery due to the proposed action alternatives, one must consider the efficiency losses related to the larger mesh size required under Alternative 1E and the losses related to closing the season due to attainment of the butterfish mortality cap for the *Loligo* fishery prior to the *Loligo* quota being reached, as well as the increased cost burden placed on industry due to the increased level of observer coverage required under Alternatives 1B-1D.

The costs to the *Loligo* industry associated with alternatives 1B-1D are substantial. Increased costs to the industry would result directly from the greatly increased levels of observer coverage necessary to operate the mortality cap system for the *Loligo* fishery. Alternatives 1B-D require that observer coverage in the directed *Loligo* fishery increase to a level sufficient to meet a CV of 30%. Two methods of calculating the number of days needed to meet this requirement resulted in total requirements of 1,087 days and 1,369 days per year. Compared to the historical average of 220 days per year, these represent increases of 867 days and 1,149 days, respectively.

Alternatives 1B-D propose that limited access *Loligo* vessels pay the direct observer cost of these additional days and that the NEFSC Observer Program funds the data management costs. The economic impact analysis in this amendment assumes that the NEFSC Observer Program continues to fund both direct observer costs and data management costs at the historical level of 220 days per year (which may not be the case, depending on future NMFS funding levels and priorities). The total direct observer cost for 867 additional required days is $671,925. The cost for 1,149 days is $890,475. When a vessel is required to take an observer, the cost for that trip would be $775 per day.

Based on recent fishing patterns, if the increased observer costs could be evenly distributed across all directed *Loligo* trips, then the added **average** cost per day fished will be $111 (if 867 additional days are required) or $147 (if 1,149 additional days are required) for all vessels in the fleet. It is important to note that when a vessel is actually required to take an observer, the cost for that trip would be $775 per day (paid by the vessel). Some vessels may not be picked over the course of a year, and some, by chance or because they fish more often, could be selected more than once. The data management costs to the NEFSC Observer Program would be $325,125 for 867 additional days or $430,875 for 1,149 additional days ($375 per day).

In addition to the direct costs to industry of the increased observer coverage, substantial losses in revenue could occur under alternatives 1B-1D due to closures of the *Loligo* fishery resulting from the mortality cap for the *Loligo* fishery being reached prior to the *Loligo* quota allocation being taken. In general, this problem is exacerbated if the mortality cap for the *Loligo* fishery is specified inappropriately relative to actual butterfish stock abundance for a given year (for example, if the mortality cap is specified based on the assumption that the stock is at a low level of abundance but it is actually above B_{msy}). To estimate these potential losses, the three methods (alternatives 1B-1D) for allocating butterfish mortality caps of 1,125 mt, 2,250 mt, and 3,750 mt were evaluated based on estimated bycatch rates in the directed *Loligo* fishery. Three estimates of bycatch rates under low, medium, and high butterfish stock sizes were used to predict how each of the mortality cap scenarios might reduce bycatch. The impact on *Loligo* revenue was evaluated assuming the butterfish to *Loligo* ratio is constant within a trimester.

At a mortality cap for the *Loligo* fishery of 1,125 mt, estimated reductions in bycatch range from 0% per trimester to 76.4% per trimester, depending on how much butterfish are encountered. Estimated annual losses of *Loligo* revenue range from $0 (assuming low bycatch rates are realized) to $15.8 million (assuming high bycatch rates are realized). At a mortality cap for the *Loligo* fishery of 2,250 mt, estimated reductions in bycatch range from 0% per trimester (also more occurrences of zero reductions than at the 1,125 mt level) to 52.8% per trimester. Estimated annual losses of *Loligo* revenue range from $0 to $7.2 million. At a mortality cap for the *Loligo* fishery of 3,750 mt, estimated reductions in bycatch range from 0% per trimester (also more occurrences of zero reductions than at the 2,250 mt level) to 21.3% per trimester. Estimated annual losses of *Loligo* revenue range from $0 to $2.5 million. The ex-vessel value of *Loligo* landings in 2006 was $27.8 million. Obviously, the economic impacts from *Loligo* closures related to the butterfish mortality cap for the *Loligo* fishery are very dependent on the amount of butterfish encountered and on the amount of butterfish allocated to the mortality cap.

The current butterfish assessment describes the estimation of discards as "imprecisely estimated," and likely "underestimated." Higher observer coverage rates will result in better estimates. If increased observer coverage reveals discarding of butterfish to be higher than anticipated, the *Loligo* fishery may close even earlier (because it would hit the cap earlier).

<u>NOTE FOR READERS</u>: Measures 2-4 which are fully described in section 5.3, were originally part of Amendment 9, but the Council deferred them for consideration to Amendment 10. When these issues were under consideration in Amendment 9, the Council chose the "no action" alternative as the preferred alternative for each measure, partly because they were being transferred to Amendment 10. The Council has not yet selected preferred alternatives for these measures in Amendment 10. Measures 2-4 were in Amendment 9 to address bycatch concerns, but since butterfish fishing mortality is primarily related to discards, these measures also now relate to butterfish rebuilding.

Measure 2 — *Loligo* minimum Codend Mesh Size

Alternatives:

2A: No Action (Maintain 1 $^{7/8}$ inch minimum codend mesh requirement)
2B: Increase minimum codend mesh size to $2^{1/8}$ inches (54mm)
2C: Increase minimum codend mesh size to $2^{3/8}$ inches (60mm)
2D: Increase minimum codend mesh size to $2^{1/2}$ inches (64mm)
2E: Increase minimum codend mesh size to 3 inches (76mm)
(all mesh size alternatives represent inside stretched mesh measurements)

<u>Problem Statement</u>

These actions are being considered to reduce the bycatch and discarding of butterfish and other finfish species in the *Loligo pealeii* fishery, as part of the Magnuson-Stevens Act requirements to rebuild butterfish and to minimize bycatch and mortality of unavoidable bycatch to the extent practicable. The problem statement for measure 1 details issues with butterfish rebuilding, so this problem statement focuses on general minimization of bycatch/bycatch mortality.

Of the three primary directed SMB fisheries (i.e. *Loligo*, *Illex*, and Atlantic mackerel; because of market conditions, availability, and regulations, there is currently minimal directed fishing for butterfish), the small-mesh *Loligo* fishery has the highest level of discarding, especially with respect to overfished stocks (e.g., butterfish, which became overfished in 2005, and scup) and stocks that are in the process of rebuilding (e.g. southern silver hake, spiny dogfish). 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-mesh, diamond-mesh codends (a minimum of 1 $^{7/8}$ inches or 48 mm, inside stretched mesh measurement is currently in effect). Other federally managed, commercial species are also discarded in the *Loligo* fishery. During 1997-2000, the *Loligo* fishery was responsible for the following discards in terms of the percentage of all Observer Program discards: butterfish- 56%, scup- 78%, silver hake- 69%, red hake- 48%, spiny dogfish- 12% and little skates- 3%. More recently (and since implementation of the Scup GRAs) during 2001-2006, the *Loligo* fishery was responsible for the following discards in terms of the percentage of all Observer Program Discards: butterfish- 68% , scup- 8% , silver hake- 56% , red hake- 31% , spiny dogfish- 10% and little skates- less than 1%.

Proposed Management Actions

Alternatives 2A-E describe different year round minimum codend mesh (inside stretched) size requirements for the directed fishery for *Loligo* ranging from in 1 $^{7/8}$ inch (no action) to 3 inches.

Biological Impact Analysis

This set of bycatch reduction alternatives has the potential to reduce *Loligo* fishery discards for multiple species on a year-round basis. Alternatives 2B, 2C, 2D, and 2E would reduce year-round discard mortality of species including butterfish, silver hake, red hake, and scup in the *Loligo* fishery. Alternatives 1B-E would need to be permanent to maintain bycatch reductions. Alternative A, the no action alternative, would not address the discard-related fishing mortality on the stocks comprised of these species.

50 % of butterfish are mature at a length of 12cm (4 ¾ inches) (O'Brien et al. 1983). In a pound net, a codend mesh size of 67mm or 2 $^{5/8}$ inches will provide escapement for most juveniles, half of 12cm (4 ¾ inches) individuals (O'Brien et al. 1983 indicates these are half juveniles and half adults), and a portion (less than half) of individuals who are greater than 12cm or 4 ¾ inches (i.e. mostly larger spawners) (Meyer and Merriner 1976). 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 escapements (pers com L. Hendrickson). Therefore, Alternative 2E will reduce the discards of butterfish juveniles and butterfish spawners, thereby increasing spawning stock biomass (assuming future effort did not increase enough to offset the effect of the greater rate of escapement of butterfish). As such, the alternative that will provide the most benefit butterfish SSB and butterfish juveniles (and also silver hake, scup, and red hake) is Alternative 2E, with the other action alternatives providing decreasing degrees of benefit to these species. Since during the period 2001-2006 the *Loligo* fishery was responsible for 56% of all Observer Program discards of silver hake and 8% of the total discards of scup, a codend mesh size increase in the *Loligo* fishery is also likely to aid in rebuilding of the scup and southern silver hake stocks.

There are few published studies of *Loligo pealeii* selectivity. Therefore, the degree to which *Loligo* retention is reduced at the proposed codend mesh size increases is difficult to quantify. Consequently, it is difficult to determine 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). There are studies of other loliginid squid suggesting "loliginid squid are size-selected (by trawl codends) in a similar fashion to fish" (Hastie 1985). However, published studies on *Loligo* growth 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 harvest 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, though studies using captive squid have shown skin and fin damage that occurred during captivity to be a significant source of mortality (Yang et al 1986).

An analysis of unpublished observer data suggests that increasing mesh sizes from 50mm (just above the current minimum of 1 $^{7/8}$ inches) to 55mm (2 $^{1/8}$ inches) would decrease *Loligo* catch rates by 22%, butterfish by 64%, and all other species combined by 35%. These same analyses suggested that increasing mesh sizes from 50mm (just above the current minimum) to 60mm (2 $^{3/8}$ inches) would decrease *Loligo* catch rates by 15%, butterfish by 67%, and all other species combined by 21%. The reader should note the discussion on mesh size measurements in the areas of controversy section below.

<u>*Social/Economic Impact Analysis*</u>*:*

Increasing mesh sizes on *Loligo* vessels will reduce their efficiency at any given point in time, but the degree is difficult to quantify. Also, published studies on *Loligo* growth show that initial efficiency losses should be 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.

Assuming *Loligo* survive escapement earlier in the year, they would be available to the fishery later in the year. 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). If efficiency does declines, fishermen will be faced with higher costs to harvest a given amount of squid, reducing profits. The preceding paragraph described some possible *Loligo* catch rate reductions of increasing mesh size based on NMFS observer data.

Measure 3 — Eliminating Current Exemptions From *Loligo* Minimum Codend Mesh Requirements[1] For *Illex* Vessels

Alternatives:

3A: No Action (*Illex* vessels are exempt from *Loligo* minimum mesh requirements in the months of June – September)
3B: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding month of September from current mesh exemption for *Illex* fishery
3C: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding months of August and September from current mesh exemption for *Illex* fishery
3D: Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels

[1] **Under each of the alternatives described above, the maximum mesh size that would be required in the *Illex* fishery would be 1 7/8 inches (i.e., status quo *Loligo* minimum codend mesh size).**

Problem Statement

These modifications are being considered as a means of reducing discarding of finfish, especially butterfish, by the *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 for the *Illex* fishery. 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 these species can seasonally co-occur, the exemption was established for the offshore area where *Loligo* is less often present. The *Illex* fishery accounted for 7% of the butterfish discards (by weight) recorded by the Observer Program during 2001-2006 and 10% of the butterfish discards (by weight) recorded by the Observer Program during 1997-2000. Butterfish discard **rates** (in terms of the proportion of catch brought on deck and then discarded) are high in the *Illex* fishery - the overall discard rate was 72% during 2001-2006 and 81% during 1997-2000. 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. The *Illex* fishery also accounts for 44% of John Dory Buckler discards observed in the observer program database.

Proposed Management Actions

The measure 3 alternatives would eliminate some or all of the current exemptions from *Loligo* mesh requirement for *Illex* vessels

Biological Impact Analysis

Among the alternatives under consideration, the most beneficial alternative for the butterfish managed resource is 3D, 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. However, as discussed in the codend mesh size increase for the *Loligo* fishery section, there would likely be minimal escapement of butterfish by such a small mesh size increase, and bycatch in the *Illex* fishery is not as big of a mortality factor relative to the *Loligo* fishery.

Due to a rapid increase in the growth rate of *Illex* between June and October, 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 3B) is not likely 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. 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 harvest fishing mortality in the directed fishery is controlled by an annual quota. To the extent that bycatch occurs in the *Illex* fishery (7% of all butterfish discards) and to the extent that this mesh size increase does facilitate escapement, bycatch could be marginally reduced and butterfish spawning stock size could be marginally increased.

Alternative A, the no action alternative, would not address the discard-related fishing mortality on the stocks comprised of these species.

Economic Impact Analysis

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 so significant economic impacts are not expected. Assuming *Illex* survive escapement earlier in the year, they would be available to the fishery later in the year.

Measure 4 **Seasonal gear restricted areas (GRAs) to reduce butterfish discards**

Four alternatives:

4A: **No Action (No butterfish GRAs)**
4B: Butterfish GRA1 (minimum codend mesh of 3 inches from January 1 through April 30 in effective area accounting for 50% of bottom otter trawl discards with mesh sizes less than 3.0 inch mesh)
4C: Butterfish GRA2 (minimum codend mesh of 3 inches from January 1 through April 30 in effective area accounting for 90% of bottom otter trawl discards with mesh sizes less than 3.0 inch mesh)
4D: Butterfish GRA3 (minimum codend mesh of $3^{3/4}$ inches from January 1 through April 30 in effective area accounting for 50% of bottom otter trawl discards with mesh sizes less than $3^{3/4}$ inch mesh)
4E: Butterfish GRA4 (minimum codend mesh of $3^{3/4}$ inches from January 1 through April 30 in effective area accounting for 90% of bottom otter trawl discards with mesh sizes less than $3^{3/4}$ inch mesh)

(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 bottom trawl fisheries, particularly during January through April, and is associated with areas of high small-mesh trawl fishing effort. Data from the Observer Program show that, in addition to butterfish and the other species managed through this FMP, SMB trawl fisheries are associated with discards of silver hake, red hake, scup, spiny dogfish, spotted hake, Atlantic herring, and blueback herring. Butterfish, scup, spiny dogfish and silver hake are in the process of rebuilding. By establishing time/area gear restrictions on bottom otter trawling, bycatch and discards of butterfish and other overfished finfish species could be reduced.

Proposed Management Actions

Four time/area gear restrictions (GRAs) are under consideration in Amendment 10. Within a given GRA, a minimum effective codend mesh (stretched measure) would be established from January 1 through April 30 for all bottom otter trawling. Specifically, the alternative GRAs are associated with either 50% or 90% of estimated butterfish discards from bottom otter trawls using < 3 or < 3.75 inch codend mesh within the specified time period – hence the four possible combinations. Note that the GRAs account for these percentages of discards by specified mesh during the period January 1-April 30 (not overall discards).

Biological Impact Analysis

Within the proposed GRAs, implementation of any of the action alternatives will reduce discards and discard mortality for juvenile and SSB butterfish and other species that are discarded in the small-mesh fisheries. These other species include the overfished stocks of scup, spiny dogfish and the southern stock of silver hake. Alternative A, the no action alternative, would not address the discard-related fishing mortality on the stocks comprised of these species. At the current time, the proposed GRAs would work in combination with the existing scup GRA (not established under this FMP) which is in effect from January 1 through March 15 (minimum mesh = 4.5 inches) and is positioned south of the proposed GRAs along the shelf break. Among the action alternatives, those with a minimum mesh of 3.75 inches (D and E) will provide greater probabilities of escapement for finfish than those with a minimum mesh of 3 inches. Additionally, the GRAs with the larger mesh size are associated with a greater probability of escapement by larger reproductively mature butterfish.

The GRAs will not comprehensively solve the issue of small-mesh fishery discarding of butterfish. According to NEFSC surveys, butterfish distribution is widespread along the shelf break during their effective period. Because the GRAs are of limited temporal and geographic scope, shifts in the spatial distribution of small-mesh fishing effort (particularly in the *Loligo* fishery) may simply 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. In addition, fishing within the GRAs with codend mesh sizes greater than 3.0 or 3.75 inches will still be permitted and discarding (albeit less) will still occur. The GRAs cover the areas responsible for approximately 16%-36% of all bottom otter trawl discards of butterfish. Realized reductions in discards will likely be less than these amounts because of likely increased effort in the GRAs with sizes above the minimum mesh size required in the GRA and also because of increased effort outside of the GRAs.

MAFMC staff also examined the observer data base's 2002-2006 (most recent 5 years) observations of butterfish discards by gear using less than 76 mm (3 inches) mesh in inshore areas during the spawning season (June through August) (see blue area in figure E1). These discards accounted for approximately only 3% by weight of total 2002-2006 NMFS observer program observed butterfish discards. The blue area accounted for almost all inshore butterfish discard observations for this time-space-gear combination.

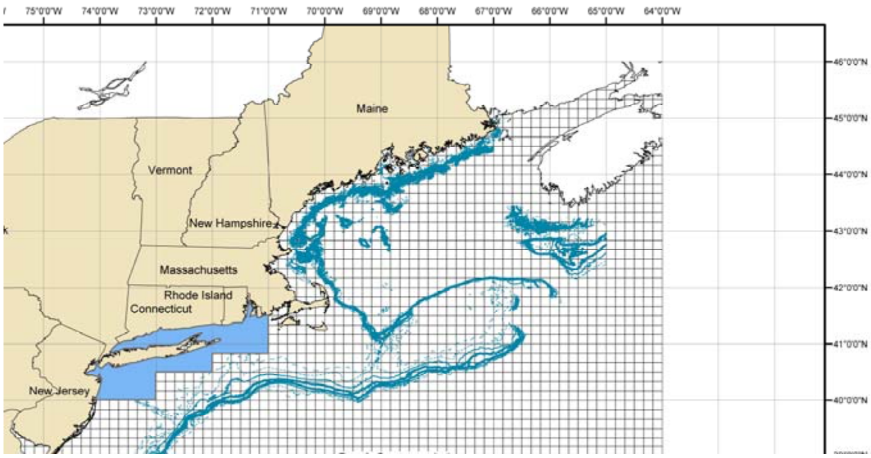

Figure E1. Inshore area examined for butterfish discards during spawning season (i.e. the solid-shaded blue area adjacent to New Jersey, New York, Connecticut, Rhode Island, and Massachusetts).

Economic Impact Analysis

Shifts in the spatial distribution of fishery effort are also likely to have economic effects. 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 4E, Alternative 4D, Alternative 4C, then Alternative 4B. Based simply on actual revenue, there is the potential for losses up to $11.1 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.

1.6 SUMMARIES OF IMPACTS OF POTENTIAL MEASURES RELATED TO 2 PURPOSES OF AMENDMENT 10.

1.6.1 Overall impacts on butterfish rebuilding

Proposed measure 1: Butterfish landings are and will be limited by closing the directed fishery once an annual harvest limit is reached. Because the butterfish mortality cap program for the *Loligo* fishery places a permanent cap on total mortality for the *Loligo* fishery, it caps discards of butterfish by that fleet which accounts for the majority butterfish discards. With landings controlled, and with discards by the fleet which accounts for most of the discards capped, the most significant sources of fishing-related butterfish (all sizes and ages) mortality will be controlled. This will help increase the spawning stock biomass of butterfish, increasing the probability of high recruitment, and also protect future age classes entering the fishery to help perpetuate healthy butterfish populations. To the extent that butterfish landings and discards are responsible for butterfish stock size, and to the extent that the butterfish ABC is correctly specified to facilitate rebuilding (annual harvest limits and the butterfish mortality cap for the *Loligo* fishery are both derived from the ABC, as described above), the butterfish mortality cap for the *Loligo* fishery will ensure butterfish recovery (also assumes bycatch in other fisheries remains low). Because the mixed species management approach utilizes a permanent cap (i.e. an output-based measure) on butterfish mortality in the *Loligo* fishery, it individually likely provides the best chance of meeting overall butterfish mortality goals in the short and long term of any of the individual management alternatives being considered. Based on the predicted lower bycatch of spawners, it would appear a codend mesh size increase to 3 inches would significantly help butterfish rebuilding. Though effort based (versus output based) restrictions upon fisherman can be elastic in the long run in the sense that fishermen can adapt and develop new fishing techniques to maintain profitability, because of the year round impact and the predicted escapement of both juveniles and some spawners, a 3 inch mesh size increase individually is predicted to be the second best management action for rebuilding butterfish (additional summary information on mesh size increases is provided in the measure 2 discussion next).

<u>Proposed measure 2</u>: A *Loligo* codend mesh size increase to 3 inches would provide for escapement of juvenile butterfish and some spawners, reducing discards of juveniles and adults, and thereby facilitate rebuilding. The effectiveness of this measure depends on future levels of effort. For example, if effort were to double for some reason, there might be minimal change in the amount of bycatch of spawners. Because of the scarcity of information on *Loligo* selectivity and uncertainty about future effort levels in general, it is difficult to calculate the long term end result effects of a 3 inch mesh size increase on butterfish rebuilding except that there would be much less bycatch of juveniles and a lower rate of bycatch of butterfish spawners per unit of *Loligo* effort. Based on the predicted lower bycatch of spawners, it would appear a codend mesh size increase to 3 inches would significantly help butterfish rebuilding, but one can not state definitively that as a stand alone measure, a 3 inch codend mesh minimum would be enough ensure the long term sustainability of the butterfish stock biomass resource. Especially in the long term, effort based (versus output based) restrictions upon fisherman can be elastic in the sense that fishermen can adapt and develop new fishing techniques to maintain profitability. Codend mesh size increases to less than 3 inches would facilitate escapement of some juvenile butterfish but not many spawners and therefore as a stand alone measure would be less likely to both enable rebuilding and ensure the long term sustainability of the resource compared to a 3 inch minimum mesh size. Reducing catch rates of butterfish via a mesh size increase could also extend the amount of time the directed *Loligo* fishery would be open before being closed by a given butterfish mortality cap (assuming catch rates of butterfish decline more than catch rates of *Loligo*).

<u>Proposed measure 3</u>: Given estimates that the *Illex* fishery accounts for only 7% of butterfish discards, and given that eliminating the codend mesh size exemptions for the *Illex* fishery would only involve a modest mesh size increase to 1.875 inches, as a stand alone measure, eliminating the codend mesh size exemptions for the *Illex* fishery would be unlikely to both enable rebuilding and ensure the long term sustainability of the butterfish stock. Some modest reductions in bycatch/discards of juvenile butterfish would be expected.

Proposed measure 4: Instituting any of the proposed gear restricted areas (GRAs) is likely to significantly reduce butterfish discards within the GRAs because the codend mesh size requirement to fish inside the GRAs would be 3.0 or 3.75 inches. If effort does not shift to areas outside the GRAs, butterfish discards would be reduced overall. If effort does shift to areas outside the GRAs, overall butterfish discards would go down if only a small amount of effort shifted and/or if the relative abundance of butterfish to *Loligo* was lower outside the GRAs. If effort does shift to areas outside the GRAs, discards could go up if the total effort increased and/or the relative abundance of butterfish to *Loligo* was higher outside the GRAs. Some shifts in fishing effort are expected, but available information is insufficient to model possible effort shifts relative to areas of target and bycatch species densities. To the extent that the GRAs reduce overall butterfish discards, and because they involve mesh sizes that facilitate escapement of juveniles and some spawners, the GRAs would likely help increase butterfish biomass. However, the percents of total bottom otter trawl butterfish discards that occur in GRAs 1, 2, 3, and 4 are only about 16%, 29%, 20%, and 36% respectively. These amounts represent the maximum bottom otter trawl butterfish discards affected by the GRAs. Actual reductions would likely be less due to probable transfer of effort to larger mesh within the GRAs, and effort shifts to areas outside the GRAs. For this reason, as a stand alone measure, any of the GRAs would be unlikely to both enable rebuilding and ensure the long term sustainability of the resource. Uncertainty about effort shifting also makes it difficult to predict possible economic losses, but the areas involved are responsible for substantial vessel revenues.

Combinations of proposed measures: The alternatives are **not** expected to have significant synergistic effects (as an example of synergistic effects, it would mean that one measure reduces butterfish discards by 5% and another by 10% but together they would reduce butterfish discards by perhaps 50%) nor is it expected any would cancel others out. Thus the effects of implementing multiple measures are expected to simply be the combined effects of individual measures. It is therefore logical that a combination of the proposed measures would improve butterfish stock size more compared to any measure by itself. Also, using a combination of more restrictive alternatives would increase butterfish stock size more than a combination of less restrictive alternatives (for example the combination of 1D and 4E would likely provide more protection than 1D and 4B), but a relative ranking of all possible combinations (~500) of the potential management actions is not possible due to data, and modeling limitations. Analysis does show however, as summarized above and detailed in Section 7, that as stand alone measures, the butterfish mortality caps on the *Loligo* fishery or a codend mesh size increase to 3 inches appear to stand the best chance of facilitating butterfish rebuilding. If one of these alternatives is not selected, the Council could try a combination of other alternatives. The combination most likely to successfully rebuild butterfish if neither a mortality cap program nor a 3 inch mesh alternative was chosen would be a combination of the mesh increase just below 3 inches (to 2 1/2 inches) combined with the most restrictive alternatives in both the elimination of the *Illex* exemption and GRA measures. While it is not possible to quantify the likelihood of success from this and all other combinations, one can expect that as less measures are used or as less restrictive alternatives for a given measure are selected, the probability of successful butterfish rebuilding will decline. If the butterfish mortality cap on the *Loligo* fishery or a codend mesh size increase to 3 inches was chosen, combining either with other measures would likely increase the probability of successful rebuilding. However, the more measures chosen the greater the economic impact, and if many measures were required to rebuild in five years, it might present an argument for a longer rebuilding timeframe to take the needs of fishing communities into account.

1.6.2 Summary of overall impacts on general discarding from each proposed measure

Proposed measure 1: This measure is more intended for butterfish rebuilding rather than general discard reduction. However, all else being equal, to the extent that the butterfish mortality cap on the *Loligo* fishery closes the *Loligo* fishery early, discards would be lowered across all species because there would be less *Loligo* fishing. Also, if fishermen are concerned that catching too many butterfish may close the *Loligo* fishery, they may try to avoid bycatch in general. Thus if the butterfish mortality cap for the *Loligo* fishery is chosen for the purposes of butterfish rebuilding, a side benefit could be possible discard reductions for other stocks.

Proposed measure 2: *Loligo* codend mesh size increases would decrease discards depending on the size of the increase. The largest bycatch decreases would come from increasing the mesh to 3 inches, and less impacts, both biologically and economically, would result from smaller increases. The economic effects of codend mesh size increases are difficult to quantitatively predict given the scarcity of *Loligo* selectivity information.

Proposed measure 3: Eliminating the codend mesh size exemptions for the *Illex* fishery is likely to slightly reduce general discards. Given that the *Illex* fishery is a relatively clean fishery and given the increase in mesh size would be small, the reduction in discards is likely to be marginal. Impacts to the *Illex* fleet are estimated to be low.

Proposed measure 4: In addition to reducing butterfish discards, the GRAs are also likely to reduce discards in the GRAs of silver hake, red hake, scup, and spotted hake that occur in the *Loligo* fishery, particularly the GRAs associated with the larger minimum codend mesh size of 3 $^{3/4}$ in. If effort does not shift to areas outside the GRAs, discards would be reduced overall. If effort does shift to areas outside the GRAs, overall discards would go down if only a small amount of effort shifted and/or if the relative abundance of discarded species was lower outside the GRAs. If effort does shift to areas outside the GRAs, overall discards could go up if the total effort increased and/or the relative abundance of discarded species to *Loligo* was higher outside the GRAs. Some shifts in fishing effort are expected, but available information is insufficient to model possible effort shifts relative to areas of target and bycatch species densities. Uncertainty about effort shifting also makes it difficult to predict possible economic losses, but the areas involved are responsible for substantial vessel revenues.

Combinations of proposed measures: The alternatives are **not** expected to have significant synergistic effects (as an example of synergistic effects, it would mean that one measure reduces butterfish discards by 5% and another by 10% but together they would reduce butterfish discards by perhaps 50%) nor is it expected any would cancel others out. Thus the effects of implementing multiple measures are expected to simply be the combined effects of individual measures. It is therefore logical that a combination of the proposed measures would decrease bycatch more compared to any measure by itself. Also, using a combination of more restrictive alternatives would decrease bycatch more than a combination of less restrictive alternatives (for example the combination of 1D and 4E would likely provide more protection than 1D and 4B), but a relative ranking of all possible combinations (~500) of the potential management actions is not possible due to data, and modeling limitations. Given the legislative, judicial, and administrative history in relation to bycatch reduction (see above section 1.3), and ***solely as a tool for general discard reduction***, it would seem the Council should select either a single measure or a combination of measures that would be considered "reasonable efforts," but that do not ban a type of fishing gear, do not ban a type of fishing, and/or do not impose costs on fishermen and processors that cannot be reasonably met.

Also, it is assumed that if one of the action alternatives for the butterfish mortality cap is selected, then the upper range of mesh sizes for the *Loligo* fishery that would be considered by the Council would be limited to 2 ½ inches (64 mm) because the butterfish mortality cap would be providing the primary protection for butterfish and, while Amendment 10 seeks to reduce discards in general, discards of butterfish are most critical for the purposes of this Amendment. Also, any mesh increase would add to the substantial economic costs related to the mortality cap program (see 7.5.1 for mortality cap costs and 7.5.2 for mesh increase costs), and the mortality cap program alone will reduce general discarding to the extent that the *Loligo* fishery is closed because of the cap program. In summary, combining the mortality cap with a 3 inch mesh was not contemplated by the Council.

1.6.3 Alternatives Ranking Summary

Because of the uncertainty involved in absolute quantification of the impacts of any given alternative, it is not currently possible to objectively rank all alternatives (nor combinations of alternatives) in terms of the two Amendment objectives: effectiveness in 1) permanently rebuilding the butterfish stock, and 2) reducing bycatch in the SMB fisheries (though these are closely linked since the largest source of butterfish fishing mortality is bycatch in the *Loligo* fishery). However, as summarized above, the analyses in this document do support the following **relative** rankings (highest to lowest) of Alternatives listed in order of effectiveness in accomplishing each of the two Amendment objectives. **Beyond these simple rankings, various combinations could be higher or lower.**

Butterfish Rebuilding Measures Effectiveness

Management measures that reduce *Loligo* fishery discards of both juveniles and spawners, on a year-round basis, will rebuild the butterfish stock the quickest and provide the most long-term sustainability.

#1 **Alternatives 1B, 1C, or 1D** - Any of the butterfish mortality cap program action alternatives will result in the most certain and largest long-term reduction in juvenile and adult butterfish discards throughout the year in the *Loligo* fishery (assuming the ABC and the discard rates are correctly specified). These Alternatives represent direct controls on butterfish fishing mortality rates in the *Loligo* fishery.

#2 **Alternatives 1E/2E** - Increasing the *Loligo* minimum codend mesh size to 3 inches will result in the second largest long-term reduction in juvenile and adult butterfish discards throughout the year in the *Loligo* fishery. This Alternative is an indirect bycatch control measure that allows escapement of most juvenile butterfish and some, but less than 50% of the butterfish spawners encountered by the *Loligo* fishery.

#3 **Combined Alternatives from Measures 2-4: 2D and 3D, and 4E** - An increase in the minimum codend mesh size to 2.5 inches (Alt. 2D), eliminating all *Illex* mesh exemptions (Alt. 3D), and implementing seasonal GRA Alternative 4E would be the next most effective action if neither a butterfish mortality cap (#1 above) nor a 3 inch mesh (#2 above) were implemented for the *Loligo* fishery.

#4 **Other Stand-alone Action Alternatives –** Would be less effective than above rankings #1, #2, or #3. Of such other stand-alone action alternatives, Alt. 2D (2.5 inch mesh) would be the most effective. Eliminating the *Illex* fishery's exemptions from the *Loligo* minimum mesh (Alts. 3D, 3C, 3B) would be the least effective. The GRA Alternatives (Alts. 4E, D, C, B) and other codend mesh size increases (Alt. C, B) would likely fall in between the *2.5 inch minimum codend mesh requirement* **and** *the elimination of the Illex fishery's exemptions from the Loligo minimum mesh* in terms of effectiveness. For measures 2-4, the later letters are expected to be more effective than earlier letters (i.e. 4E is expected to be more effective than 4B).

General Discarding Measures Effectiveness

#1 **Alternative 1E/2E** - An increase in the *Loligo* minimum codend mesh size to 3 inches would provide the greatest reduction of bycatch species in the SMB fisheries (recall from above it is also the second most effective butterfish stock rebuilding proposed action other than the mortality caps).

#2/#3 **Alternatives 2D/2C** - An increase in the *Loligo* minimum codend mesh size to 2.5 or 2 3/8 inches would respectively likely provide the second and third greatest reductions of bycatch species in the SMB fisheries.

Eliminating the *Illex* fishery's exemptions from the *Loligo* minimum mesh (Alts. 3D, 3C, 3B) would likely be the least effective for reducing bycatch. In terms of effectiveness as stand-alone measures, other alternatives would likely fall in between *eliminating the Illex fishery's exemptions from the Loligo minimum mesh* **and** *2C*.

1.6.4 Summary Tables

Overview of Measures: Table E-0 provides a concise general summary of the measures and their anticipated effects.

Impacts of the Alternatives Table: 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 Table: 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-0. Overview of Measures

Alternatives	Effectiveness to Rebuild Butterfish[1]	Effectiveness to Reduce Discards	Implementation Difficulty	Enforcement Difficulty[2]	Monitoring Needs	Economic Effects[3]
No Action: Status Quo 500 mt directed quota, 5,000 lb trip limit, 3" mesh to possess 1,000 lb or greater; 1 7/8 *Loligo* mesh requirement	NONE: already in effect and will not reduce butterfish discarding	NONE: already in effect and will not reduce general discarding	Easy: infrastructure[4] currently in place	Difficult, but already in place	Existing reporting adequate. More observer coverage would better estimate discards	None: already in effect
Measure 1: **Butterfish Mortality Cap on *Loligo* Fishery**	HIGH: Direct, year-round control on butterfish mortality in *Loligo* fishery, which accounts for most butterfish mortality (reduces juv. and spawner discards)	LOW-MEDIUM: discards reduced **if** *Loligo* closes early due to butterfish mortality cap (no *Loligo* fishing during closure)	Difficult: needs infrastructure[4] for closing *Loligo* fishery based on butterfish landings and discards	Difficult, but similar to what is already in place	Requires substantial increase in observer coverage. Additional reporting (e.g. trip declaration) likely required.	Substantial costs for infrastructure, industry-funded observers, and if *Loligo* fishery is closed early
Measure 2: **Increased *Loligo* Minimum Codend Mesh Size Requirement** (2 1/8", 2 3/8", 2 1/2", 3")	LOW-HIGH: Indirect, year-round, listed in order of increasing effectiveness: 2 1/8", 2 3/8", 2 1/2", 3". Some spawner escapement with 2.5" and 3" mesh	LOW-HIGH: Indirect, year-round, listed in order of increasing effectiveness: 2 1/8", 2 3/8", 2 1/2", 3"	Easy: infrastructure[4] currently in place	Difficult, but similar to what is already in place	Existing reporting adequate. More observer coverage would better estimate discards	Cost for new codends and possible reduction in *Loligo* catch (% unknown and depends on size)
Measure 3: **Elimination of *Illex* Fishery's Exemption from Loligo Mesh Requirements**	LOW: *Illex* fishery only accounts for ~7% of butterfish discards and increase to 1 7/8" won't allow much additional escapement of juveniles	LOW: *Illex* fishery is relatively clean and increase to 1 7/8" won't allow much additional escapement of bycatch	Easy: infrastructure[4] currently in place	Difficult, but similar to what is already in place	Existing reporting adequate. More observer coverage would better estimate discards	Cost for new codends & "gilling" issues with 1 7/8 mesh; minimal reduction in *Illex* retention;
Measure 4: **Seasonal Gear Restricted Areas**	LOW-MEDIUM: Should reduce winter discards (juv. & adults) in GRA. But: not year-round; strictest GRA only accounts for 36% of butterfish discards by bottom otter trawls; within GRA, gear likely to still catch some butterfish; effort likely to shift outside GRA	LOW-MEDIUM: Should reduce winter discards in GRA. But: not year-round measure; within GRA, gear likely to still retain some bycatch; and effort likely to shift to areas outside the GRA	Moderate changes to existing infrastructure[4]	Difficult, and would be in addition to what is already in place. Coast Guard noted season, location, and shape makes Enf. more difficult	Coast Guard has recommended VMS requirement to promote compliance. More observer coverage would better estimate discards	Moderate costs for infrastructure, monitoring, and reporting. LOW to HIGH lost revenue from not fishing in GRAs depending on GRA & effort shifting

1 - The most effective measures occur year-round and increase the number of spawners as well as juveniles

2 - Based on "Guidelines for resource managers on the enforceability of fishery management measures" ASMFC (2002).

3 - Economic effects includes costs to NOAA Fisheries Service, the States, and/or the fishing industry.

4 - Infrastructure may include (but is not limited to) resources necessary to: monitor, track catch, implement closures, set quotas and/or allocations, and enforce requirements for affected fisheries.

Table E-1. Management alternatives under consideration in Amendment 10 and expected impacts on the "valued ecosystem components" (VECs).

Management Measure		**VECs**				
		Managed resource	**Non-target species**	**Habitat including EFH**	**Protected Resources**	**Human Communities**
BUTTERFISH STOCK REBUILDING PROGRAM	Alternative 1A: No action	Butterfish - No impact (relative to status quo) *Loligo*- No impact	No impact (relative to status quo)	No Impact	No Impact	No impact
	Alternative 1B: Butterfish rebuilding program with butterfish mortality cap for *Loligo* fishery distributed by trimester based on current *Loligo* quota allocation	Butterfish:Positive *Loligo*: neutral to positive if butterfish cap constrains *Loligo* fishery	Neutral to positive if effort in *Loligo* fishery is reduced	Neutral to positive if effort in *Loligo* fishery is reduced	Neutral to positive if effort in *Loligo* fishery is reduced	Neutral to negative in short term; Potentially positive in long term if directed butterfish fishery is re-established
	Alternative 1C: Butterfish rebuilding program with butterfish mortality cap for *Loligo* distributed by trimester based on recent *Loligo* landings	Butterfish:Positive *Loligo*: neutral to positive if butterfish cap constrains *Loligo* fishery	Neutral to positive if effort in *Loligo* fishery is reduced	Neutral to positive if effort in *Loligo* fishery is reduced	Neutral to positive if effort in *Loligo* fishery is reduced	Neutral to negative in short term; Potentially positive in long term if directed butterfish fishery is re-established
	Alternative 1D: Butterfish rebuilding program with butterfish mortality cap for *Loligo* distributed by trimester based on bycatch rate method	Butterfish:Positive *Loligo*: neutral to positive if butterfish cap constrains *Loligo* fishery	Neutral to positive if effort in *Loligo* fishery is reduced	Neutral to positive if effort in *Loligo* fishery is reduced	Neutral to positive if effort in *Loligo* fishery is reduced	Neutral to negative in short term; Potentially positive in long term if directed butterfish fishery is re-established
	Alternative 1E: Implement a 3.0 inch minimum mesh size in the directed *Loligo* fishery	Butterfish:positive *Loligo*: neutral to positive	positive	Potentially negative if bottom trawl effort in *Loligo* fishery increases	Potentially negative if effort in *Loligo* fishery increases	Negative short term ; Potentially positive in long term if directed butterfish fishery is re-established

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 2A: No Action	Butterfish – negative would contribute to continued discarding and stock deterioration	*Loligo* - 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 habitat disturbances	No impact- changes to intensity or distribution of fishing effort are not expected resulting in no additional interactions with protected species	No impact- changes to intensity or distribution of fishing effort are not expected , thus socio-economic impacts are not expected
	Alternative 2B: Increase minimum codend mesh size to $2^{1/8}$ inches (50 mm)	Butterfish - low positive, minimal impact due to low predicted escapement	*Loligo* – low negative to low positive depending on survival of escapees	Low positive- a slight decrease in discard morality would be expected relative to 2A	Neutral to low negative- reduced *Loligo* retention could result in increased effort depending on responses to regulation; increased effort could result in additional habitat disturbances	Neutral to low negative- reduced *Loligo* retention could result in increased effort depending on responses to regulation; increased effort could result in additional interactions with protected species	Neutral to low negative- loss due to codend replacement should not be significant, however revenue loss due to increased escapement of *Loligo* is likely to occur compared to status quo (2A)

	Alternative 2C: Increase minimum codend mesh size to $2^{3/8}$ inches (60 mm)	Butterfish – literature selectivity parameters for butterfish escapement predict low positive; observer data suggest positive *Loligo* – low negative to low positive depending on survival of escapees	Low positive- a slight decrease in discard morality would be expected relative to 2A-2B	Neutral to low negative- reduced *Loligo* retention could result in increased effort depending on responses to regulation; increased effort could result in additional habitat disturbances	Neutral to low negative- reduced *Loligo* retention could result in increased effort depending on responses to regulation; increased effort could result in additional interactions with protected species	Neutral to low negative- loss due to codend replacement should not be significant, however revenue loss due to increased escapement of *Loligo* is likely to occur to a greater extent than under 2A-2B
	Alternative 2D: Increase minimum codend mesh size to $2^{1/2}$ inches	Butterfish – low positive, expected to provide benefit to stock through increased escapement *Loligo* – low negative to low positive depending on survival of escapees	Low positive- a slight decrease in discard morality would be expected relative to 2A-2C	Neutral to low negative- reduced *Loligo* retention could result in increased effort depending on responses to regulation; increased effort could result in additional habitat disturbances	Neutral to low negative- reduced *Loligo* retention could result in increased effort depending on responses to regulation; increased effort could result in additional interactions with protected species	Neutral to low negative- loss due to codend replacement should not be significant, however revenue loss due to increased escapement of *Loligo* is likely to occur to a greater extent than under 2A-C

	Alternative 2E: Increase minimum codend mesh size to 3 inches	Butterfish - High Positive *Loligo* – low negative to low positive depending on survival of escapees	Positive- a greater decrease in discard mortality would be expected relative to 2A-2D	Neutral to low negative- reduced *Loligo* retention could result in increased effort depending on responses to regulation; increased effort could result in additional habitat disturbances	Neutral to low negative- reduced *Loligo* retention could result in increased effort depending on responses to regulation; increased effort could result in additional interactions with protected species	Neutral to low negative- loss due to codend replacement should not be significant, however revenue loss due to increased escapement of *Loligo* is likely to occur to a greater extent than under 2d
EXEMPTIONS FROM *LOLIGO* MINIMUM MESH REQUIREMENTS FOR *ILLEX* VESSELS -	**Alternative 3A: No Action**	Butterfish - Low Negative – would not allow for increased escapement of butterfish *Loligo* - 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 protected species interactions	No Impact- changes to intensity or distribution of fishing effort are not expected, thus socio-economic impacts are not expected
	Alternative 3B: Exclude month of September from current mesh exemption for *Illex* fishery	Butterfish - Low-positive, may increase escapement of butterfish, thus reducing mortality Other SMB - No Impact- not expected to increase *Illex* or *Loligo* mortality	Low Positive- when the *Illex* fishery is not exempt from the *Loligo* minimum mesh size it would reduce mortality on non-target species	No impact- changes to intensity or distribution of fishing effort expected to be minor, thus no additional or fewer habitat disturbances	No Impact- minor changes to intensity or distribution of fishing effort, thus no additional or fewer protected species interactions	Potentially Low Negative – any changes to harvest effort are expected to be minor, thus this measure would not generate measurable socio-economic impacts

	Alternative 3C: Exclude months of August and September from current mesh exemption for *Illex* fishery	Butterfish - Low Positive- may increase escapement of butterfish, thus reducing mortality *Illex* - Potentially Low Negative - mortality may increase, but the extent is unclear Other SMB - No Impact – not expected to increase or reduce mortality	Low Positive- –when the *Illex* fishery is not exempt from the *Loligo* minimum mesh size, it would reduce 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 protected species interactions, particularly with pilot whales	Potentially Negative - likely to require additional harvest effort in order to meet harvest targets, thus expected to generate negative socio-economic impacts
	Alternative 3D: Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels	Butterfish - Low Positive - Low Positive – would have greatest positive impact on butterfish because it would maximize the use of larger mesh, allowing greater escapement *Illex* - 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

Table E-1 (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 4A: No Action	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 4B: Butterfish GRA1 (minimum of 3 inch codend mesh size in effective area)	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 E-1 (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 4C: Butterfish GRA2 (minimum of 3 inch codend mesh size in effective area)	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 ~$12,067 revenue/trip. Loss of closing this area to vessels would depend upon how vessels could make up catch in other areas or seasons or maintain revenue by changing mesh size
	Alternative 4D: Butterfish GRA3 (minimum of 3$^{3/4}$ inch codend mesh size in effective area)	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 E-1 (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 4E: Butterfish GRA4 (minimum of $3^{3/4}$ inch codend mesh size in effective area)	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

For Tables E-1 and E-2, please refer to the following underlined impact definitions:

Managed Species, Non-Target Species, Protected Species:
Positive: actions that increase stock/population size
Negative: actions that decrease stock/population size

Habitat:
Positive: actions that improve the quality or reduce disturbance of habitat
Negative: actions that degrade the quality 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

Impact Qualifiers:
Low (as in *low* positive or *low* negative): to a lesser degree
High (as in *high* positive or *high* negative) to a greater degree
Potentially: a relatively higher degree of uncertainty is associated with the impact

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 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 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 MSA requires that management actions be taken only after consideration of impacts to the biological, physical, economic, and social dimensions of the human environment.

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 MSA 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 to the mandates of the MSFCMA/MSA and would not be implemented. Additional scrutiny of the management alternatives during the Public Hearing Process should help to further characterize the potential costs and benefits associated with the various alternatives.

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Table E-2. Summary comparison of cumulative effects for Amendment 10 alternatives.

Valued Ecosystem Components (VEC)		Managed Resources	Non-Target Species	Habitat	Protected Species	Human Communities
Baseline Effects without Amendment 10 (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	**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 10 Alternatives to Overall Cumulative Effect of Baseline**				
Implement butterfish rebuilding program						
1A	**No Action**	**--**	**0 to** < **--**	**0**	**0**	**0**
1B	**Mortality Cap; butterfish allocation = current Loligo allocation**	**+B** < +L; 0A	< +	< +	**0 to +**	**0 to** < **--** short term, + long term
1C	**Mortality Cap; butterfish allocation = recent Loligo landings distribution**	**+B** < +L; 0A	< +	< +	**0 to +**	**0 to** < **--** short term, + long term
1D	**Mortality Cap; butterfish allocation = bycatch rate method**	**+B** < +L; 0A	< +	< +	**0 to +**	**0 to** < **--** short term, + long term
1E	**No Cap; 3" mesh to possess any Loligo**	**+B** < +L; 0A	+	< --	**potentially --**	**0 to** < **--** short term, + long term

(Table E-2 continued)						
Modify *Loligo* Minimum Mesh Size						
2A	**No Action**	--B 0 A	0	0	0	0
2B	Increase minimum codend mesh size to $2^{1/8}$ inches	< + B 0 A	< +	< --	< --	< --
2C	Increase minimum codend mesh size to $2^{3/8}$ inches	< + B 0 A	< +	< --	< --	< --
2D	Increase minimum codend mesh size to $2^{1/2}$ inches	< + B 0 A	< +	< --	< --	< --
2E	Increase minimum codend mesh size to 3 inches	>+B 0 A	+	< --	< --	--
Exemptions from *Loligo* Minimum Mesh Size Requirements for *Illex* Vessels						
3A	**No Action**	< -- B 0 A	< --	0	0	0
3B	Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding September from current mesh exemption	< + B 0 A	< +	0	0	< --
3C	Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding August and September from current mesh exemption	< + B 0 A < -- I	< +	< --	< --	--
3D	Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels	< + B 0 A < -- I	< +	< --	< --	--
Implementation of Seasonal Gear Restricted Areas (GRA) to Reduce Butterfish Discards						
4A	**No action**	-- B 0 A	0	0	0	0
4B	Butterfish GRA 1 (minimum of 3 inch codend mesh size in effective area)	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	--
4C	Butterfish GRA 2 (minimum of 3 inch codend mesh size in effective area)	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	> --
4D	Butterfish GRA 3 (minimum of $3^{3/4}$ inch codend mesh size in effective area)	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	--

	(Table E-2 continued)					
4E	Butterfish GRA 4 (minimum of $3^{3/4}$ inch codend mesh size in effective area)	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	> --

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

1.7 AREAS OF CONTROVERSY

The public hearing process for Amendment 10 is the primary vehicle to allow affected members of the public to comment on issues and alternatives that concern them. During that time, some of the management alternatives under consideration may be identified as controversial by affected members of the fishing community and other concerned citizens. During the development of the DSEIS for Amendment 10, comments from stakeholders at Council and Committee meetings with Industry Advisors indicated several areas of controversy:

1) Industry voiced concerns about the economic impact of increasing the minimum mesh size in the *Loligo* fishery and/or the implementation of gear restricted areas where larger mesh sizes would be required.

2) Concerns that industry has not been given credit for bycatch reductions that have already occurred due to changes in fishing practices in the *Loligo* fishery over time.

3) Some industry members noted that they report mesh size in the VTR as the inside stretch measure plus the diameter of one knot and that this would impact conclusions drawn from VTR data about the impacts of changes in the minimum codend mesh sizes required in the *Loligo* fishery. They have also voiced concerns that at-sea observers have either not always measured the mesh size of their codends (but rather have asked the Captain of the vessel what codend size was in use), or have sometimes measured the wrong part of the codend. Due to the lack of any universal convention to describe mesh size among vessel operators, the potential exists that the mesh size reported by the Captain might differ from an actual measurement of the mesh size. The extent of these problems related to mesh measurements is currently being investigated by the observer program via an audit of their data QAQC and training methods. More information on the observer program's finding should be available during public hearings.

4) The industry has voiced concerns about the costs associated with increased observer coverage necessary to implement the butterfish mortality cap in the *Loligo* fishery.

1.8 CONSIDERED BUT REJECTED MANAGEMENT ACTIONS

There were nine considered but rejected management actions in Amendment 10. The considered but rejected actions would have:

1. developed a less than five-year plan to allow the butterfish stock to rebuild to $B_{MSY;}$
2. developed a seven-year plan to allow the butterfish stock to rebuild to $B_{MSY;}$
3. developed a ten-year plan to allow the butterfish stock to rebuild to $B_{MSY;}$
4. reduced fishing effort in the *Loligo* fishery through rationalization and individual tradable quotas (including a butterfish mortality cap for the *Loligo* fishery);
5. reduced bycatch by requiring jig gear;
6. provided for a small-mesh fishing area where minimal butterfish bycatch can be demonstrated;
7. provided for variable *Loligo* trip limit conditional on minimum mesh size;

8. provided for a conservation quota for gear-based solutions to reduce butterfish bycatch and
9. ability to create sectors in the *Illex* and *Loligo* fisheries.

1-3: Seven-year, ten-year, and less than five-year durations for the rebuilding plan were considered but rejected. The Council evaluated several attributes of these durations before concluding to reject them. Primarily, the Council considered the durations based on the rebuilding timeline requirements of the Magnuson Stevens Act to:

> (1) be as short as possible, taking into account the status and biology of any overfished stocks of fish, the needs of fishing communities, recommendations by international organizations in which the United States participates and the interaction of the overfished stock of fish within the marine ecosystem; and
>
> (2) not exceed 10 years, except in cases where the biology of the stock of fish, other environmental conditions or management measures under an international agreement in which the United States participates dictate otherwise.

Though imprecise, the models used to evaluate butterfish rebuilding indicate that rebuilding may occur rapidly (and suggest that the butterfish biomass may already be above the target biomass (B_{msy}) in 2007). For this reason, the seven-year and ten-year rebuilding schedules were rejected; a five-year time frame seems quite possible. A less than five-year schedule was rejected as not taking into account the needs of fishing communities. Given the model suggests butterfish may already be rebuilt, and that the primary rebuilding driver will be good recruitment, a less than five-year rebuilding time frame would impose unnecessary hardship on fishing communities. The real necessity is to have in place a program that will conserve the biomass that results from the next (or current) good recruitment events.

4: A butterfish rebuilding program needs to be developed and implemented as quickly as possible. Because of the complex requirements and negotiations involved in determining ITQ share allocations, developing an ITQ program is a time consuming process and, therefore, cannot be included is this action. The uncertainty in implementing the new limited access privilege program provisions in MSA would also unacceptably delay Amendment 10. ITQ programs can be considered in future amendments.

5: Requiring the use of jig gear did not have any support from the industry since the efficiency of jigging for *Loligo pealeii* squid is not well documented. Additionally, converting the *Loligo* fleet to jigging gear would have involved large capital expenditures to outfit vessels and experimental research to determine the effectiveness of catching *Loligo* and avoiding bycatch. Therefore, it was not considered further for this action.

6: Butterfish and *Loligo* co-occurrence analyses conducted by survey season indicate that both species co-occur throughout the year and there are no large areas which consistently result in *Loligo* catches with minimal or low catches of butterfish. Co-occurrence varies by year, season, depth, and latitude. During summer and fall, the co-occurrence of butterfish and *Loligo* does not decrease consistently with depth. During the winter, on average, co-occurrence is generally lowest within a narrow depth range of 150 m - 179 m. Co-occurrence increases in deeper water. The 150 m - 179 m depth range overlaps with the depth range of the winter *Loligo* fishery (110 m -183 m), so limiting fishing to this narrow depth range is not expected to considerably reduce the bycatch of butterfish in the winter *Loligo* fishery. The relationship between co-occurrence and depth varies by year and latitude, making both the prediction of annual fishing depth limits and the enforcement of a depth-based fishing boundary very difficult. In addition, NEFSC survey data indicate that forcing the winter *Loligo* fishery into deeper water is likely to result in an increase in spiny dogfish bycatch. For these reasons, the alternative of establishing a small-mesh fishing area, within a polygon or by depth restriction, was considered but rejected.

7: The details of providing for a variable *Loligo* trip limit conditional on minimum mesh size have not been developed yet, so this management measure is not being considered in this action but could be considered in a future action. In addition, this measure would involve changes in fishing behavior that are difficult to monitor and enforce.

8: The conservation quota is a tool to encourage gear-based research to minimize butterfish bycatch. The details of this conservation quota have not been developed yet, so this management measure is not being considered in this action. However, a conservation quota can be considered in a future action.

9: The creation of sectors can be effective in reducing the race to fish, promoting efficient use of fishing capital, and providing a mechanism for members of the sector to develop locally appropriate means for staying within their allocation. The primary reason these changes occur is economic incentive. The guaranteed allocation facilitates harvest when conditions are optimal, as opposed to just getting to the fish before someone else does (particularly for a quota managed fishery). In addition to addressing capacity issues, sector creation also has the potential to reduce the administrative and enforcement burdens on councils and the NMFS. The creation of sectors was rejected for further consideration in this Amendment because the time constraints imposed by the MSA to rebuild the butterfish stock did not allow the Council sufficient time to address the resource allocation implications of sector formation. The Council intends to consider sector formation in these fisheries in a future management action.

1.9 REGULATORY BASIS FOR THE AMENDMENT

Amendment 10 was developed in accordance with the MSA 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 (MSA), which amended and reauthorized the MSA and included a new emphasis on precautionary fisheries management. New provisions mandated by the MSA 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 legislation was recently reauthorized through passage of the Magnuson Stevens Fishery Conservation and Management Reauthorization Act of 2007. 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 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 MSA and NEPA, it also addresses the requirements of the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA). When preparing an FMP 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.

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2.0 LIST OF ACRONYMS

ACFCMA	Atlantic Coastal Fisheries Cooperative Management Act
ASMFC	Atlantic States Marine Fisheries Commission or Commission
B	Biomass
B_{msy}	Biomass Associated with Maximum Sustainable Yield
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
HAPC	Habitat Area of Particular Concern
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
MSB	Mackerel, Squid, Butterfish
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

LIST OF ACRONYMS (continued)

SARC	Stock Assessment Review Committee
SAV	Submerged Aquatic Vegetation
SAW	Stock Assessment Workshop
SMA	Small Business Administration
SMB	Squid, Mackerel, and Butterfish
SSB	Spawning Stock Biomass
MSA	Sustainable Fisheries Act
TAL	Total Allowable Landings
TL	Total Length
VEC	Valued Ecosystem Component
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

Table 1. Summary of the purpose and need for the action.

SUMMARY OF THE PURPOSE AND NEED FOR THE ACTION	
NEED FOR ACTION	CORRESPONDING PURPOSE
The butterfish stock was designated as being overfished in 2005 triggering the requirement that a rebuilding plan be developed to rebuild the butterfish stock to B_{msy} as quickly as possible but not to exceed ten years.	One purpose of Amendment 10 is to evaluate the measures necessary to bring the FMP into compliance with MSA National Standard 1 which requires overfished stocks to be rebuilt.
This action is needed to consider impacts resulting from bycatch and discards because excessive bycatch or discards may contribute to reduced yields for certain species.	Another purpose of Amendment 10 is to evaluate measures that reduce bycatch and/or discards and improve monitoring of incidentally caught species.

Purpose 1: Rebuild Butterfish

The first purpose of Amendment 10 is to develop a rebuilding program that allows the butterfish stock to rebuild in the shortest amount of time possible (but not to exceed ten years) and permanently protects the long-term health and stability of the rebuilt stock. The Mid-Atlantic Fishery Management Council (Council) was notified by NOAA's National Marine Fisheries Service (NMFS) on February 11, 2005, that the butterfish stock was designated as overfished. Hence, the primary reason for the development of Amendment 10 is to establish a rebuilding program per the MSA rebuilding provisions which will allow the butterfish stock to rebuild to B_{MSY} (22,798 mt, i.e. the rebuilding target) in as short a time period as possible (taking into account the status and biology of any overfished stocks, the needs of fishing communities, recommendations by international organizations in which the United States participates, and the interaction of the overfished stock of fish within the marine ecosystem), but not to exceed ten years.

Status of Butterfish

In 2004 the 38th Northeast Regional Stock Assessment Workshop (38th SAW) Stock Assessment Review Committee (SARC) (available at: http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0403/) provided estimates of butterfish fishing mortality and stock biomass estimates through 2002, and determined that butterfish was overfished in 2002 (NEFSC 2004; see Appendix i). Although assessment stock size estimates are highly imprecise (80% confidence interval ranged from 2,600 mt to 10,900 mt), the overfished determination was based on the fact that the 2002 biomass estimate for butterfish (7,800 mt) fell below the threshold level defining the stock as overfished (1/2 Bmsy=11,400 mt). Butterfish discards are estimated to equal twice the annual landings (NEFSC 2004). Analyses have shown that the primary source of butterfish discards is the *Loligo* fishery because it uses small-mesh, diamond-mesh codends (as small as 1 $^{7/8}$ inches minimum mesh size) and because butterfish and *Loligo* co-occur year round. The truncated age distribution of the butterfish stock is also problematic. Historically, the stock was characterized by a broader age distribution and the maximum age was six years. The lifespan is now three years (NEFSC 2004). The truncated age structure results in reduced egg production and the reduced lifespan artificially reduces the mean generation time required to rebuild the stock. Because of the overfished determination, current federal law obligates the Council to develop and implement a stock rebuilding plan.

There is no peer reviewed information available on butterfish abundance in 2008. Recent, unpublished NEFSC survey indices suggest that butterfish relative abundance may have increased in 2006 and 2007. For example, the NEFSC 2007 spring survey indices for butterfish were the second highest by number and the third highest by weight in the 40 year history of the survey time series (but should be interpreted with caution due to the influence of a single very large tow). Also, while abundance indices are certainly one component of assessments, such indices do not provide a point estimate of stock size or status determination, and the assessment process is much more complex than just abundance indices. It should also be noted that, historically, the spring and fall survey indices have not tracked each other. Regardless, the 2004 SAW/SARC report is the authoritative reference for stock status and current federal law obligates the Council to develop and implement a stock rebuilding plan until a peer reviewed butterfish stock assessment determines the stock is rebuilt to the B_{msy} level (the next butterfish assessment is scheduled for 2010). Also, even if butterfish abundance levels increased after higher recruitment events, the expected level of discard mortality would also increase under the no action alternative. Therefore, while temporary stock recovery could theoretically occur, the stock could quickly return to an overfished status in the absence of measures to control fishing mortality due to discarding.

Purpose 2: General Bycatch/Bycatch Mortality Minimization

The second purpose of Amendment 10 is to minimize bycatch and the fishing mortality of unavoidable bycatch, to the extent practicable, in SMB fisheries. National Standard 9 of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires that conservation and management measures, to the extent practicable, minimize bycatch, and to the extent that bycatch cannot be avoided, minimize the mortality of such bycatch. Amendment 8 to the Atlantic Mackerel, Squid and Butterfish Fishery Management Plan was found to be deficient relative to National Standard 9 and, a result, Amendment 9 to the FMP was developed (in part) to address these deficiencies. Amendment 10 has three measures that were transferred from Amendment 9 (i.e., *Loligo* minimum codend mesh size, eliminating exemptions from *Loligo* minimum mesh requirements for *Illex* vessels, seasonal gear restricted areas to reduce butterfish discards) which are intended to reduce bycatch and discarding of target and non-target species in the SMB fisheries and bring the FMP into compliance with MSA bycatch requirements. At its June 2007 meeting, the Council chose to remove these three measures from Amendment 9 and incorporate them into Amendment 10. Therefore, each of these measures is given full consideration in this action. Amendment 10 is expected to be implemented soon after Amendment 9 and, as such, no meaningful delay in addressing the bycatch deficiencies in the MSB FMP should occur.

Status of Discarding in the SMB Fisheries

There is significant bycatch/discarding in the SMB fisheries, predominantly in the *Loligo* fishery for species of primary concern. For a summary, see tables 15a and 15b, which list for key species, the proportion of NMFS observer discards accounted for by the directed SMB fisheries. As examples, during 2001-2006, the *Loligo* fishery was responsible for the following in terms of the percentage of all Observer Program Discards: butterfish- 68% , scup- 8% , silver hake- 56% , red hake- 31% , spiny dogfish- 10%, striped bass- 8%, and summer flounder- 7%.

4.2 MANAGEMENT MEASURES

This fishery management plan amendment is required under the MSA because (as noted above) A) butterfish was designated as being overfished by NMFS in 2005 (although overfishing was not occurring) and B) the MSB FMP was found to be deficient relative to National Standard 9 (i.e. bycatch minimization) . This action would establish bycatch reduction measures and a rebuilding program allowing the butterfish stock to rebuild to B_{MSY} in 5 years. The basic rebuilding strategy proposed by the Council is to limit directed fishing for butterfish and implement measures to permanently control fishing mortality resulting from discarding of butterfish in the *Illex* and/or *Loligo* fisheries.

The adaptive management strategy proposed by the Council in this amendment establishes a schedule of Allowable Biological Catch (ABC=landings+discards) specifications that facilitate the rebuilding of the butterfish stock to the B_{msy} level. The proposed 5 year planning horizon is intended to balance the need to (1) rebuild the overfished butterfish stock to the B_{msy} level in as short a period as possible, but not to exceed ten years (as required under MSA National Standard 1) and (2) minimize the negative social and economic impacts of the rebuilding plan on fishing communities (as required under MSA National Standard 7).

The primary measures being considered by the Council to rebuild butterfish and reduce discards include: 1) the implementation of a mixed species management system with a butterfish mortality cap on the *Loligo* fishery (see below) to monitor and control total mortality of butterfish (i.e., landings and discards) both during the rebuilding period, and after the stock is rebuilt, 2) increases in the minimum mesh size required in the *Loligo* fishery, 3) elimination of *Illex* fishery exemptions from *Loligo* minimum mesh size requirements, and 4) the implementation of seasonal gear restricted areas to reduce discards of butterfish.

Measure 1: Develop **a butterfish mortality cap program for the *Loligo* fishery** or institute a 3 inch minimum codend mesh requirement to allow the butterfish stock to rebuild to B_{MSY} and protect the long-term health and stability of the rebuilt stock. In this document, anytime the language "mortality cap" is used, it refers to a **butterfish mortality cap program for the *Loligo* fishery**.

Under Alternatives 1B-D, the directed fishery for butterfish would be limited per the fishing mortality rates specified, and a butterfish mortality cap program for the *Loligo* fishery would be implemented. The *Loligo* fishery butterfish mortality cap amount would be 75% of the ABC to cover landings and discards (allocated by *Loligo* trimesters- see appendix v for details). The remaining 25% of the ABC would cover harvest and discard mortality in other fisheries. The process for closing the directed butterfish fishing will generally remain the same as in the 2008 specifications. Council staff, in coordination with the SMB Monitoring Committee will analyze NMFS dealer weighout data and observer program data on an ongoing basis during the annual specification process to determine if the rebuilding program constrains overall mortality, and the Council will consider changes to the rebuilding program as necessary. If problems are detected, the SMB Committee will request further analysis and management recommendations through the annual specification process or an amendment or framework as necessary and appropriate.

Since *Loligo* is allocated by trimester, the butterfish mortality cap would also be allocated by trimester. The butterfish mortality cap for the *Loligo* fishery could be allocated based on: the current seasonal allocation of the *Loligo* quota (1B), recent *Loligo* landings (1C), or an alternative butterfish bycatch allocation which takes into account the seasonal allocation of the *Loligo* quota and expected butterfish discard rates by trimester (1D). The directed *Loligo* fishery would close when the pre-specified closure trigger (80%-90% set during the annual specifications process- see **5.3.1**) for the butterfish mortality cap for the *Loligo* fishery for each trimester is harvested. The three mortality cap alternatives would have the same annual quota, so the differences between them are primarily economic- they would primarily affect *when* the directed *Loligo* fishery would close, not overall butterfish mortality. See next measure for details on the 3 inch mesh requirement.

<u>Measure 2</u>: Increase Loligo minimum codend mesh size to reduce discards of butterfish and other non-target fish;

This action was originally considered under Amendment 9 (but was deferred to Amendment 10) 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 minimum 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 in the *Loligo* fishery were required. By enhancing the survival of butterfish, especially juvenile butterfish but also some spawners for the larger mesh size increases, this action should also help to promote the achievement of butterfish stock rebuilding as well as FMP management objective 1. If the Council chooses to increase the minimum mesh size requirement in the *Loligo* fishery, it is likely that a decrease in the number of butterfish retained would extend the *Loligo* season under the mixed species management model using a butterfish mortality cap. Thus, the Council may choose a combination of measures including establishing a total butterfish mortality cap in the *Loligo* fishery *and* an increase in the *Loligo* minimum mesh size which in total would achieve the objective of rebuilding and maintaining the butterfish stock at sustainable levels by permanently controlling butterfish fishing mortality in the *Loligo* fishery.

<u>Measure 3</u>: Eliminate some exemptions for Illex vessels from Loligo minimum codend mesh requirements to reduce discards of butterfish and other fish;

This action was originally considered under Amendment 9 (but was be deferred to Amendment 10) 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 U.S. commercial, U.S. recreational, and foreign fishermen), as well as Magnuson-Stevens Act mandates related to bycatch and discarding. While the primary reason this set of alternatives was considered in Amendment 9 was related to evidence that *Loligo* were being taken incidentally in the *Illex* fishery, consideration of the issue was deferred to Amendment 10 because changes to the *Illex* mesh exemption could have implications for butterfish discards in the *Illex* fishery. Eliminating the codend mesh size exemptions for the *Illex* fishery is likely to modestly reduce general discards. Given that the *Illex* fishery is a relatively clean fishery and given the increase in mesh size would be small, the reduction in discards is likely to be marginal. Impacts to the *Illex* fleet are estimated to be low.

<u>Measure 4</u>: **establish seasonal gear restricted areas (GRAs)** to reduce the discarding of butterfish and other non-target fish.

This action was considered under Amendment 9 (but was deferred to Amendment 10) as a means to reduce the amount of butterfish discards in small mesh bottom 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 $\leq$ 3.0 inches and $\leq$ 3.75 inches. The proposed butterfish GRAs encompass areas which are associated with the high butterfish discarding by small mesh bottom otter trawl fishing activity. As with the proposed increase in the *Loligo* minimum mesh requirement, this action, by enhancing the survival of juvenile butterfish and some spawners, 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. However, the percents of total bottom otter trawl butterfish discards that occur in GRAs 1, 2, 3, and 4 are only about 16%, 29%, 20%, and 36% respectively. These amounts represent the maximum bottom otter trawl butterfish discards affected by the GRAs. Actual reductions would likely be less due to probable transfer of effort to larger mesh within the GRAs (that will still catch some butterfish), and effort shifts to areas outside the GRAs.

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4.3 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 (Table 2).

Table 2. History of FMP Development

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 seasonal management of the *Illex* fishery
1997	Amendment 7	• Established consistency among FMPs in the NE region of the U.S. relative 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
2007	Amendment 9 (proposed)	• Allow multi-year specifications for all species managed under the FMP • Maintain the moratorium on entry into the directed *Illex* fishery • Revise the biological reference points for *Loligo* • Designate EFH for *Loligo pealeii* eggs • Reduce gear impacts to EFH • Increase the *Loligo* minimum mesh size requirements[1] • Modify the Existing Exemptions from *Loligo* minimum mesh requirements for *Illex* vessels[1] • Modify the *Loligo* possession limit for the directed *Illex* fishery during closure of the directed *Loligo* fishery[1] • Establish an Electronic Daily Reporting Requirement for the Directed *Illex* fishery • Implementation of seasonal gear restricted areas (GRAs) to reduce butterfish discards[1] • Establish the Use of Alternative Gears and Gear Modifications in the Atlantic mackerel, squid, and butterfish fisheries
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

[1] Issue deferred to Amendment 10

4.4 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 U.S. 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 U.S. commercial, U.S. recreational, and foreign fishermen.

4.5 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 MEASURES AND ALTERNATIVES

5.1 BACKGROUND INFORMATION

BACKGROUND INFORMATION ON THE BUTTERFISH STOCK

In 2004 the 38th Northeast Regional Stock Assessment Workshop (38th SAW) Stock Assessment Review Committee (SARC) (available at: http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0403/) provided estimates of butterfish fishing mortality and stock biomass estimates through 2002, and determined that butterfish was overfished in 2002 (NEFSC 2004; see Appendix i). Although assessment stock size estimates are highly imprecise (80% confidence interval ranged from 2,600 mt to 10,900 mt), the overfished determination was based on the fact that the 2002 biomass estimate for butterfish (7,800 mt) fell below the threshold level defining the stock as overfished (1/2 Bmsy=11,400 mt) (Figures E1a, E1b). Butterfish discards are estimated to equal twice the annual landings (NEFSC 2004). Analyses have shown that the primary source of butterfish discards is the *Loligo* fishery because it uses small-mesh, diamond-mesh codends (as small as 1 $^{7/8}$ inches minimum mesh size) and because butterfish and *Loligo* co-occur year round. The truncated age distribution of the butterfish stock is also problematic. Historically, the stock was characterized by a broader age distribution and the maximum age was six years. The lifespan is now three years (NEFSC 2004). The truncated age structure results in reduced egg production and the reduced lifespan artificially reduces the mean generation time required to rebuild the stock. Because of the overfished determination, current federal law obligates the Council to develop and implement a stock rebuilding plan.

There is no peer reviewed information available on butterfish abundance in 2008. Recent, unpublished NEFSC survey indices suggest that butterfish relative abundance may have increased in 2006 and 2007. For example, the NEFSC 2007 spring survey indices for butterfish were the second highest by number and the third highest by weight in the 40 year history of the survey time series (but should be interpreted with caution due to the influence of a single very large tow). Also, while abundance indices are certainly one component of assessments, such indices do not provide a point estimate of stock size or status determination, and the assessment process is much more complex than just abundance indices. It should also be noted that, historically, the spring and fall survey indices have not tracked each other. Regardless, the 2004 SAW/SARC report is the authoritative reference for stock status and current federal law obligates the Council to develop and implement a stock rebuilding plan until a peer reviewed butterfish stock assessment determines the stock is rebuilt to the B_{msy} level (the next butterfish assessment is scheduled for 2010). Also, even if butterfish abundance levels increased after higher recruitment events, the expected level of discard mortality would also increase under the no action alternative. Therefore, while temporary stock recovery could theoretically occur, the stock could quickly return to an overfished status in the absence of measures to control fishing mortality due to discarding.

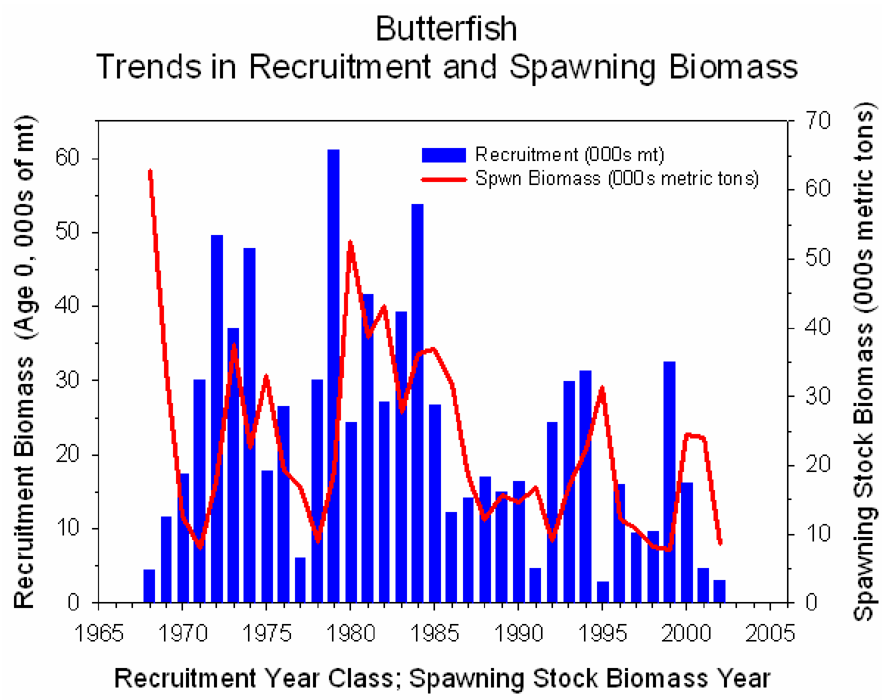

Figure source: NMFS Status of Stocks butterfish webpage.

Figure E1a. Trends in recruitment (age 0) and spawning biomass (age 1+) for butterfish.

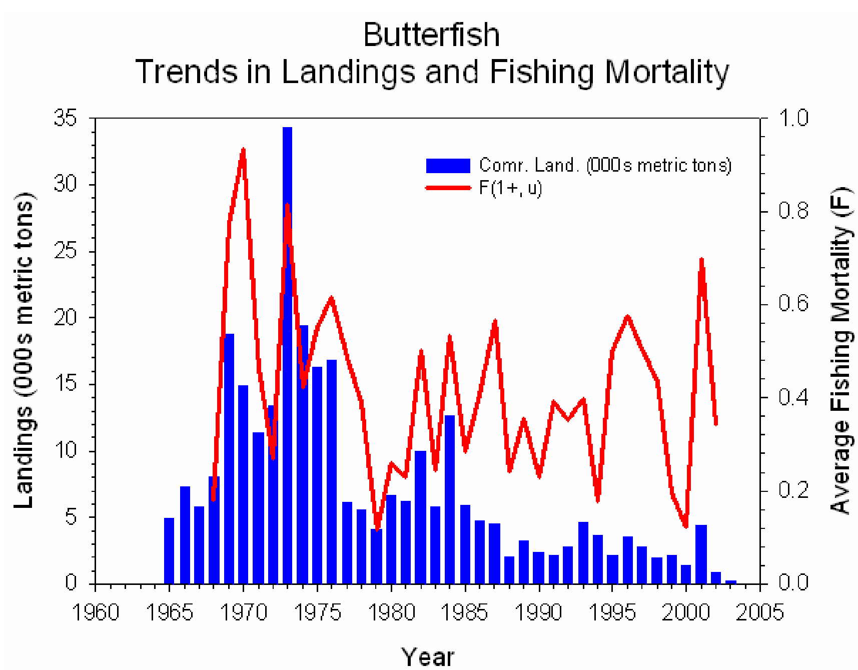

Figure source: NMFS Status of Stocks butterfish webpage.

Figure E1b. Trends in butterfish landings and fishing mortality.

Butterfish Stock Rebuilding Projections

The Amendment 10 Fishery Management Action Team (FMAT) conducted additional analyses to estimate recruitment and stock recovery time frames for butterfish. Because age composition data of landings and discards are lacking for the most recent years since 2002, it was not possible to update the model used in the 2004 analytical stock assessment. In consultation with the MAFMC SSC, it was decided to use an auto-regressive (AR) time-series model to forecast recruitment biomass for the stock recovery analysis (see Appendix ii). Since the recent stock assessment was only current through 2002, recruitment for 2003-2006 was predicted with a linear regression between survey biomass at age 0 and recruit biomass at age 0 for 1991-2002 (Figure C1 in Appendix ii). Estimates for year-classes during this period ranged from 3.32-17.72 thousand mt. These values along with the recruit time-series from the butterfish assessment (1966-2002) were used to investigate the utility of an auto-regressive (AR) time-series model for predicting future recruitment.

An AR model was chosen since it is a sensible a priori assumption that recruitment in trailing years is somehow related to recruitment in previous years. An AR model was fit and used to forecast recruit biomass during 2007-2016, a ten year time frame (see Table C2 and Figure C5 in Appendix ii). The forecasted recruitment ranged from 11.4 - 14.2 thousand mt for the period. These forecasted recruitment data were used in a projection to determine if and when the stock would rebuild. To simulate a low level of discarding, a fishing rate of F=0.1 was used to project the biomass of butterfish during 2005-2016. Under this scenario the butterfish stock recovers quickly to above Bmsy (22,800 mt) in 2007 and remains above the target level of B_{msy} (22,800 mt) during 2007-2016 (Figure E2).

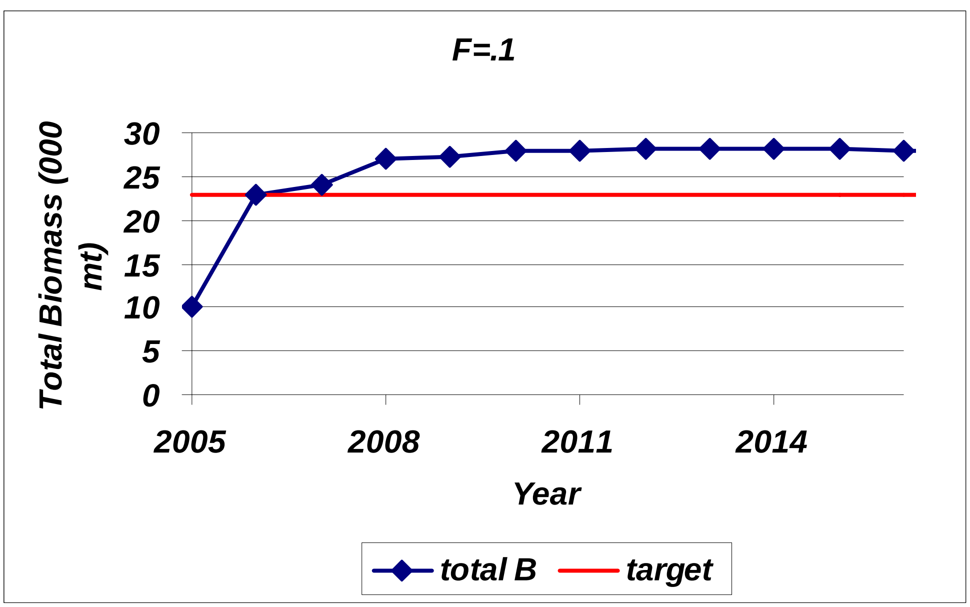

Figure E2. Total stock biomass projection results for the butterfish based on an auto regressive model and assuming a low level of discard mortality (i.e., F=0.1).

In summary, results of the AR model indicated that the butterfish stock could reach slightly above B_{msy} by 2007 given the level of recruitment projected from the model which included NEFSC survey data through the fall of 2006 (assuming a fishing mortality rate of F=0.1 is maintained). Note these projections do not represent stock status and like the stock size estimates, the projection estimates are likely highly imprecise. The NEFSC 2007 spring survey indices were not imputed into the model, but were the second highest by number and the third highest by weight in the 40 year history of the survey time series. This survey result must be viewed with caution, however, since the high index value in the spring 2007 survey appears to have been driven by one large tow. Also, while abundance indices are certainly one component of assessments, such indices do not provide a point estimate of stock size or status determination, and the assessment process is much more complex than just abundance indices. It should also be noted that, historically, the spring and fall survey indices have not tracked each other. While available information suggests that butterfish biomass may have increased since 2002, lacking a peer reviewed stock assessment to investigate otherwise, the status determination for butterfish remains designated as overfished. It is also important to note that if butterfish abundance levels increase, the expected level of discard mortality would also increase under the no action alternative. Therefore, while temporary stock recovery could theoretically occur, the stock could quickly return to an overfished status in the absence of measures to control fishing mortality due to discarding.

Factors Affecting Rebuilding of the Butterfish Stock

The biology and sources of fishing mortality for butterfish pose some unique challenges relative to rebuilding this stock under MSA. First, the species is short lived and has a relatively high natural mortality rate (assumed to be 0.8). Characteristic of short lived species, butterfish exhibit a high degree of variability with respect to year class strength and subsequent recruitment to the stock compared to longer lived species. For example, modeling results from the 2004 stock assessment indicated that annual estimates of recruitment biomass for butterfish ranged from 3,000-60,000 mt during the period 1968-2002 (Figure E3). Recruitment biomass averaged about 23,000 mt during this time period, which closely approximates the estimate of B_{msy}. Thus the stock may have a high potential to rebuild to the target level (B_{msy}) in a relatively short period of time as echoed by the results of the AR model described above.

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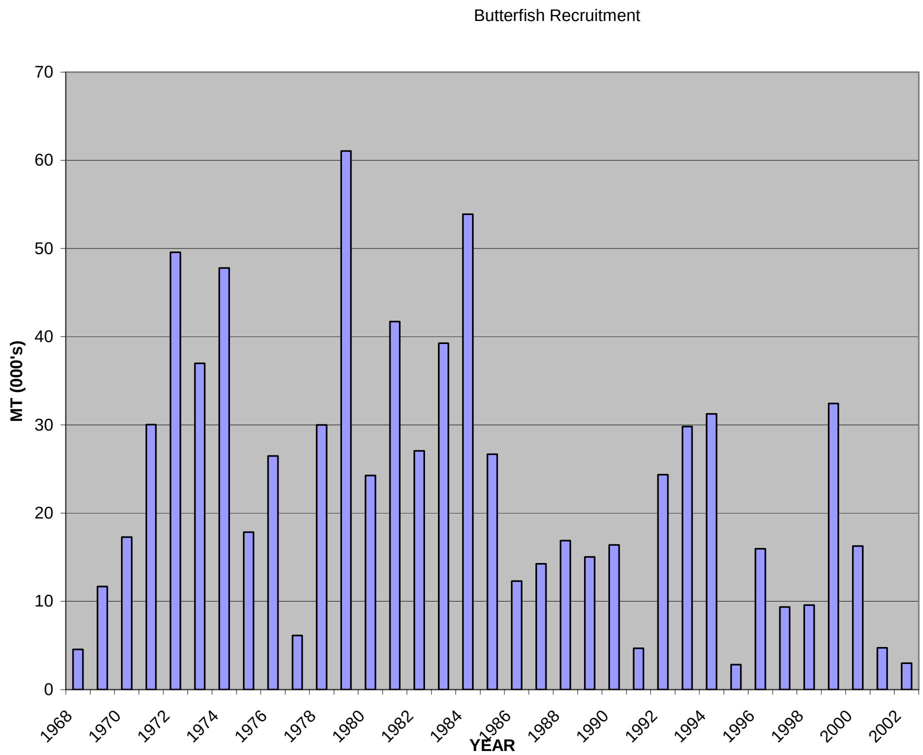

Figure E3. Recruitment biomass for the butterfish stock, 1968-2002 (NEFSC 2004).

Another unique aspect relative to the rebuilding plan for this stock is the fact that most of the fishing mortality in recent years was the result of discarding of butterfish taken incidentally in the other directed fisheries, principally the *Loligo* squid fishery. *Loligo* and butterfish co-occur in time and space more or less ubiquitously throughout the geographical range of both species. Both species are found in coastal waters during spring and summer and move offshore during the fall and winter months where they tend to inhabit the same ecological niche over broad areas of the continental shelf. This biological interaction creates a situation where both species may be taken and retained simultaneously, depending on the characteristics of the fishing gear deployed gear. As a result, the two species have a high potential for simultaneous interactions with certain small mesh fisheries.

The *Loligo* fishery is prosecuted across the continental slope following the seasonal movements of the species using small mesh bottom otter trawl gear. Fmsy is 0.38 and the FMP specifies that the DAH be specified as the catch associated with 75% of Fmsy, which would equal 9131 MT. The mesh sizes used in this fishery range from about 2 to 2.5 inches, but the majority of *Loligo* are taken with mesh sizes at the lower end of that range. Given the morphology of butterfish, the incidental capture of butterfish in the *Loligo* fishery appears unavoidable as it is currently prosecuted. For example, the L_{50} (length at which 50% of the fish encountered are retained by the gear) for butterfish for 2.0 inch mesh corresponds to an age of approximately 0.5 years. Butterfish do not begin to reach sexual maturity until at age 1 and reach a maximum size age of 6 years. Thus, the trawl gear deployed in the directed *Loligo* fishery retains butterfish over a size range which includes adults and even juveniles. In fact, the *Loligo* fishery accounts for about 75% of the butterfish caught and 68% discarded annually based on unpublished NMFS at sea observer data. Since the majority of butterfish mortality in recent years is the result of discarding of butterfish in non-directed fisheries and the *Loligo* fishery accounts for the majority of those discards, the Council seeks to rebuild the butterfish stock by controlling fishing mortality on butterfish principally using measures which would control or reduce the incidental take of butterfish in the directed *Loligo* fishery.

BACKGROUND INFORMATION ON DISCARDING

There is significant bycatch/discarding in the SMB fisheries, predominantly in the *Loligo* fishery for species of primary concern. For a summary, see tables 15a and 15b, which list for key species, the proportion of NMFS observer discards accounted for by the directed SMB fisheries. As examples, during 2001-2006, the *Loligo* fishery was responsible for the following in terms of the percentage of all Observer Program Discards: butterfish- 68% , scup- 8% , silver hake- 56% , red hake- 31% , spiny dogfish- 10%, striped bass- 8%, and summer flounder- 7%.

National Standard 9 of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires that conservation and management measures, to the extent practicable, minimize bycatch, and to the extent that bycatch cannot be avoided, minimize the mortality of such bycatch. This of course begs the question of how to define "practicable."

Both NMFS online guide to the 1996 Amendments to the Magnuson-Stevens Act (available at: http://www.nmfs.noaa.gov/sfa/sfaguide/) and responses to comments in the National Standard Guidelines Final Rule published in the Federal Register in 1998 (available at: http://www.epa.gov/fedrgstr/EPA-GENERAL/1998/May/Day-01/g11471.htm) note that there is legislative history suggesting that for the sole purpose of bycatch/bycatch mortality minimization, this provision was intended so that Councils make reasonable efforts to reduce discards, but was neither intended to ban a type of fishing gear nor to ban a type of fishing nor to impose costs on fishermen and processors that cannot be reasonably met. **Note this "reasonable efforts" concept would only apply in relation to general discarding, not butterfish discarding, since butterfish are overfished and must be rebuilt, by current law (see Purpose 1 above).**

The meaning of “practicable” was also discussed in Conservation Law Foundation v. Evans, 360 F.3d 21, 27-28 (1st Cir. 2004). The court stated:

> *…the plaintiffs essentially call for an interpretation of the statute that equates "practicability" with "possibility," requiring NMFS to implement virtually any measure that addresses EFH and bycatch concerns so long as it is feasible. Although the distinction between the two may sometimes be fine, there is indeed a distinction. The closer one gets to the plaintiffs' interpretation, the less weighing and balancing is permitted. We think by using the term "practicable"*

Congress intended rather to allow for the application of agency expertise and discretion in determining how best to manage fishery resources.

NMFS has provided additional information on "practicable":

What does "to the extent practicable mean"? From a National perspective, there is too much bycatch mortality in a fishery if a reduction in bycatch mortality would increase the overall net benefit of that fishery to the Nation through alternative uses of the bycatch species. In this case, a reduction in bycatch mortality is practicable and the excess bycatch mortality is a wasteful use of living marine resources. In many cases, it may be possible but not practicable to eliminate all bycatch and bycatch mortality (NMFS 2008).

While neither NMFS nor the Courts appear to have provided perfect clarity on how much bycatch reduction should take place, it seems clear that the biological and economic benefits and costs should be weighed. Unfortunately, it is difficult to precisely quantify many of the biological and economic benefits and costs of measures proposed in this Amendment with the available scientific information. However, from a qualitative perspective, the reader may find the information in Tables E0, E1, and E2 helpful in weighing such benefits and costs. These tables summarize the impact information presented in section 7.

Amendment 8 to the Atlantic Mackerel, Squid and Butterfish Fishery Management Plan was found to be deficient relative to National Standard 9 and, a result, Amendment 9 to the FMP was developed (in part) to address these deficiencies. Amendment 10 has three measures that were transferred from Amendment 9 (i.e., *Loligo* minimum codend mesh size, eliminating exemptions from *Loligo* minimum mesh requirements for *Illex* vessels, seasonal gear restricted areas to reduce butterfish discards) which are intended to reduce bycatch and discarding of target and non-target species in the SMB fisheries and bring the FMP into compliance with MSA bycatch requirements. At its June 2007 meeting, the Council chose to remove these three measures from Amendment 9 and incorporate them into Amendment 10. Therefore, each of these measures is given full consideration in this action. Amendment 10 is expected to be implemented soon after Amendment 9 and, as such, no meaningful delay in addressing the bycatch deficiencies in the MSB FMP should occur.

5.2 MANAGEMENT PROGRAM

<u>Adaptive/Mixed Species Management</u>

Butterfish rebuilding is complicated in several ways. In terms of biology, butterfish natural mortality is high (M=0.8) and butterfish have a short lifespan. In terms of the fisheries involved, discards are estimated to equal twice the annual landings (NEFSC 2004). Analyses have shown that the primary source of butterfish discards is the *Loligo* fishery because it uses small-mesh, diamond-mesh codends (as small as 1 $^{7/8}$ inches minimum mesh size) and because butterfish and *Loligo* co-occur year round. To rebuild the relatively low value butterfish fishery, management must primarily affect the relatively high value *Loligo* fishery.

To address this complexity, an adaptive/mixed species approach will be used, in that it may make economic sense for the percentage of the ABC allocated to harvest versus discards to vary, perhaps using more butterfish as discards to allow the *Loligo* fishery to operate versus landing more butterfish given the relatively low value of the butterfish fishery. **Total fishing mortality would still be constrained within biological limits that facilitate stock rebuilding and maintenance** (via harvest limits and the measures proposed by this Amendment). While this can be done through the current specifications process, the concept is important so it is noted in this DSEIS for the reader. While the Magnuson-Stevens Act also mandates general minimization of bycatch and bycatch mortality bycatch to the extent practicable, in the case of *Loligo* and butterfish, to the extent practicable could mean that butterfish bycatch is capped at levels that facilitate rebuilding and maintenance of the stock, but most of the fishing mortality for butterfish is from bycatch. For example, currently the ABC is split 1/3 for harvest (500MT) and 2/3 for discards (1000MT) based on discard estimates. As butterfish rebuilds and the ABC increases, the Council, through the annual specifications process may keep this same ratio, or may keep landings low and allocate more of the ABC to discards (so as to allow the *Loligo* fishery to operate). In the annual specifications, analysis will describe the pros and cons of different allocation models and the Council will make a decision on this fundamentally allocative matter. The general goal would be to rationally maximize benefits from the combined use of sustainable *Loligo* and butterfish resources, simply acknowledging the tradeoff that may occur between butterfish DAH and *Loligo* DAH because of the butterfish bycatch in the *Loligo* fishery (i.e. use a mixed-species management approach). Strict limits on directed harvest currently available through the specifications would control harvest and the measures proposed in Amendment 10 would control bycatch/discards.

Regardless of the allocation, in order to rebuild the butterfish stock and maintain it at B_{msy}, a reduction in the amount of butterfish bycatch (and associated discard mortality) and an increase in butterfish recruitment will both be necessary. Increased recruitment will be dependent on environmental conditions and on ensuring the survival of sufficient numbers of spawners. The long term key to success will be having controls in place to control mortality once good recruitment events occur so as to sustain the butterfish biomass.

<u>Determination of ABC</u>

In the rebuilding period, through the current annual specifications process, the Council proposes to set the ABC and DAH at levels well below the level defined by the FMP fishing mortality control rule for when the stock is at or above B_{msy}. Once the stock is determined to be rebuilt, yields will be specified annually according to the fishing mortality control rule currently specified in the FMP (i.e., the yield associated with 75% F_{msy}; Max OY = MSY= 12,175MT). The ABC for butterfish during rebuilding will be specified through the annual specification process based on the most recent estimates of stock biomass and the following control rule: ABC will equal **the yield associated with applying a fishing mortality rate of F=0.1 to the most current estimate of stock biomass**. An F of 0.1 facilitates rebuilding according to an auto-regressive (AR1) time-series model developed by the SMB FMAT and reviewed by the MAFMC SSC (see appendix ii). IOY, DAH, and DAP will be established through the same annual specification process as currently occurs. DAH will be the amount available for harvest after discards are accounted for.

Stock biomass and overfishing/overfished status will be determined based on the outcome of the SAW/SARC process (next scheduled for 2010). For the purposes of annual ABC specification, and in the absence of a current SAW/SARC stock estimate, butterfish stock biomass will be annually estimated in the specifications process by a process similar to how annual summer flounder stock size estimates are conducted. The annual stock size estimation procedure would incorporate all relevant and available data possibly including NEFSC survey results, observer data, landings data, etc. Optimally the annual stock size estimate would consist of re-running updated data though the same methodology as the previous assessment. Reference Points will not be annually examined. If the next assessment occurs in 2010, ABCs for 2009 and 2010 would have to be based on surveys or other data and might only be a status quo catch and discard approach (there would be no stock assessment available to project off of or update during the specification development timeline for 2009 or 2010). Regardless, the process would develop a Summary Report (lab reference document), which would try to maintain the format of the SAW/SARC Summary Reports. Since the stock size will determine the ABC, the Science and Statistical Committee (SSC) will review the annual stock size estimate along with the annual quotas.

As there will be additional analytical work required compared to the current specification process, staff from the Council, NERO, and NEFSC will need to work closely to ensure that timing milestones are developed and adhered to so that specifications are in place in a timely manner. Since the mortality cap program is proposed to begin in 2010, the annual stock estimate procedures would need to be developed by early 2009 to facilitate timely preparation of the 2010 regulations.

It is anticipated that applying F=0.1 to the estimated biomass will result in ABC specifications in the range of the table below, but if stock was estimated to be lower than anticipated, applying F=0.1 could result in a lower ABC specification. Likewise, if stock was estimated to be higher than anticipated, applying F=0.1 could result in a higher ABC specification than is illustrated in the following table.

Table 3 . ABC Ranges.

Year	ABC Specification (mt)
2009	1500-2000
2010	1500-2000
2011	1500-5000
2012	1500-7200
2013	1500-9000

Incidental limit setting and the process for closing directed butterfish fishing will generally remain the same as in the 2008 specifications. While not yet final, they will likely specify that closure occurs when 80% of the DAH is projected to be taken, at which point all vessels would be subject to a 600 or 250 pound limit depending on when the closure occurred. Incidental limits will likely be 600 or 250 pounds depending on when the directed fishery closes. Final regulations for the 2008 year will be published in the Federal Register.

As stated above, once the stock is determined to be rebuilt, yields will be specified annually according to the fishing mortality control rule currently specified in the FMP (i.e., the yield associated with 75% F_{msy}; Max OY = MSY= 12,175MT). The Council feels the current control rule can be successful in the future because A) there will be some mesh size increase and/or mortality cap program in place, and B) the directed fishery is and will be more strictly limited to account for discard mortality. Currently, when calculating DAH from ABC, it is assumed that 67% of ABC must be assigned to cover discard mortality. In 2001 and 2002 (the last years we have SAW/SARC information on butterfish abundance) only about 18% of ABC was assigned to cover discard mortality. Future DAH assignments will take all available data into account.

The Amendment 10 FMAT voiced concern that compared to landings by vessels with *Loligo*/butterfish permits, the proportion of butterfish landings by vessels without *Loligo*/butterfish permits has become relatively high recently (see Table 61). The problem would be that these landings and assumed accompanying discards are more difficult to monitor and control as they likely come from vessels fishing in state waters (or they would be illegal), and thus could impair butterfish rebuilding. Council staff examined several sources of data and concluded that while the issue does not appear to be critical at this time, it warrants close tracking, especially if a butterfish mortality cap on the *Loligo* fishery is chosen.

This conclusion is based on the following evidence: 1) The proportion has risen not because unpermitted landings have increased, but because landings by permitted vessels have declined faster. Landings by weight of unpermitted vessels have in fact been decreasing. 2) Unpermitted landings are entered into the dealer weighout database so they are tracked as landings for purposes of closing the directed fishery. While there may be a delay in the case of reports provided by States, there will be a 20% buffer (relative to DAH) for closing directed butterfish fishing. 3) The issue of tracking butterfish discards does not relate so much to butterfish landings as to *Loligo* landings, and only a small percentage of *Loligo* landings do not enter through mandatory dealer reporting (i.e. the state records in Table 3a, which breaks down the 9%-10% of *Loligo* landings that recently have been landed by vessels without *Loligo* permits [from Table 54]). Thus almost all *Loligo* landings will be available for calculating estimated butterfish discards. The small percentage unavailable for observer trips would be unlikely to change estimates of butterfish discards rates, but as discussed in 5.3.1, on this issue and any other issue, the SMB Monitoring Committee will be tracking the performance of any chosen alternatives and the Council may need to reevaluate rebuilding measures as performance information becomes available.

Table 3a. Breakdown of non-permitted *Loligo* Landings.

Record Type	2004	2005	2006
Some Federal permit, no SMB permit	1%	0%	1%
No Permit, records from State	4%	4%	3%
No Permit, records from Dealer	5%	5%	5%
Sub-Total:	9%	10%	9%

<u>Proposed Rebuilding Timeframe</u>

The Council proposes a five-year butterfish rebuilding program. Time frames of seven and ten years were considered but rejected due to the biology of the butterfish stock (which facilitates relatively rapid rebuilding) and/or because those timeframes would lead to alternatives that are very similar to a five-year program. Time frames of less than five years were rejected due to the needs of fishing communities. A five year time frame balances the Magnuson Stevens Act requirements of rebuilding in a time frame as short as possible, taking into account the status and biology of butterfish, and taking into account the needs of fishing communities. While the rebuilding plan is described over 5 years because it is likely butterfish can be rebuilt in 5 years, some measures to control butterfish discarding will need to be permanent to ensure long term sustainability of the butterfish stock.

Year 1 (2009) of the rebuilding plan will maintain the 2008 annual ABC specification for butterfish at 1,500 mt (landings limited to 500 mt) and could include an increase in the minimum mesh size requirement in the *Loligo* fishery up to 2 $^{3/8}$ inches (60 mm). In year 1, keeping landings low aids in butterfish rebuilding by restricting directed fishing, and as described below in section 7.1.2, a mesh increase up to 60mm could help to increase the butterfish stock size by increasing escapement of juveniles. However, the key provisions of this rebuilding plan occur in years 2-5.

Years 2-5 (2010-2013) of the rebuilding plan under measure 1 (see below) would institute and maintain either a mixed species management system with a butterfish mortality cap for the *Loligo* fishery that would track *Loligo* landings and butterfish mortality (landings and discards) simultaneously, or a 3 inch minimum mesh requirement. Under the mixed species management program, the directed *Loligo* fishery would be closed when either the *Loligo* quota or the butterfish mortality cap quota (landings + discards) for the *Loligo* fishery is reached, whichever comes first. In this document, anytime the language "mortality cap" is used, it is meant to reference a butterfish mortality cap program for the *Loligo* fishery. The butterfish mortality cap program for the *Loligo* fishery would control the sum of butterfish landings and discards in the *Loligo* fishery so as to facilitate rebuilding and protection of the butterfish stock after it rebuilds.

Also in years 2-5, but as an alternative, or in addition, to the mixed species approach, the Council could choose alternatives from measures 2-4 (mesh size increases, changes to the current *Loligo* mesh exemption program, and/or gear restricted areas as summarized below and detailed later). The analysis contained in the DSEIS will show however that as stand alone management actions, measure 1 alternatives (mortality cap or the 3 inch minimum codend mesh requirement) are most likely to be successful in the long run.

The reader will note that a 3 inch minimum codend mesh requirement for *Loligo* vessels appears twice, as Alternative 1E and Alternative 2E (codend mesh requirements). This is partly an artifact of how the Alternatives were developed though the Council process, and partly because the 3 inch minimum codend mesh requirement and the butterfish mortality cap for the *Loligo* fishery are most likely to be effective as stand-alone actions in terms of rebuilding. As such, it is useful to have the 3 inch minimum codend mesh requirement in both the Measure 1 group as well as the Measure 2 group to facilitate comparison with other related Alternatives .

The primary measures being considered by the Council to rebuild butterfish include: 1) the implementation of a mixed species management system with a butterfish mortality cap on the *Loligo* fishery (see below) to monitor and control total mortality of butterfish (i.e., landings and discards) both during the rebuilding period, and after the stock is rebuilt, 2) increases in the minimum mesh size required in the *Loligo* fishery, 3) elimination of *Illex* fishery exemptions from *Loligo* minimum mesh size requirements, and/or 4) the implementation of seasonal gear restricted areas to reduce discards of butterfish. These measures are presented in detail below.

<u>Bycatch Reduction</u>

Amendment 8 to the Atlantic Mackerel, Squid and Butterfish Fishery Management Plan was found to be deficient relative to National Standard 9 and, a result, Amendment 9 to the FMP was developed (in part) to address these deficiencies. Amendment 10 has three measures that were transferred from Amendment 9 (i.e., *Loligo* minimum codend mesh size, eliminating exemptions from *Loligo* minimum mesh requirements for *Illex* vessels, seasonal gear restricted areas to reduce butterfish discards) which were primarily intended to reduce bycatch and discarding of target and non-target species in the SMB fisheries and bring the FMP into compliance with MSA bycatch requirements. At its June 2007 meeting, the Council chose to remove these three measures from Amendment 9 and incorporate them into Amendment 10. Therefore, each of these measures is given full consideration in this action. Amendment 10 is expected to be implemented soon after Amendment 9 and, as such, no meaningful delay in addressing the bycatch deficiencies in the MSB FMP should occur. Since discard mortality in the *Loligo* fishery is the largest contributor to overall fishing-related mortality on butterfish, the discard provisions carried over from Amendment 9 also have meaning for the purposes of butterfish rebuilding.

5.3 Alternatives Considered for Implementing the Butterfish Rebuilding Plan and Reducing Discards

5.3.1 Measure 1 Alternatives (Butterfish Mortality Cap or 3 Inch Minimum Mesh for the *Loligo* Fishery)

Under Alternatives 1B-D, the directed fishery for butterfish would be limited per the fishing mortality rates specified, and a butterfish mortality cap program for the *Loligo* fishery would be implemented. Since NMFS Observer data show that the majority of butterfish bycatch occurs in the *Loligo* fishery, the Council is only proposing a mortality cap program for the *Loligo* fishery and the cap amount would be 75% of the ABC (allocated by *Loligo* trimesters- see appendix v for details). The remaining 25% of the ABC would cover harvest and discard mortality in other fisheries. Excepting a paradigm shift in fishing, controlling butterfish mortality in the *Loligo* fishery will control overall butterfish mortality. The process for closing directed butterfish fishing will generally remain the same as in the 2008 specifications. If the directed butterfish fishery is closed, *Loligo* moratorium vessels and all other vessels would be subject to the closure-related incidental trip limits set in the annual specifications. Council staff, in coordination with the SMB Monitoring Committee will analyze NMFS dealer weighout data and observer program data on an ongoing basis during the annual specification process to determine if the rebuilding program constrains overall mortality, and the Council will consider changes to the rebuilding program as necessary. If problems are detected, the SMB Committee will request further analysis and management recommendations through the annual specification process or an amendment or framework as necessary and appropriate.

Since *Loligo* is allocated by trimester, the butterfish mortality cap would also be allocated by trimester. The butterfish mortality cap for the *Loligo* fishery could be allocated based on: the current seasonal allocation of the *Loligo* quota (1B), recent *Loligo* landings (1C), or an alternative butterfish bycatch allocation which takes into account the seasonal allocation of the *Loligo* quota and expected butterfish discard rates by trimester (1D). The directed *Loligo* fishery would close when the pre-specified closure trigger (80%-90% set during the annual specifications process- see below) of the butterfish mortality cap for the *Loligo* fishery for each trimester is harvested. The three mortality cap alternatives would have the same annual quota, so the differences between them are primarily economic- they would primarily affect *when* the directed *Loligo* fishery would close, not overall butterfish mortality.

Tracking of the butterfish mortality cap would parallel tracking of DAH, however butterfish landed **or discarded** by vessels landing more than 2,500 pounds of *Loligo* would count against the butterfish mortality cap for the *Loligo* fishery. Mortality cap landings will be tracked by NMFS Fishery Statistics Office and its quota monitoring program. Discard rates generated though a new observer program (detailed in later sections) will be applied to mortality cap landings of *Loligo* to estimate mortality cap discards. For example, consider we knew that on average, **1** pound of butterfish was discarded per **20** pounds of *Loligo* kept. If **4000** pounds of *Loligo* were kept on a trip, one could estimate that 200 pounds of butterfish were discarded (**4000/20*1=200**). When the sum of mortality cap butterfish landings plus mortality cap estimated butterfish discards reaches a specified trigger (see **5.3.1**) in each *Loligo* trimester, the directed *Loligo* fishery would be closed.

The process for closing directed butterfish fishing will generally remain the same as in the 2008 specifications (closure at 80% of projected DAH). All butterfish landings would count against DAH to determine when the directed butterfish fishery is closed. If the directed butterfish fishery is closed, *Loligo* moratorium vessels and all other vessels would be subject to the closure-related incidental trip limits set in the annual specifications. These limits would limit directed fishing for butterfish. Discards would be tracked as described in the previous paragraph.

New Observer System

Alternatives 1B-D would require the development of a completely new system to monitor and regulate the mortality levels of butterfish in the directed *Loligo* fishery that include: substantially increased observer coverage levels (industry-funded); possible additional trip and vessel catch reporting; and possible changes to dealer catch reporting. A description of the level of sea sampling required to achieve acceptable levels of precision of estimates of total butterfish mortality (landings and discards) in the *Loligo* fishery is given in Appendix iii and the *Loligo* sea sampling protocol is described in Appendix iv. In summary, vessels which intend to participate in the directed *Loligo* fishery would be required to notify NMFS of their intention to make a directed *Loligo* trip and could be required to carry an observer. Vessels that do not notify for a specific trip would not be permitted to possess more than 2,500 pounds of *Loligo* for that trip.

Industry would be required to pay the at-sea portion of this program. The level of coverage necessary to estimate the butterfish bycatch rate in the directed *Loligo* fishery with an acceptable level of precision (30% CV) would require a roughly 5-6 fold increase in observer coverage relative to recent levels of sea sampling by NMFS. In addition to the greatly increased cost to industry, the increased level of observer coverage would substantially increase NMFS administrative costs associated with implementation of the new management system. Another consideration is that regulation of the *Loligo* fishery under this system would be additionally based on a statistical estimate of total butterfish mortality (calculated by NMFS in cooperation with Council staff) in that fishery rather than just the current relatively simple accounting of *Loligo* landings. The statistical estimation procedure would be accompanied by an associated statistical risk that the resulting butterfish mortality estimates are either too high or too low.

If requested by NMFS, owners of vessels possessing *Loligo*/butterfish moratorium vessels which intend to conduct a directed *Loligo* trip (i.e., possess more than 2,500 pound of *Loligo*) will be required to carry a certified NMFS observer. An owner of a *Loligo* vessel required to carry an observer must arrange for carrying an observer certified through the observer training class operated by the Northeast Fisheries Observer Program NMFS/NEFOP certified) from an observer service provider approved by NMFS. A list of approved observer service providers shall be posted on the NOAA/NEFOP website. The owner, operator, or vessel manager of a vessel selected to carry an observer must contact the observer service provider and must provide advance notice of the fishing trip for the provider to arrange for observer deployment for the specified trip.

An owner, operator, or vessel manager of a *Loligo* vessel that cannot procure a certified observer within a reasonable amount of time from the advance notification to the provider due to the unavailability of an observer, may request a waiver from NMFS from the requirement for observer coverage for that trip, but only if the owner, operator, or vessel manager has contacted all of the available observer service providers to secure observer coverage and no observer is available. If this is the case, NMFS shall issue such a waiver, generally within 24 hours

Unless otherwise notified by the Regional Administrator, owners of *Loligo* vessels shall be responsible for paying the cost of the observer for all *Loligo* fishing trips on which an observer is carried onboard the vessel, regardless of whether the vessel lands or sells *Loligo* on that trip. Observer service providers are responsible for setting the daily rate for observer coverage on a vessel.

Data collected from the at sea observer program will be transmitted via fax or email to the NMFS NERO Office of Statistics soon after the vessels return to port. Estimates of the incidental catch of butterfish in the *Loligo* fishery will be made on a regular basis using a statistical expansion method to be developed by the NMFS NEFSC and NERO. The estimation procedure will be similar to the methods currently used for yellowtail flounder in the sea scallop fishery. The ratio of butterfish caught to *Loligo* landed will be computed for directed *Loligo* trips based on data collected in the at sea observer program. Estimates of total *Loligo* landings from NMFS dealer data reports for the week in question will be used in conjunction with the sea sampling data to provide an estimate of incidental butterfish take in the directed *Loligo* fishery (i.e., the ratio of butterfish taken/*Loligo* landed from the sea sampling program will be scaled to the dealer reported landings of *Loligo* to provide an estimate of total butterfish taken in the directed *Loligo* fishery - see example above just before the "New Observer Program" subheading). The Regional Administrator shall close the directed fishery for *Loligo* when it is projected that the trigger level for the butterfish mortality cap is reached for a given trimester in the *Loligo* fishery. The butterfish mortality threshold level triggering a closure of the directed *Loligo* fishery will be specified annually during the quota specification setting process in the range of 80%-90% of the amount of the butterfish mortality cap for the *Loligo* fishery allocated to a given trimester. An 80% closure trigger was recommended by NMFS because of the anticipated low precision of weekly butterfish catch projections, given the two-week time lag in landings reporting (SAFIS Database), and the likely variability in weekly discard estimates for the *Loligo* fishery. It may be prudent to adopt an 80% closure trigger during the first year of managing for the first two trimesters and then close the third trimester when 90% of the annual total mortality cap quota is reached (a higher percentage of the larger annual number still provides a buffer - this is similar to how the squid closure triggers work). The Monitoring Committee can compute the precision of the weekly catch estimates to determine appropriate closure triggers for the following years of the rebuilding plan. Enforcement of closures would occur in a similar fashion as enforcement of current trimester closures occurs.

<u>Alternative 1E (3 inch mesh)</u>

Under Alternative 1E, the directed fishery for butterfish would be limited per the fishing mortality rates specified above and in the FMP, and a permanent minimum codend mesh size requirement of 3 inches would be implemented in the *Loligo* fishery (would not include a butterfish mortality cap for the *Loligo* fishery). The details of a 3-inch codend mesh size measure are described below in measure 2 (codend mesh requirements), but a codend mesh size of 3 inches will reduce the discard of most butterfish juveniles and some spawners, thereby increasing spawning stock biomass (assuming effort did not increase in the future so as to offset the effect of the greater rate of escapement of butterfish spawners).

5.3.1A Alternative 1A: No action (continue the quota specifications and current SMB regulations)

Under this alternative, no adjustments to the ABC specification or other measures implemented for a given fishing year would be made during the five year rebuilding horizon. As such, specification by the Council of management measures for *Loligo*, *Illex*, Atlantic mackerel and butterfish would occur each year as per the current FMP with no additional butterfish stock rebuilding measures being implemented as a result of this amendment.

5.3.1B Alternative 1B: Butterfish rebuilding program with butterfish mortality cap implemented to control total annual fishing mortality on butterfish with the seasonal allocation of the butterfish mortality cap based on the current allocation of *Loligo* quota distribution by trimester

Under this alternative the directed fishery for butterfish would be limited per the fishing mortality rates specified in the FMP. This alternative would also implement the mixed species management model with a butterfish mortality cap described above. ABC for butterfish would be specified annually within the range of specifications as described in Table 3. The directed *Loligo* fishery would be allocated 75% of the ABC specification for butterfish for a given year, allocated to each trimester based on the same percentages used in the current allocation of the *Loligo* quota by trimester. That is, the annual butterfish ABC would be allocated to each trimester as follows: Trimester 1=43%, Trimester 2=17% and Trimester 3=40% (see Appendix v). Based on estimates from data collected in the at sea observer program, the directed *Loligo* fishery would be closed when 80%-90% (see above for details) of the butterfish mortality cap for the *Loligo* fishery or the *Loligo* quota was taken, whichever comes first.

5.3.1C Alternative 1C: Butterfish rebuilding program with butterfish mortality cap implemented to control total annual fishing mortality on butterfish with the seasonal allocation of the butterfish mortality cap based on recent *Loligo* landings (2002-2006) by trimester

Under this alternative the directed fishery for butterfish would be limited per the fishing mortality rates specified in the FMP. This alternative would also implement the mixed species management model with a butterfish mortality cap described above. ABC for butterfish would be specified annually within the range of specifications as described in Table 3. The directed *Loligo* fishery would be allocated 75% of the ABC specification for butterfish for a given year based on the historical distribution of butterfish discard estimates using data the NMFS at-sea observer program, allocated to each trimester based on the seasonal distribution of *Loligo* landings in recent years (2002-2006). That is, the annual butterfish ABC would be allocated to each trimester as follows: Trimester 1=50.1%, Trimester 2=17.3% and Trimester 3=32.6% (see Appendix v). Based on estimates from data collected in the at sea observer program, the directed *Loligo* fishery would be closed when 80%-90% (see above for details) of the butterfish mortality cap for the *Loligo* fishery or the *Loligo* quota was taken during each trimester, whichever comes first.

5.3.1D Alternative 1D: Butterfish rebuilding program with butterfish mortality cap implemented to control total annual fishing mortality on butterfish with the seasonal allocation of the butterfish mortality based on the bycatch rate method

Under this alternative the directed fishery for butterfish would be limited per the fishing mortality rates specified in the FMP. This alternative would implement the mixed species management model with a butterfish mortality cap described above. ABC for butterfish would be specified annually within the range of specifications as described in Table 3. The directed *Loligo* fishery would be allocated 75% of the ABC specification for butterfish for a given year, allocated to each trimester (see appendix ii) using the bycatch rate method. That is, the annual butterfish ABC would be allocated to each trimester as follows: Trimester 1=65.0%, Trimester 2=3.3% and Trimester 3=31.7% (see Appendix v). This method was developed to account for the amount of *Loligo* quota allocated to each trimester and the bycatch rate expected during each trimester based on 2002-2005 sea sampling bycatch rate estimates by trimester in the *Loligo* fishery. Based on discard estimates from data collected in the at sea observer program, the directed *Loligo* fishery would be closed when 80%-90% (see above for details) of the butterfish mortality cap for the *Loligo* fishery or the *Loligo* quota was taken during each trimester, whichever comes first.

5.3.1E Implement a 3.0 inch minimum mesh requirement in the directed *Loligo* fishery

Under this alternative the directed fishery for butterfish would be limited per the fishing mortality rates specified in the FMP and a permanent increase in the minimum codend mesh size requirement, to 3 inches (76 mm), for the *Loligo* fishery would be implemented. This alternative would not implement the mixed species management program described above. Published studies suggest that a 3.0 inch minimum diamond mesh translates into a probability of escapement of 50% of butterfish 4 $^{3/4}$ inches in fork length (50% of 4 $^{3/4}$ inch fish are reproductively mature (Meyer and Merriner 1976, O'Brien et al. 1983, pers com with L. Hendrickson). This measure would facilitate butterfish rebuilding and also facilitate reduction of bycatch of other non-target species in the *Loligo* fishery.

Note for readers: Alternatives in sections 5.3.2, 5.3.3, and 5.3.4 were originally included in Amendment 9, but the Council deferred them for consideration to Amendment 10. For each of these alternatives, the Council selected "no action" as the preferred alternative in Amendment 9.

5.3.2 Measure 2 Alternatives (*Loligo* Minimum Mesh Size Requirements)

The Council considered 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 effect. 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 recently reproductively mature fish (12 cm in length) at a poundnet 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 constriction, 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).

Since there are already *Loligo* minimum codend mesh requirements in place, it is expected that these measures would be relatively easy to implement, enforcement would be relatively comparable, and current monitoring would be relatively adequate.

5.3.2A Alternative 2A: 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.

5.3.2B Alternative 2B: Increase minimum codend mesh size to $2^{1/8}$ inches (54 mm)

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.

5.3.2C Alternative 2C: Increase minimum codend mesh size to $2^{3/8}$ inches (60 mm)

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 $2^{3/8}$ inches (60mm) diamond, inside stretch measure.

5.3.2D Alternative 2D: Increase minimum codend mesh size to $2^{1/2}$ inches (64 mm)

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.

5.3.2E Alternative 2E: Increase minimum codend mesh size to 3 inches (76 mm)

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 and other species.

5.3.3 Measure 3 Alternatives (Eliminate Exemptions from *Loligo* Minimum Mesh Requirements for *Illex* Vessels)

The Council considered 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 *Loligo* minimum mesh requirements described above. When landward of these geographic coordinates, however, these vessels are not exempt from the *Loligo* minimum mesh requirements. 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. For the set of alternatives described under section 5.3.3, the maximum mesh size that could be required in the *Illex* fishery would be 1 7/8 inches (48 mm). That is, if the Council chooses to implement any of the action alternatives under this section, the maximum mesh size that would be required, regardless of the mesh required in the *Loligo* fishery, would be 1 7/8 inches (48 mm).

Since there are already *Loligo* minimum codend mesh requirements in place, it is expected that these measures would be relatively easy to implement, enforcement would be relatively comparable, and current monitoring would be relatively adequate.

5.3.3A Alternative 3A: No Action (*Illex* vessels are exempt from *Loligo* minimum mesh requirements in the months of June through September

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

5.3.3B Alternative 3B: 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.

5.3.3C Alternative 3C: 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*.

5.3.3D Alternative 3D: 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.

5.3.4 Measure 4 Alternatives (Seasonal Gear Restricted Areas)

The Council is considering the establishment of gear restricted areas (GRAs) 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. The technical methodology for this analysis is presented in Appendix 1 of Amendment 9 to this FMP. Compared to the timeframe for the data inputs used in Amendment 9, the current analysis is based on observed discards and small mesh fishery effort from 2001-2006. Observer program coverage for the small mesh bottom otter trawl fishery increased substantially in 2004-2006; thus the updated analyses should accurately reflect current patterns in discarding and fishery effort. Comparison of past butterfish discarding patterns with recent year patterns was conducted, however, and the data show no discernable shift the general distribution of butterfish discarding. Butterfish discarding has been concentrated in the areas covered by the proposed GRAs since at least 1997.

Within any of the proposed GRAs, the use of bottom otter trawl gear would be subject to a specified minimum effective codend mesh size (inside stretch measure) during the period January through April. 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 inches are necessary to allow escapement of juvenile butterfish as well as a portion of the spawners that are encountered by bottom otter trawls.

Implementing the GRAs would likely require a significant outreach effort to facilitate compliance, and the Coast Guard has noted that gear restricted area types of regulations can only be enforced by at-sea boardings and that the time of year, general locations, and shapes of the proposed GRAs make them even more difficult to enforce. If a GRA alternative is selected, the Coast Guard has recommended the addition of a VMS requirement to promote compliance.

MAFMC staff examined the observer data base's 2002-2006 (most recent 5 years) observations of butterfish discards by gear using less than 76 mm (3 inches) mesh in inshore areas during the spawning season (June through August). These discards accounted for approximately only 3% by weight of total 2002-2006 NMFS observer program observed butterfish discards (Figure E1).

5.3.4A Alternative 4A: No Action (No butterfish GRAs)

Under this alternative, no seasonal GRAs would be established through Amendment 10 to the FMP.

5.3.4B Alternative 4B: Butterfish GRA1 (minimum codend mesh of 3 inches from January 1 through April 30 in effective area)

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 1**). The delineated area is associated with an area accounting for 50% of bottom otter trawl discards using codend mesh sizes of less than 3 inches (76 mm) from January through April. 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.

5.3.4C Alternative 4C: Butterfish GRA2 (minimum codend mesh of 3 inches from January 1 through April 30 in effective area)

Under this alternative, the use of bottom otter trawl gear in the area that has been designated as Butterfish GRA2 (**Figure 2**) 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 area accounting for 90% of bottom otter trawl discards using codend mesh sizes of less than 3 inches (76 mm) from January through April. As in Alternative 4.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.

5.3.4D Alternative 4D: Butterfish GRA3 (minimum codend mesh of $3^{3/4}$ inches from January 1 through April 30 in effective area)

Under this alternative, the use of bottom otter trawl gear in the area that has been designated as Butterfish GRA3 (**Figure 3**) 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 area accounting for 50% of bottom otter trawl discards using codend mesh sizes of less than 3 3/4 inches (95 mm) from January through April. Compared to the 3 inch minimum mesh size considered under Alternative 4.B, the GRA boundary associated with Alternative 4.D is slightly larger. Additionally, the escapement of reproductively mature butterfish is much more likely according to a butterfish selectivity analysis by Meyer and Merriner (1976).

5.3.4E Alternative 4E: Butterfish GRA4 (minimum codend mesh of $3^{3/4}$ inches from January 1 through April 30 in effective area)

Under this alternative, the use of bottom otter trawl gear in the area that has been designated as Butterfish GRA4 (**Figure 4**) would require the use of nets with a minimum codend mesh size of 3 $^{3/4}$ inches (95 mm). The delineated area is associated with an area accounting for 90% of bottom otter trawl discards using codend mesh sizes of less than 3

3/4 inches (95 mm) from January through April. Compared to the 3 inch minimum mesh size considered under Alternative 4.C, the GRA boundary associated with Alternative 4.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 compared to Alternative 4.D.

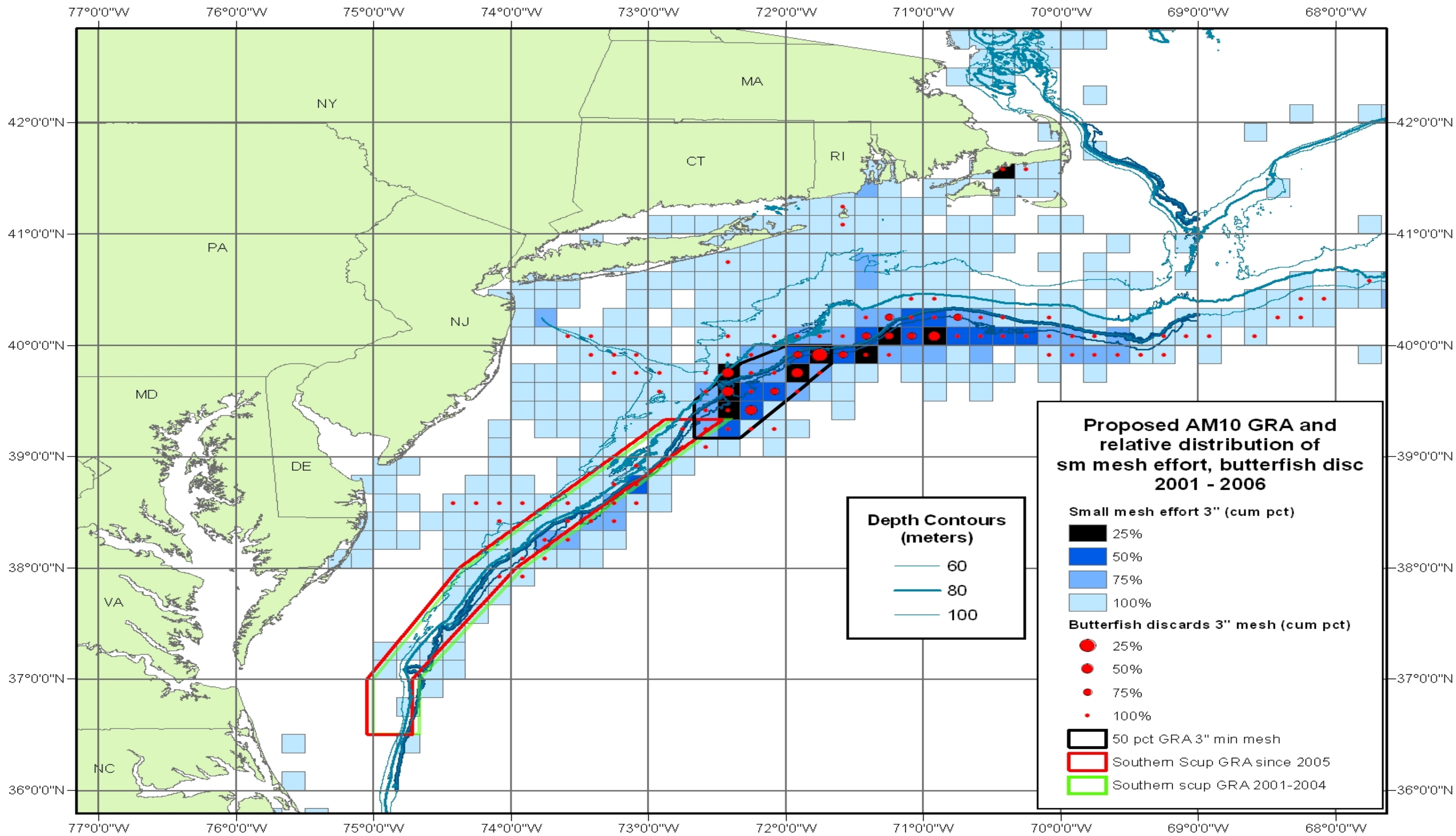

Figure 1. Location of potential gear restricted area “Butterfish GRA 1” (effective Jan-Apr).
Shading in the highlighted ten-minute squares (10 Lat min 4 10 Long min) reflects fishing effort from vessels using bottom otter trawls with less than 3 inch codend mesh, while the circles indicate the distribution and intensity of butterfish discarding in these ten-minute squares.

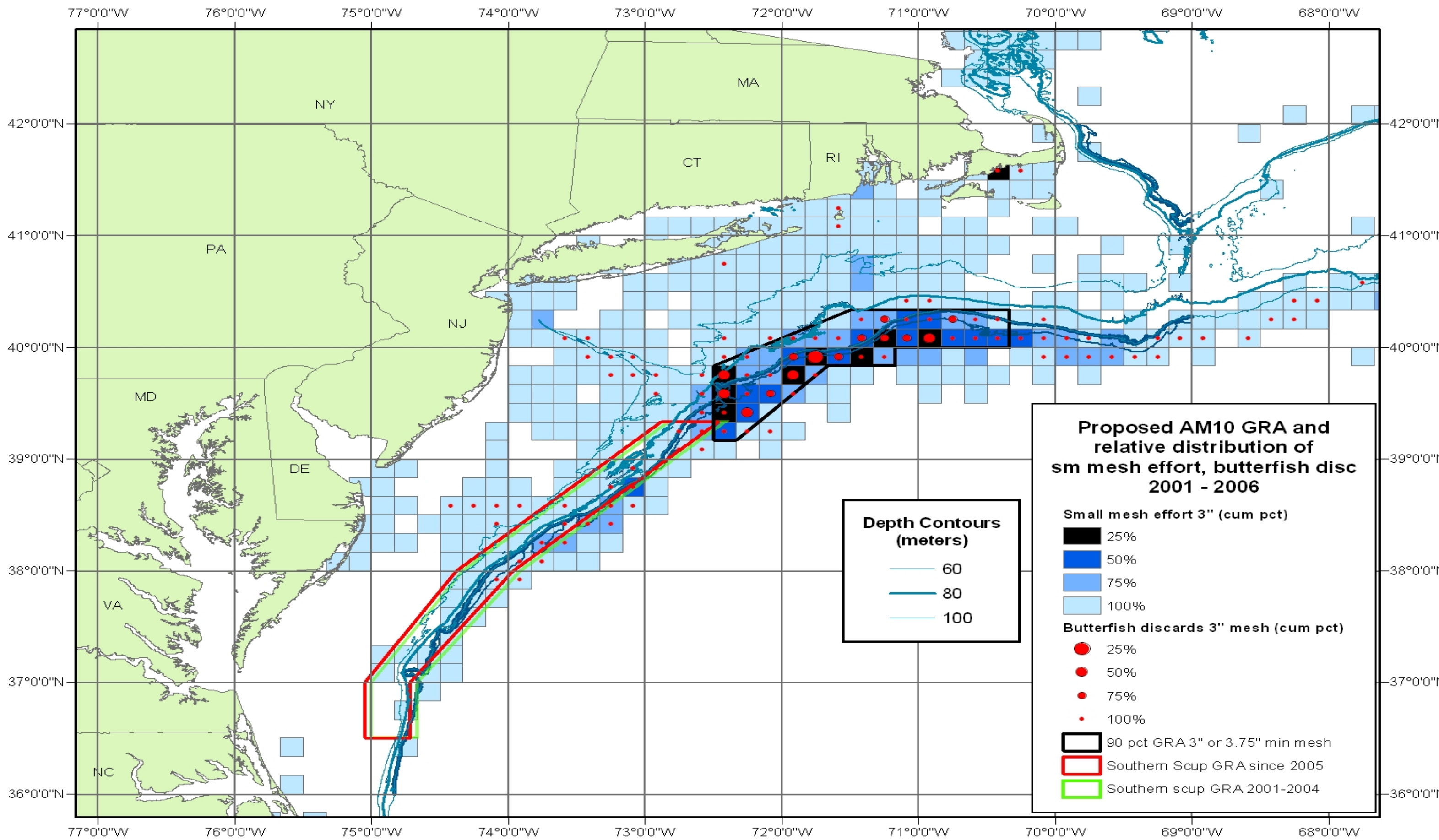

Figure 2. Location of potential gear restricted area "Butterfish GRA 2" (effective Jan-Apr).
Shading in the highlighted ten-minute squares (10 Lat min 4 10 Long min) reflects fishing effort from vessels using bottom otter trawls with less than 3 inch codend mesh, while the circles indicate the distribution and intensity of butterfish discarding in these ten-minute squares.

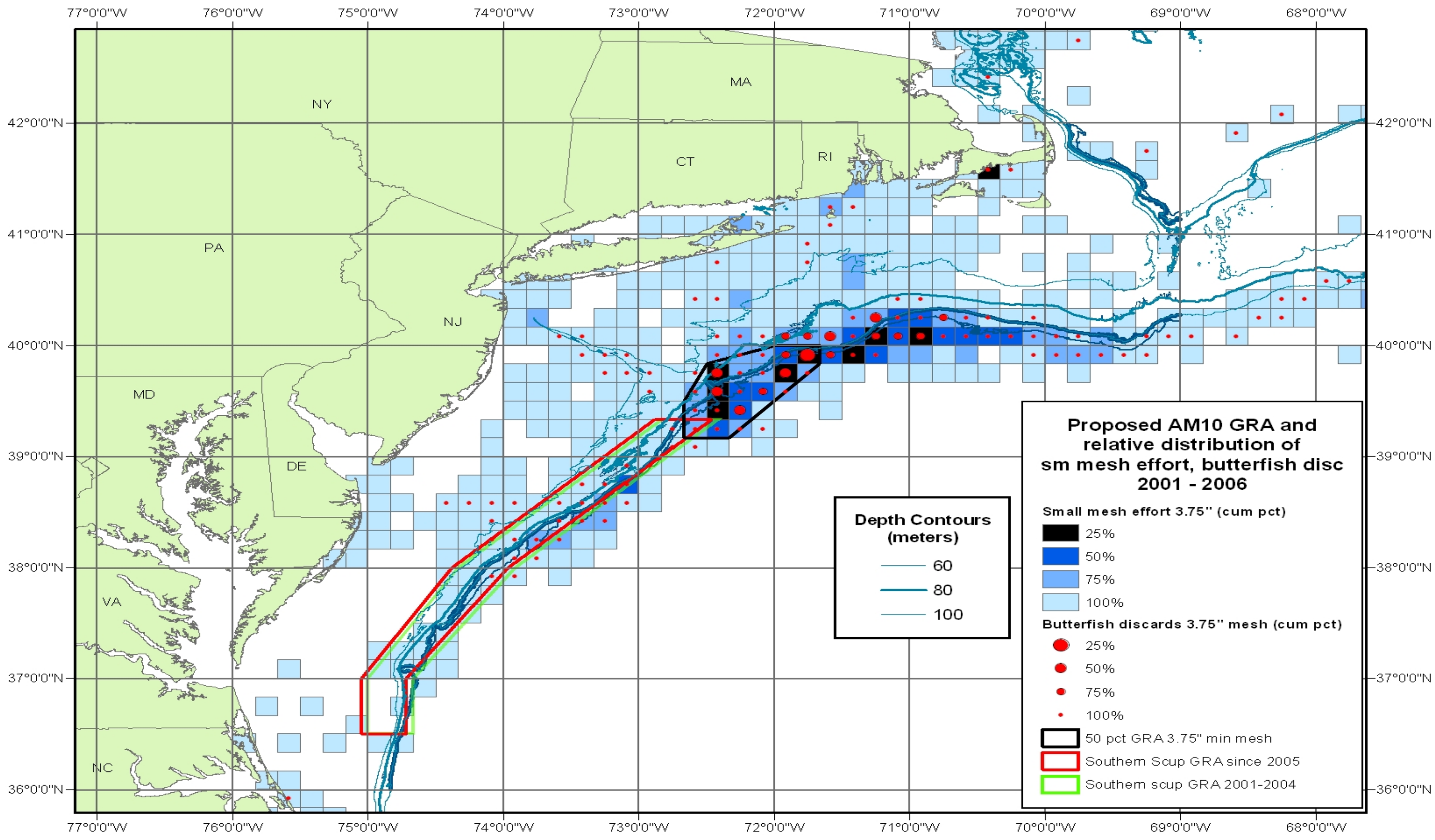

Figure 3. Location of potential gear restricted area “Butterfish GRA 3” (effective Jan-Apr).
Shading in the highlighted ten-minute squares (10 Lat min 4 10 Long min) reflects fishing effort from vessels using bottom otter trawls with less than 3 ¾ inch codend mesh, while the circles indicate the distribution and intensity of butterfish discarding in these ten-minute squares.

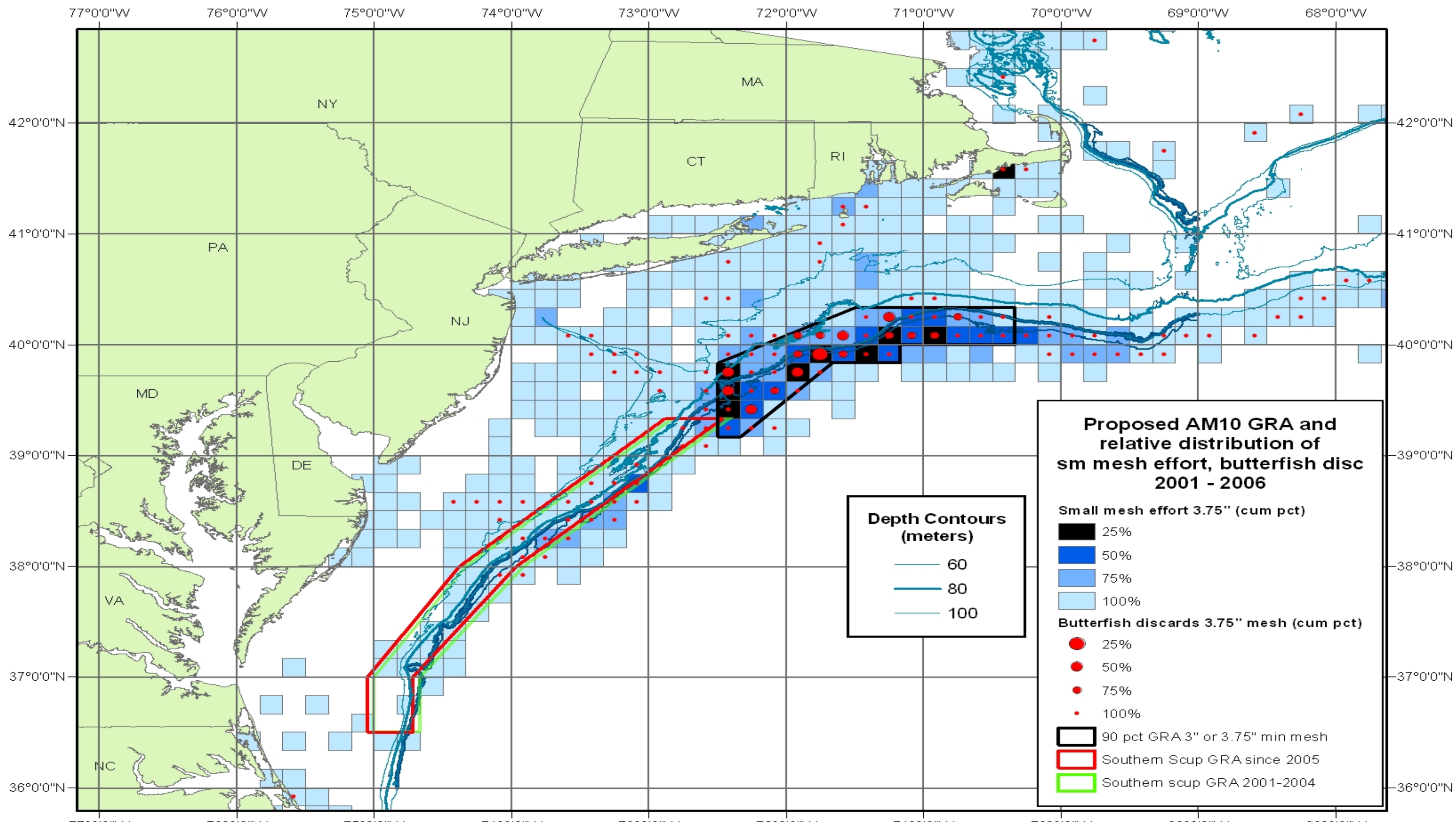

Figure 4. Location of potential gear restricted area “Butterfish GRA 4” (effective Jan-Apr).
Shading in the highlighted ten-minute squares (10 Lat min 4 10 Long min) reflects fishing effort from vessels using bottom otter trawls with less than 3 ¾ inch codend mesh, while the circles indicate the distribution and intensity of butterfish discarding in these ten-minute squares.

5.4 ALTERNATIVES CONSIDERED BUT REJECTED FOR FURTHER ANALYSIS

CONSIDERED BUT REJECTED MANAGEMENT ACTIONS

There are currently nine considered but rejected management actions in Amendment 10. The considered but rejected actions would have:

- developed a less than five-year plan to allow the butterfish stock to rebuild to $B_{MSY;}$
- developed a seven-year plan to allow the butterfish stock to rebuild to $B_{MSY;}$
- developed a ten-year plan to allow the butterfish stock to rebuild to $B_{MSY;}$
- reduced fishing effort in the *Loligo* fishery through rationalization and individual tradable quotas (including a butterfish mortality cap for the *Loligo* fishery);
- reduced bycatch by requiring jig gear;
- provided for a small-mesh fishing area where minimal butterfish bycatch can be demonstrated;
- provided for variable *Loligo* trip limit conditional on minimum mesh size; and
- provided for a conservation quota for gear-based solutions to reduce butterfish bycatch.
- ability to create sectors in the *Illex* and *Loligo* fisheries

Seven-year, ten-year, and less than five-year durations for the rebuilding plan were considered but rejected. The Council evaluated several attributes of these durations before concluding to reject them. Primarily, the Council considered the durations based on the rebuilding timeline requirements of the Magnuson Stevens Act to:

> (1) be as short as possible, taking into account the status and biology of any overfished stocks of fish, the needs of fishing communities, recommendations by international organizations in which the United States participates, and the interaction of the overfished stock of fish within the marine ecosystem; and
>
> (2) not exceed 10 years, except in cases where the biology of the stock of fish, other environmental conditions, or management measures under an international agreement in which the United States participates dictate otherwise.

While imprecise, the models used to evaluate the rebuilding of the butterfish stock indicate that rebuilding may occur rapidly (and suggests that the butterfish BMSY may be slightly above the target threshold in 2007). For this reason, the seven-year and ten-year rebuilding schedules were rejected; a five-year time frame seems quite possible. A less than five-year schedule was rejected as not taking into account the needs of fishing communities. Given the model suggests butterfish may already be rebuilt, and that the primary rebuilding driver will be good recruitment, a less than five-year rebuilding time frame would inflict unnecessary hardship on fishing communities. The real necessity is to have in place a program that will conserve the biomass that results from the next (or current) good recruitment events.

A butterfish rebuilding program needs to be developed and implemented as quickly as possible. Developing an ITQ program is a time consuming process and, therefore, cannot be included is this action. ITQ programs can be considered in future amendments.

Requiring the use of jig gear did not have the support of the industry. Additionally, it would have involved large capital expenditures to outfit vessels and experimental research to determine the effectiveness of catching *Loligo* and avoiding bycatch. Therefore, it was not considered further for this action.

Butterfish and *Loligo* co-occurrence analyses conducted by survey season indicate that both species co-occur throughout the year and there are no large areas which consistently result in *Loligo* catches with minimal or low catches of butterfish. Co-occurrence varies by year, season, depth, and latitude. During summer and fall, the co-occurrence of butterfish and *Loligo* does not decrease consistently with depth. During the winter, on average, co-occurrence is generally lowest within a narrow depth range of 150 m - 179 m. Co-occurrence increases in deeper water. The 150 m - 179 m depth range overlaps with the depth range of the winter *Loligo* fishery (110 m -183 m), so limiting fishing to this narrow depth range is not expected to considerably reduce the bycatch of butterfish in the winter *Loligo* fishery. The relationship between co-occurrence and depth varies by year and latitude, making both the prediction of annual fishing depth limits and the enforcement of a depth-based fishing boundary very difficult. In addition, NEFSC survey data indicate that forcing the winter *Loligo* fishery into deeper water is likely to result in an increase in spiny dogfish bycatch. For these reasons, the alternative of establishing a small-mesh fishing area, within a polygon or by depth restriction, was considered but rejected.

The details of providing for variable *Loligo* trip limit conditional on minimum mesh size have not been developed yet, so this management measure is not being considered in this action but could be considered in a future action.   In addition, this measure requires changes in fishing behavior that are difficult to monitor and enforce.

The conservation quota is a tool to encourage gear-based research to minimize butterfish bycatch. The details of this conservation quota have not been developed yet, so this management measure is not being considered in this action. However, a conservation quota can be considered in a future action.

The creation of sectors can be effective in reducing the race to fish, promoting efficient use of fishing capital, and providing a mechanism for members of the sector to develop locally appropriate means for staying within their allocation. The primary reason these changes occur is economic incentive. The guaranteed allocation facilitates harvest when conditions are optimal, as opposed to just getting to the fish before someone else does (particularly for a quota fishery).   In addition to addressing capacity issues, sector creation also has the potential to reduce the administrative and enforcement burdens on councils and the NMFS. The creation of sectors was rejected for further consideration in this Amendment because the time constraints imposed by the MSA to rebuild the butterfish stock did not allow the Council sufficient time to address the resource allocation implications of sector formation. The Council intends to consider sector formation in these fisheries in a future management action.

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.

Identification of the Selected Valued Ecosystem Components

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 or indirectly 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). Certain management options (primarily mesh size increases) could also affect the directed NE small-mesh whiting fishery due to the nature of that fishery and its association in time and space with SMB 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 5. The management unit identified in the FMP (Section 4.4) 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. Figure 6 illustrates the extent of these various geographic areas and the areas where the managed species were harvested during the period 1997-2006.

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 7. 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.

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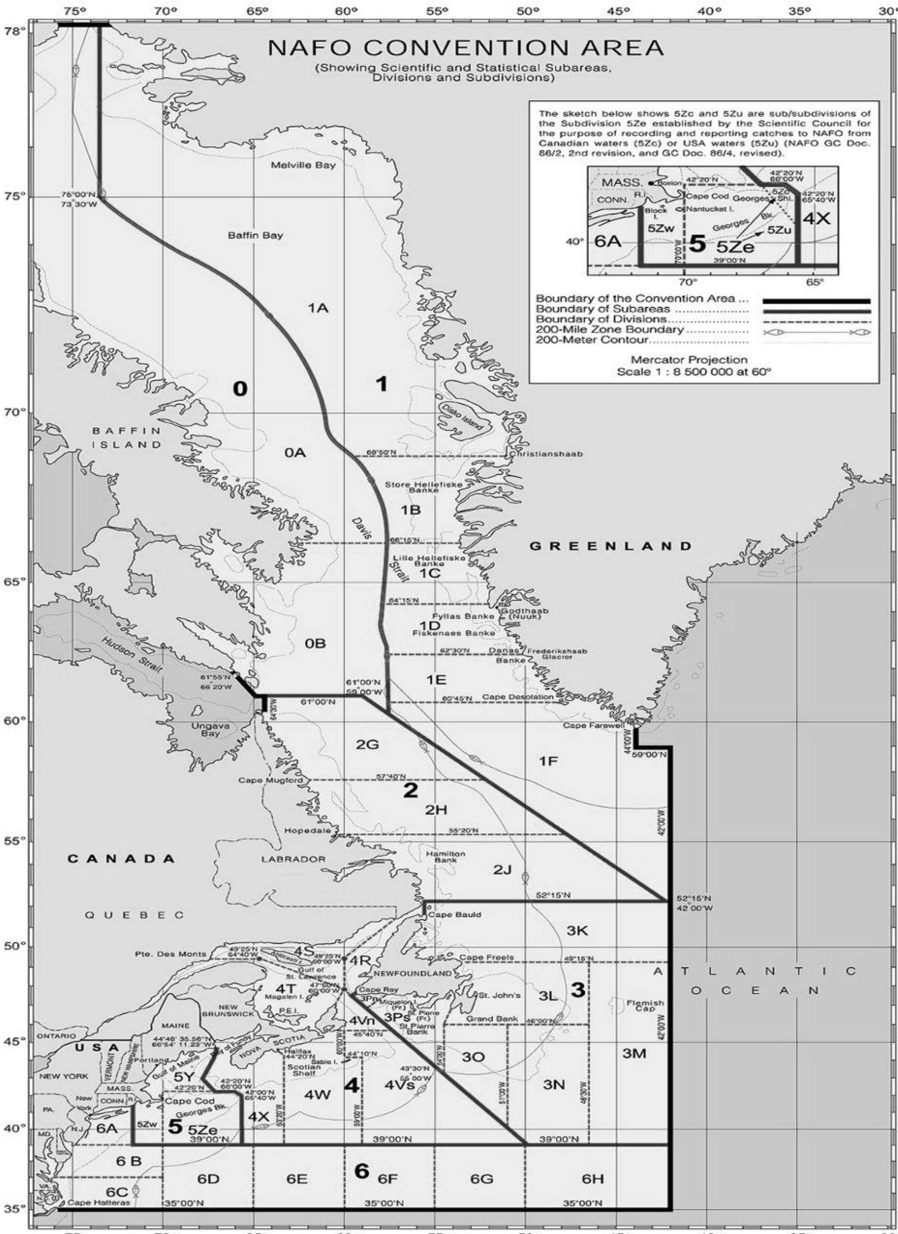


Figure 5 NAFO Convention Area. Indicates scientific and statistical subareas.

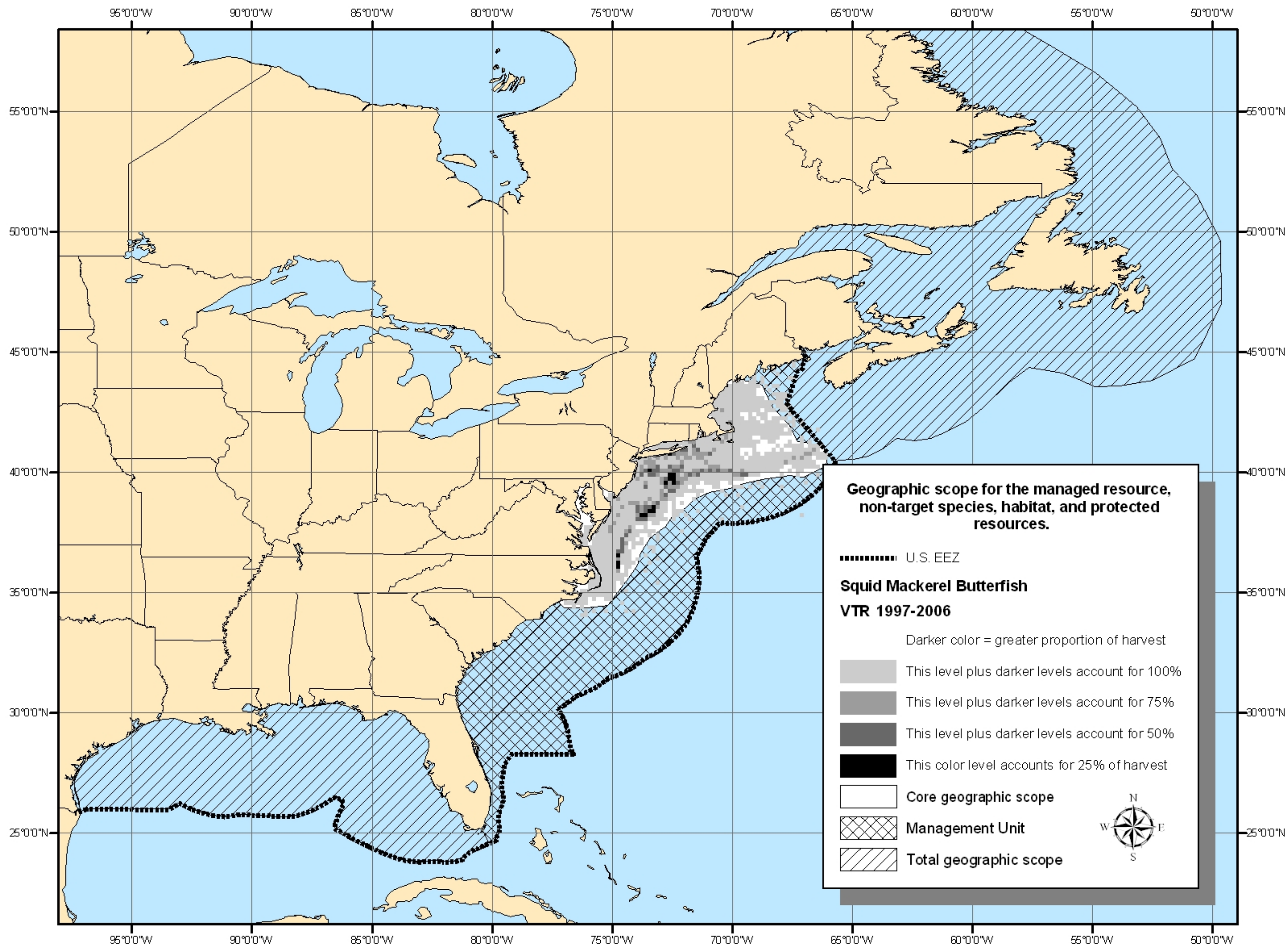
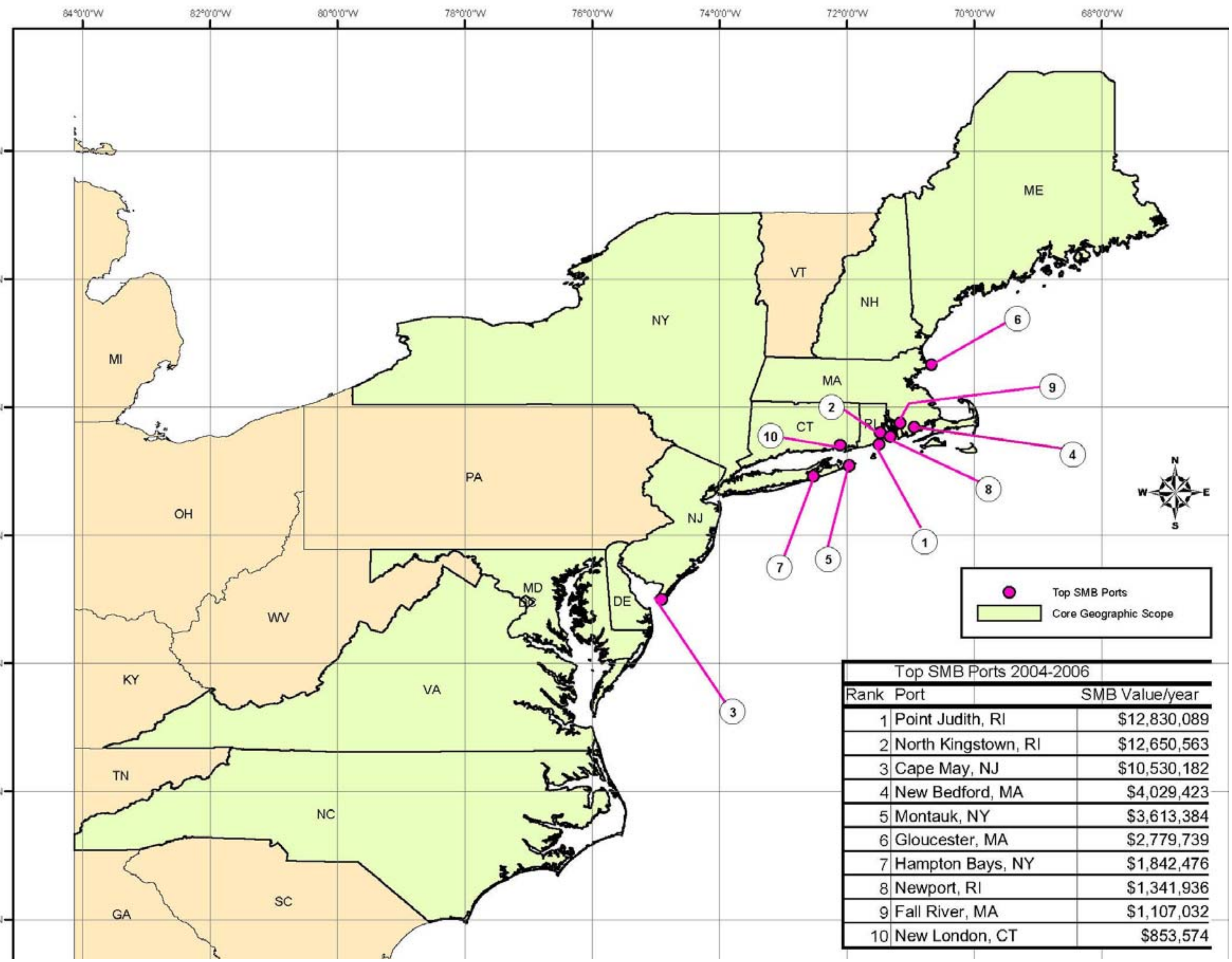


Figure 6. Geographic scope of the VECs, not including human communities.



Top SMB Ports 2004-2006		
Rank	Port	SMB Value/year
1	Point Judith, RI	$12,830,089
2	North Kingstown, RI	$12,650,563
3	Cape May, NJ	$10,530,182
4	New Bedford, MA	$4,029,423
5	Montauk, NY	$3,613,384
6	Gloucester, MA	$2,779,739
7	Hampton Bays, NY	$1,842,476
8	Newport, RI	$1,341,936
9	Fall River, MA	$1,107,032
10	New London, CT	$853,574

Figure 7. 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.

Specification of status determination criteria (Magnuson-Stevens National Standard 1):

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 focus 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 stock assessment information indicates that fishing mortality has exceeded threshold levels, overfishing is said to be occurring. When stock assessment information 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 conditions. 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 ($\pm$ 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 ($\pm$ 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 (1000s mt), landings (1000s mt), and recruits (millions of individuals) during 2006-2008 for the northwest Atlantic stock of mackerel given in SARC 42 are as follows (Table 4):

Table 4. Mackerel SSB and recruit projections 2005-2008.

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

Commercial Atlantic Mackerel Fishery.

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 5) 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 5). 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 5 and Figure 8. 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 NE Dealer weighout database, the vast majority of commercial Atlantic mackerel landings are taken by trawl gear (Table 5). Among trawl types, unspecified midwater otter trawls and paired midwater otter trawls have become increasingly important in recent years. From 2002-2006, paired midwater trawls comprised 38% of commercial Atlantic mackerel landings, while unspecified midwater trawls also accounted for 40% 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 22% of the landings, and bottom otter trawls accounted for 71% of the landings.

Table 5. U.S. commercial Atlantic mackerel landings (mt) from 1982 - 2006, by major gear type and recent quota specifications.

YEAR	TRAWL: OTTER, BOTTOM, FISH	TRAWL: OTTER, MIDWATER	TRAWL: OTTER, MIDWATER, PAIRED	ALL OTHERS	TOTAL	IOY	Percent of IOY Landed
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	16,585		
1992	11,302	.	1	458	11,761		
1993	3,762	479	.	412	4,653		
1994	8,366	1	.	551	8,917	120,000	7%
1995	7,920	50	.	499	8,468	100,000	8%
1996	13,345	1,295	.	1,088	15,728	105,500	15%
1997	13,927	628	.	847	15,403	90,000	17%
1998	12,095	571	1,363	495	14,525	80,000	18%
1999	11,181	99	.	752	12,031	75,000	16%
2000	4,551	736	.	362	5,649	75,000	8%
2001	584	11,396	.	360	12,340	85,000	15%
2002	4,008	11,669	10,477	376	26,530	85,000	31%
2003	5,291	17,212	11,572	222	34,298	175,000	20%
2004	5,884	23,170	20,499	5,440	54,993	170,000	32%
2005	5,437	8,410	18,894	9,468	42,209	115,000	37%
2006	10,349	24,413	19,360	2,519	56,640	115,000	49%

Source: Unpublished NMFS dealer weighout data.

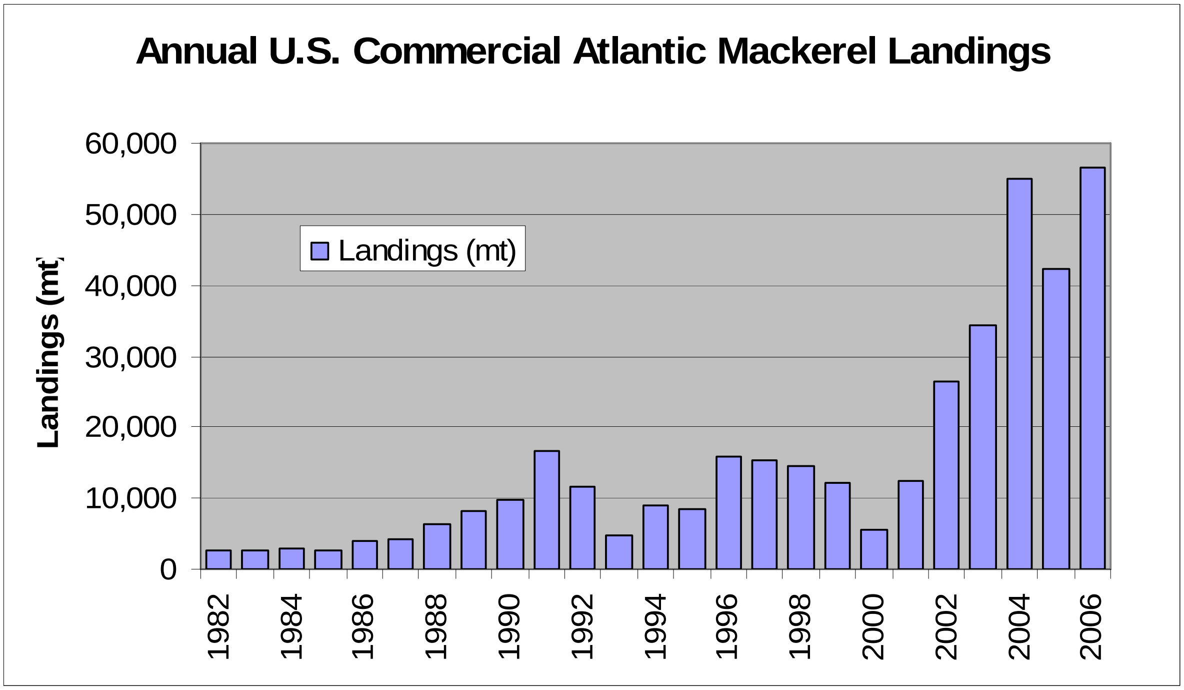


Figure 8. Annual U.S. commercial Atlantic mackerel landings (mt).
Source: Unpublished NMFS dealer weighout data.

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; Figure 9). 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 10).

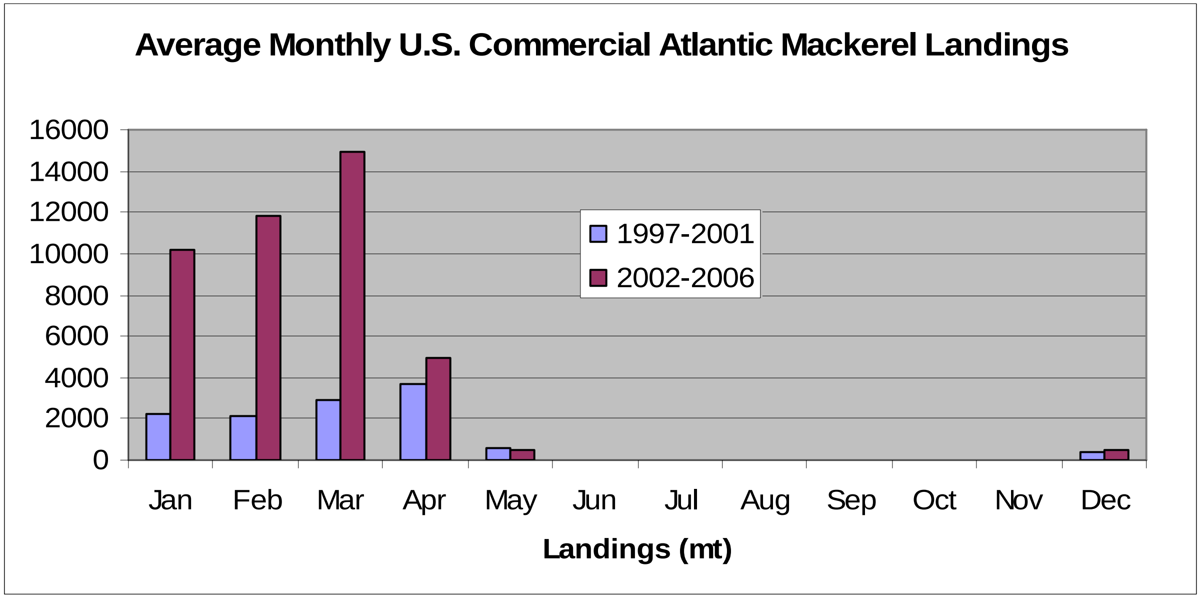


Figure 9. Average monthly U.S. commercial Atlantic mackerel landings (mt) from 1997-2001 and 2002-2006
Source: Unpublished NMFS dealer weighout data.

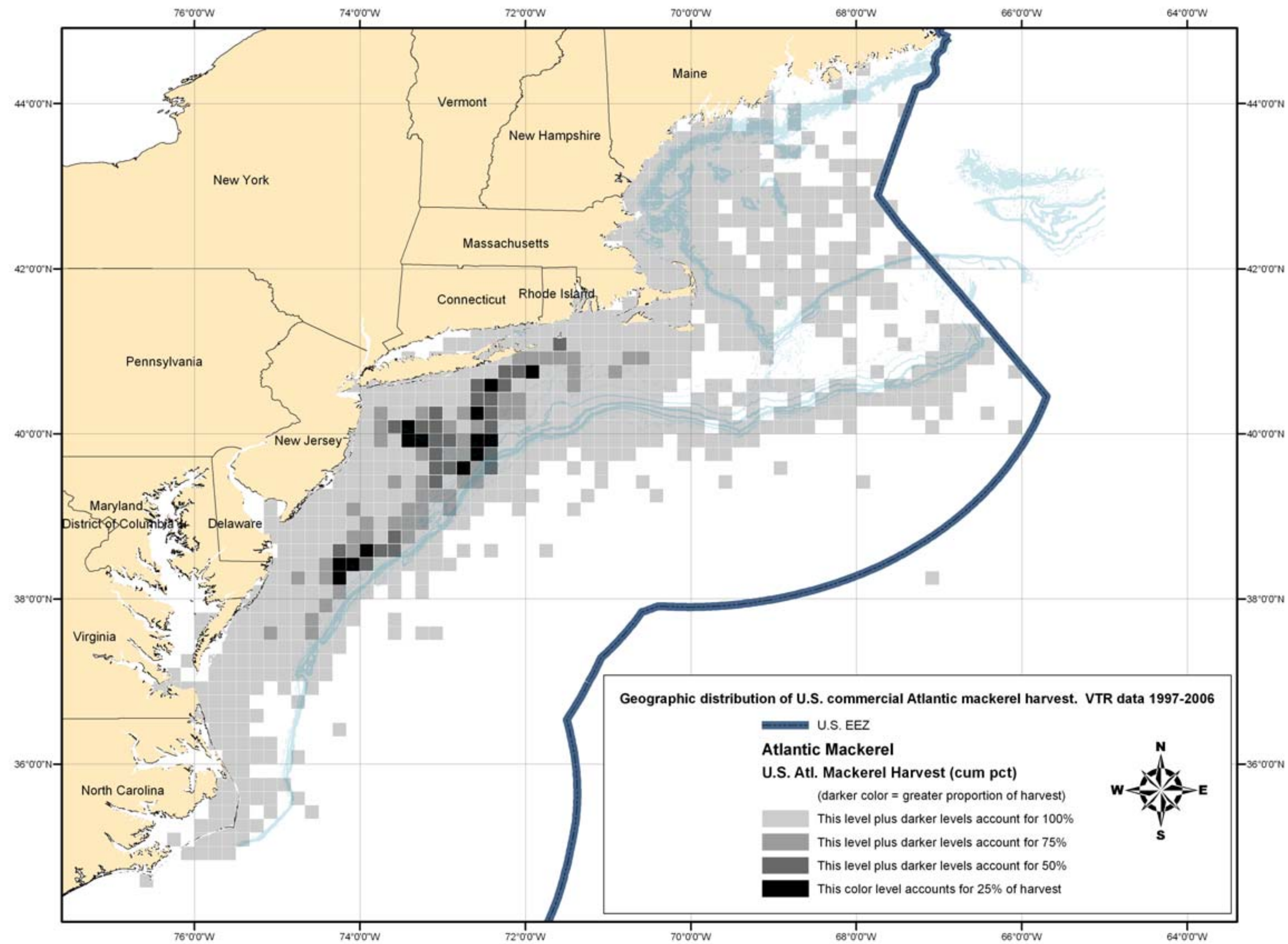


Figure 10. Geographic distribution of Atlantic mackerel harvest according to VTR data (1997 – 2006)

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. From 2001-2006, NMFS Observer data shows that 2% of mackerel caught were discarded (by weight). NMFS Observer data shows that 77% of the observed Atlantic mackerel discards occurred when bottom otter trawls were used and 23% of observed Atlantic mackerel discards occurred when mid-water otter trawls were used. However, during this period, only 3% of NMFS observer observations of discarded mackerel were from tows using unspecified mid-water trawl gear and there were no observations of discards from paired mid-water trawls. Given the recent prevalence of mid-water trawl gear in directed Atlantic mackerel landings, it is likely that the observer data is an unreliable source of information for characterizing Atlantic mackerel discards in the directed Atlantic mackerel commercial fishery.

Self-reported discarding from the VTR data show that from 2001-2006, 75% of Atlantic mackerel discards came from paired mid-water trawls, 12% came from bottom otter trawls, and 11% came from mid-water otter trawls.

SARC 42 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 2001-2006. 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 286 mt in 1992 to 4,223 mt in 1986, and have exceeded 1,000 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

Fishing mortality threshold: F_{MSY} = 1.22.

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

Stock size threshold: 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 2001-2006 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 of *Illex* averaged 5% of the annual *Illex* catches by weight. Annual discards were highest in 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 5 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 6; Figure 11). 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; Table 6), 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 are taken by bottom otter trawls (Table 6).

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Table 6. U.S. commercial *Illex* landings (mt) from 1982 – 2006, by major gear type, and recent quotas.

YEAR	TRAWL_OTTER_BOTTOM_FISH	All Others	Total	Quota	Percent of Quota Landed
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	6,801	0	6,801		
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	17,693	657	18,350	30,000	61%
1995	13,970	6	13,976	30,000	47%
1996	15,690	1,279	16,969	21,000	81%
1997	13,004	352	13,356	19,000	70%
1998	23,219	349	23,568	19,000	**124%**
1999	7,309	80	7,389	19,000	39%
2000	8,967	44	9,011	24,000	38%
2001	4,009	0	4,009	24,000	17%
2002	2,709	41	2,750	24,000	11%
2003	6,111	280	6,391	24,000	27%
2004	24,428	1,669	26,097	24,000	**109%**
2005	7,975	4,057	12,032	24,000	50%
2006	13,447	497	13,944	24,000	58%

Source: Unpublished NMFS dealer weighout data

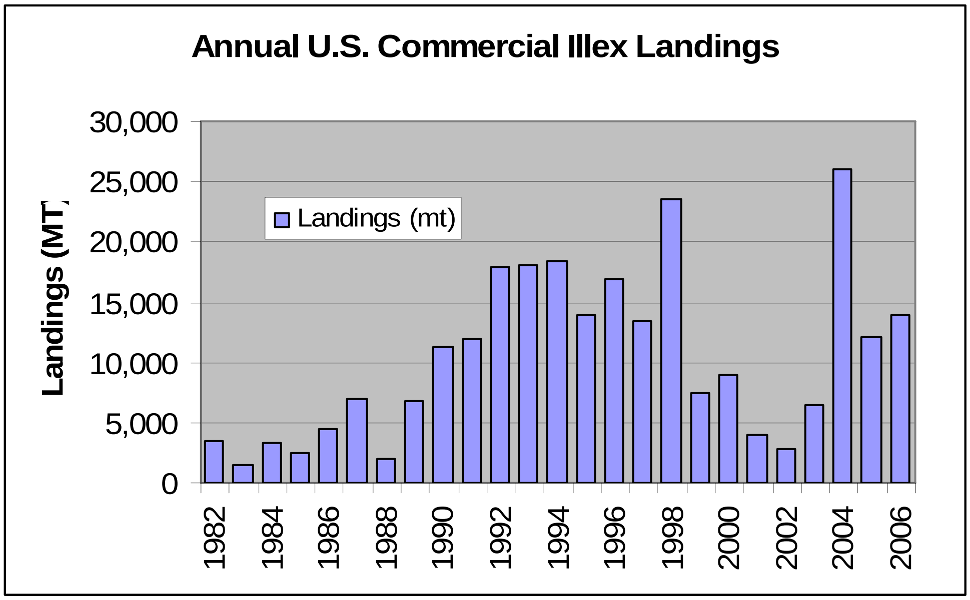

Figure 11. Annual U.S. commercial *Illex* landings (mt).
Source: Unpublished NMFS dealer weighout data.

Temporal and Geographic Patterns of Commercial *Illex* Harvest

The bulk of commercial *Illex* landings occur in May - Oct (**Figure 12**). 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 13**, Figure 21).

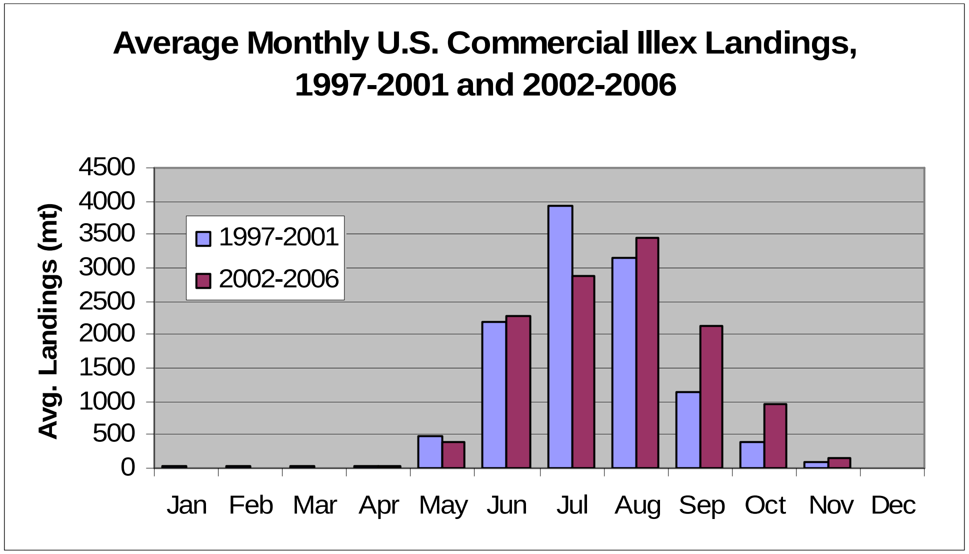

Figure 12. Average monthly U.S. Commercial *Illex* landings (mt) 1997-2001 and 2002-2006.
Source: Unpublished NMFS dealer weighout data.

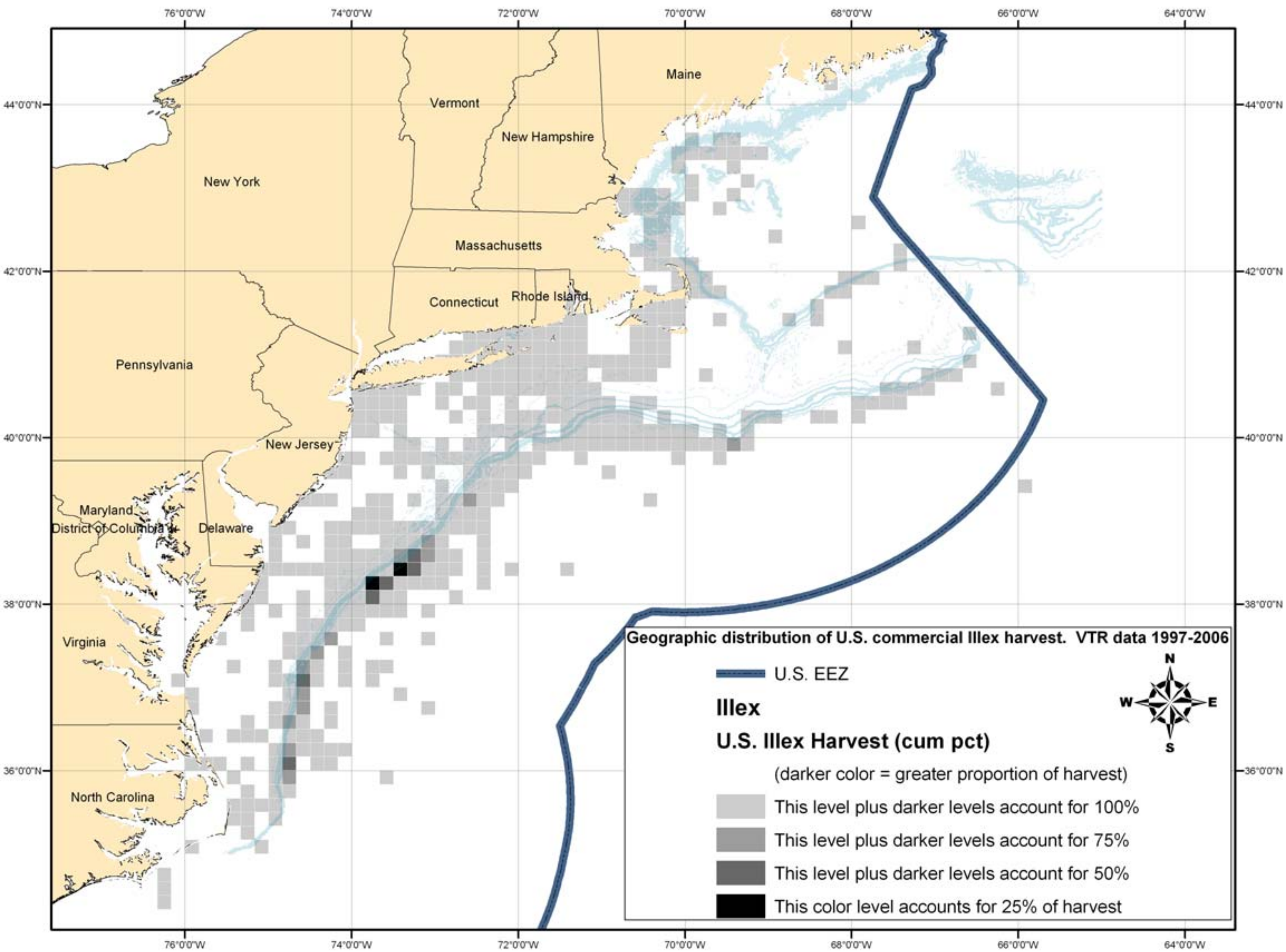

Figure 13. Geographic distribution of *Illex* harvest according to VTR data (1997 – 2006).

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 2001-2006 from the NEFSC Observer Program database indicate that 51% of the *Illex* bycatch occurred in the offshore *Loligo* fishery and 35% of the *Illex* bycatch occurred in the offshore *Illex* 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, from 2001-2006 annual discards of *Illex* averaged 5% of the annual *Illex* total catches by weight.

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 7**; **Figure 14**). 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 were implemented for 2007 (MAFMC 2007).

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Table 7. Commercial *Loligo* landings (mt) from 1982 - 2006, by major gear type, and recent quotas.

YEAR	TRAWL: OTTER, BOTTOM, FISH	Pound Nets	Floating Traps	Other	Unknown	Total	Quota	Percent of Quota Landed
1982	2,445	75	1	4	0	2,524		
1983	8,266	2	23	441	0	8,731		
1984	6,648	438	67	5	0	7,158		
1985	6,217	281	359	7	0	6,864		
1986	10,867	522	77	46	0	11,512		
1987	9,699	552	96	7	0	10,354		
1988	16,811	1,007	649	95	0	18,562		
1989	22,416	725	450	59	0	23,650		
1990	14,354	280	306	13	0	14,954		
1991	18,849	161	317	81	0	19,409		
1992	17,914	119	44	100	0	18,177		
1993	21,885	204	84	99	0	22,272		
1994	22,404	100	37	5	18	22,563	44,000	51%
1995	17,622	165	13	23	524	18,348	36,000	51%
1996	11,720	135	74	484	0	12,414	25,000	50%
1997	15,649	196	231	30	6	16,113	21,000	77%
1998	18,962	74	34	53	0	19,123	21,000	91%
1999	18,938	108	45	16	3	19,109	21,000	91%
2000	17,198	166	61	42	12	17,480	[a]15,000	**117%**
2001	14,021	65	89	62	0	14,238	17,000	84%
2002	16,508	107	31	57	3	16,707	17,000	98%
2003	11,839	29	58	10	0	11,935	17,000	70%
2004	12,761	87	0	1,708	892	15,447	17,000	91%
2005	11,646	44	1	3,880	1,413	16,983	17,000	100%
2006	12,549	37	39	1,797	1,458	15,879	17,000	93%

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

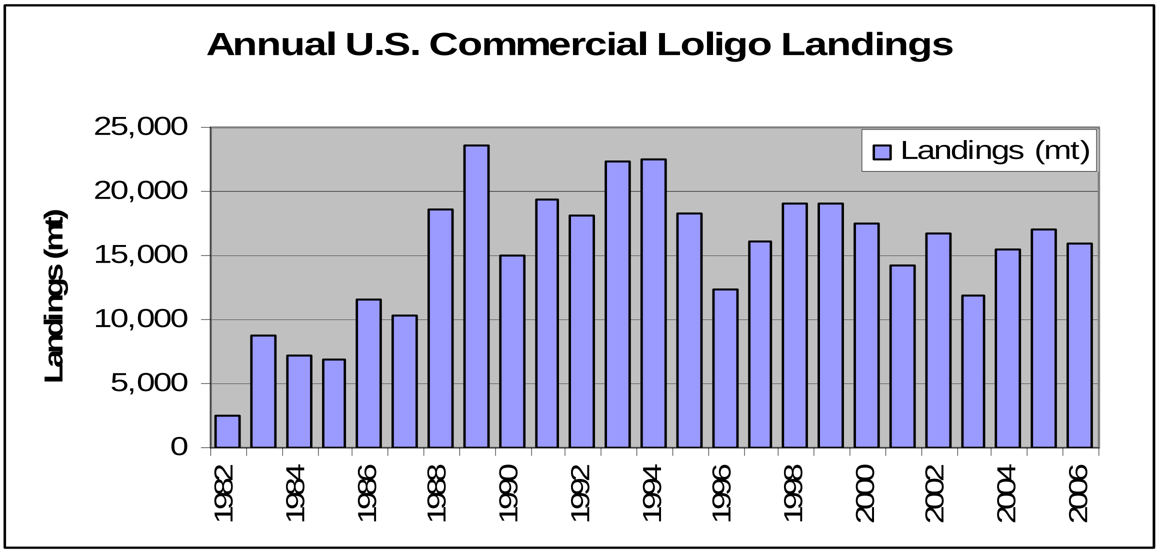


Figure 14. Annual U.S. commercial *Loligo* landings (mt).
Source: Unpublished NMFS dealer weighout data.

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 9; Figure 15). 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 (Figures 16-21).

Since 2000, allocation of the annual quota has been divided up into smaller periods (trimesters in 2000, quarters in 2001 and thereafter until trimesters again in 2007) 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 (see Table 8 for closure periods). During the first year of the sub-annual quota monitoring, 2000, annual *Loligo* landings exceeded the annual quota by 17% (**Table 7**). Tables 9, 9a, and 9b show a worsening derby situation in the first period of the *Loligo* fishery (i.e. a shift in landings to earlier in the first period). This is partly related to vessels that had not previously targeted *Loligo* beginning to do so (personal communication with L. Hendrickson on analysis of hull numbers participating in the *Loligo* fishery).

Table 8. *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
<u>2006</u> Feb 13 - Mar 31; Apr 21 - Apr 27; May 23 - Jun 30; Sep 2 - Sep 30
<u>2007</u> Apr 13 - Apr 30; (year not finished as of current draft)

Table 9. U.S. commercial landings (mt) of *Loligo* by month from 1997 - 2006.

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Totals
1997	719	1,526	1,075	1,391	1,135	314	690	775	1,265	3,312	1,950	1,959	16,113
1998	1,710	4,390	4,575	1,557	365	203	452	284	391	1,536	1,744	1,916	19,123
1999	1,582	1,394	1,727	1,950	630	549	1,362	1,738	1,887	2,470	2,190	1,628	19,109
2000	1,635	2,624	2,315	339	1,294	1,723	1,620	1,323	931	3,047	390	238	17,480
2001	856	1,035	2,026	1,461	604	461	825	622	512	1,768	2,213	1,856	14,238
2002	1,560	1,677	1,600	1,521	1,643	455	1,764	1,844	358	2,723	566	997	16,707
2003	1,188	2,031	1,843	420	281	88	50	114	1,214	932	2,112	1,662	11,935
2004	2,478	3,642	1,148	1,262	814	484	222	218	125	581	1,464	3,010	15,447
2005	3,274	4,394	615	2,724	676	285	241	64	301	1,050	2,069	1,290	16,983
2006	3,476	1,727	350	1,690	1,357	427	806	1,411	274	1,525	1,621	1,215	15,879
Monthly Averages	1,848	2,444	1,727	1,431	880	499	803	839	726	1,894	1,632	1,577	

Source: Unpublished NMFS dealer weighout data.

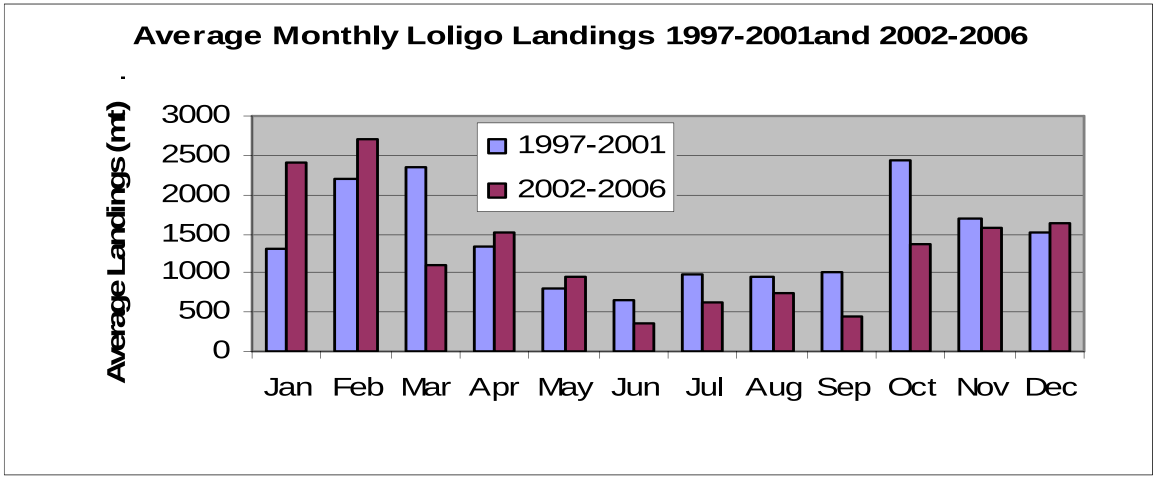


Figure 15. Average monthly U.S. Commercial *Loligo* landings (mt) 1997-2001 and 2002-2006.
Source: Unpublished NMFS dealer weighout data

Table 9a. 1997-2006 Trips that Landed at Least 2500 pounds *Loligo. VTR*

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1997	84	170	141	177	168	64	171	134	165	388	232	244	2,138
1998	223	308	346	174	37	27	90	68	74	257	184	184	1,972
1999	169	177	196	219	79	86	269	276	217	236	151	151	2,226
2000	192	195	173	62	206	296	614	440	214	264	115	63	2,834
2001	129	152	195	187	101	85	177	143	98	195	191	184	1,837
2002	146	221	244	204	233	160	341	432	184	300	100	109	2,674
2003	146	232	220	77	41	6	7	9	35	166	192	227	1,358
2004	204	310	169	165	208	104	42	31	20	85	110	183	1,631
2005	218	275	238	282	54	106	45	13	70	121	122	102	1,646
2006	280	161	161	220	300	133	184	327	111	188	178	124	2,367

Table 9b. 1997-2006 Days Fished on Trips that Landed at Least 2500 pounds *Loligo. VTR*

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1997	372	747	630	659	349	188	442	476	611	1,307	857	853	7,492
1998	860	1,223	1,479	754	71	64	300	242	283	1,054	1,030	965	8,324
1999	857	886	990	1,031	189	303	827	922	807	960	709	598	9,078
2000	640	899	760	118	377	785	346	260	372	928	107	118	5,712
2001	599	561	722	627	172	56	507	354	379	811	866	829	6,483
2002	722	876	907	742	605	205	696	679	221	1,083	301	475	7,513
2003	663	889	911	349	104	37	27	31	141	662	889	779	5,481
2004	834	1,114	513	686	438	155	100	93	67	362	540	845	5,748
2005	998	974	548	957	33	74	102	41	238	528	712	515	5,720
2006	1,186	626	442	726	228	56	310	693	164	840	898	589	6,759

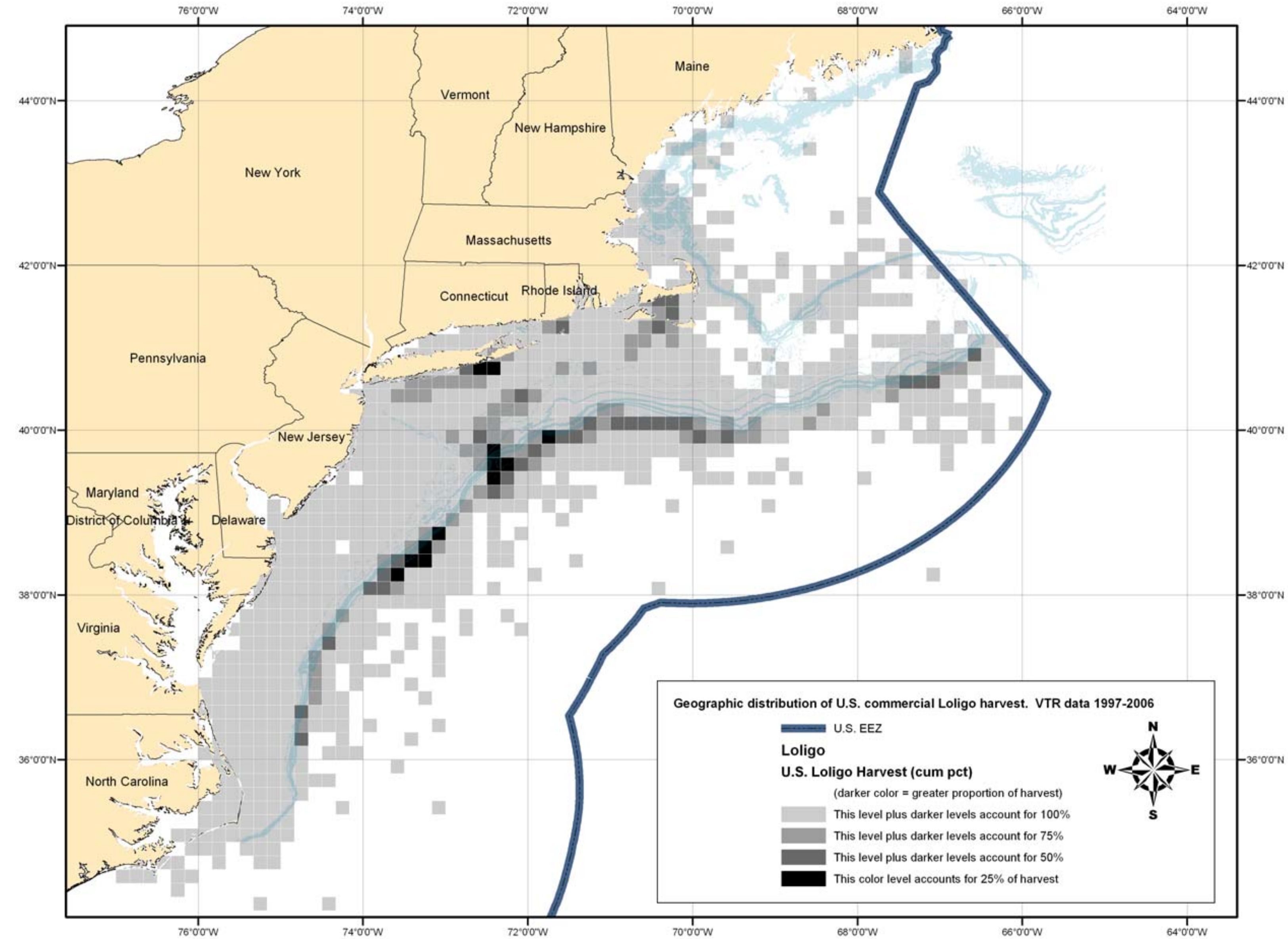


Figure 16. Geographic distribution of *Loligo* harvest according to VTR data (1997 – 2006).

Figure 17. Distribution of Loligo effort Jan-Mar 1997-2004

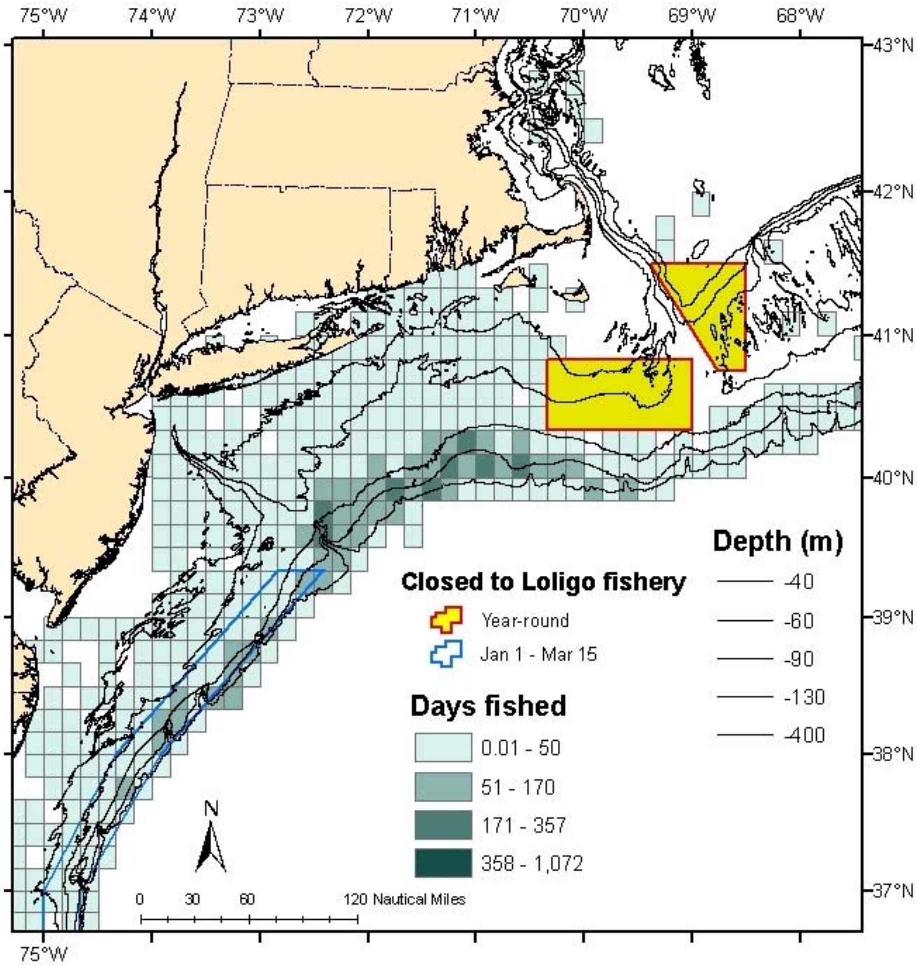


Figure 18. Distribution of Loligo effort Apr-Jun 1997-2004

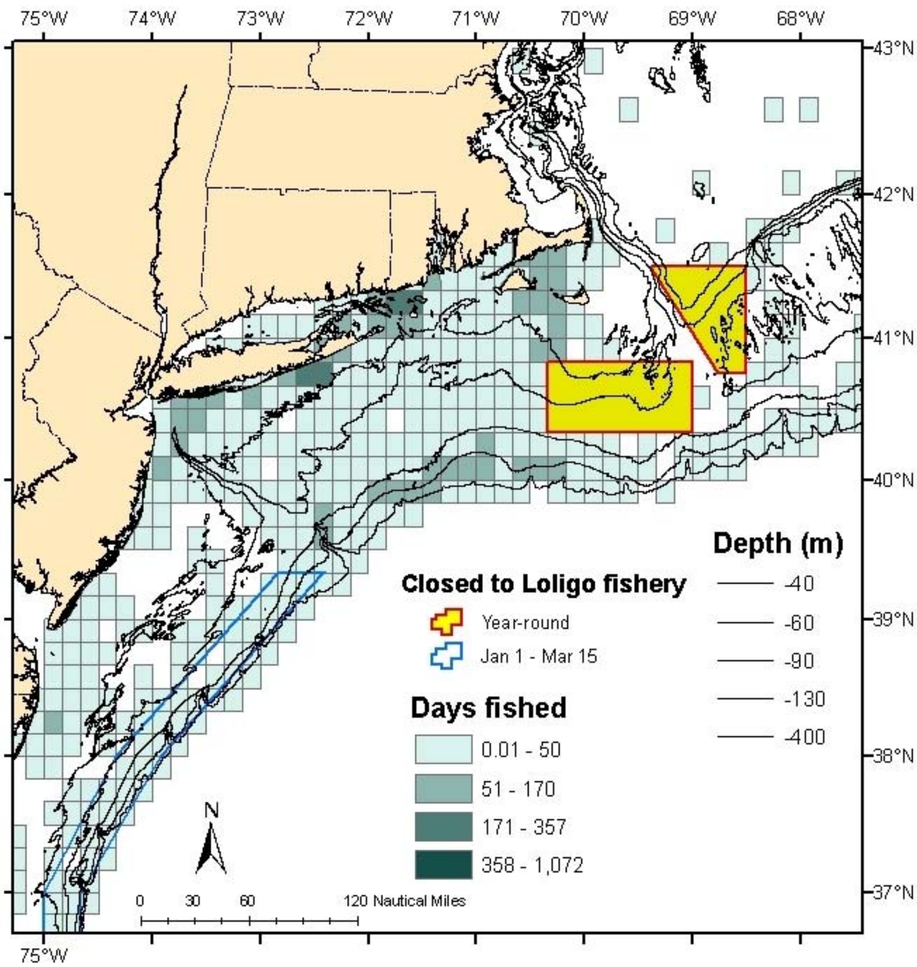


Figure 19. Distribution of Loligo effort Jul-Sep 1997-2004

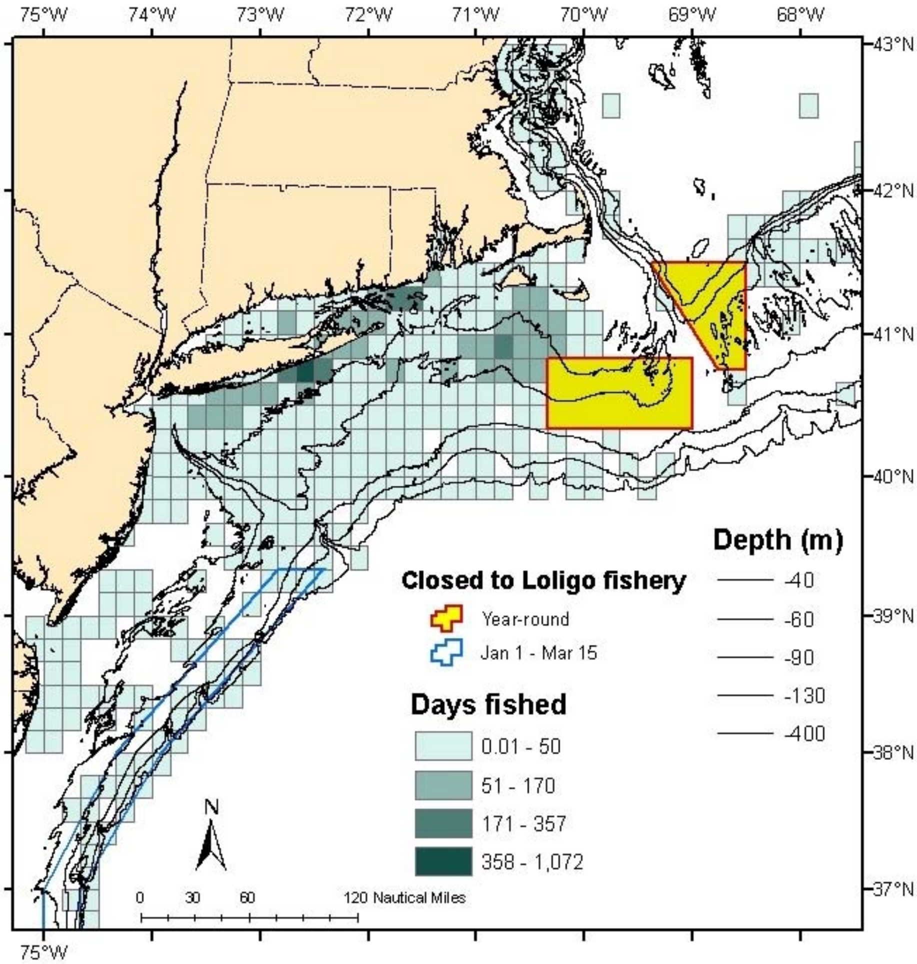
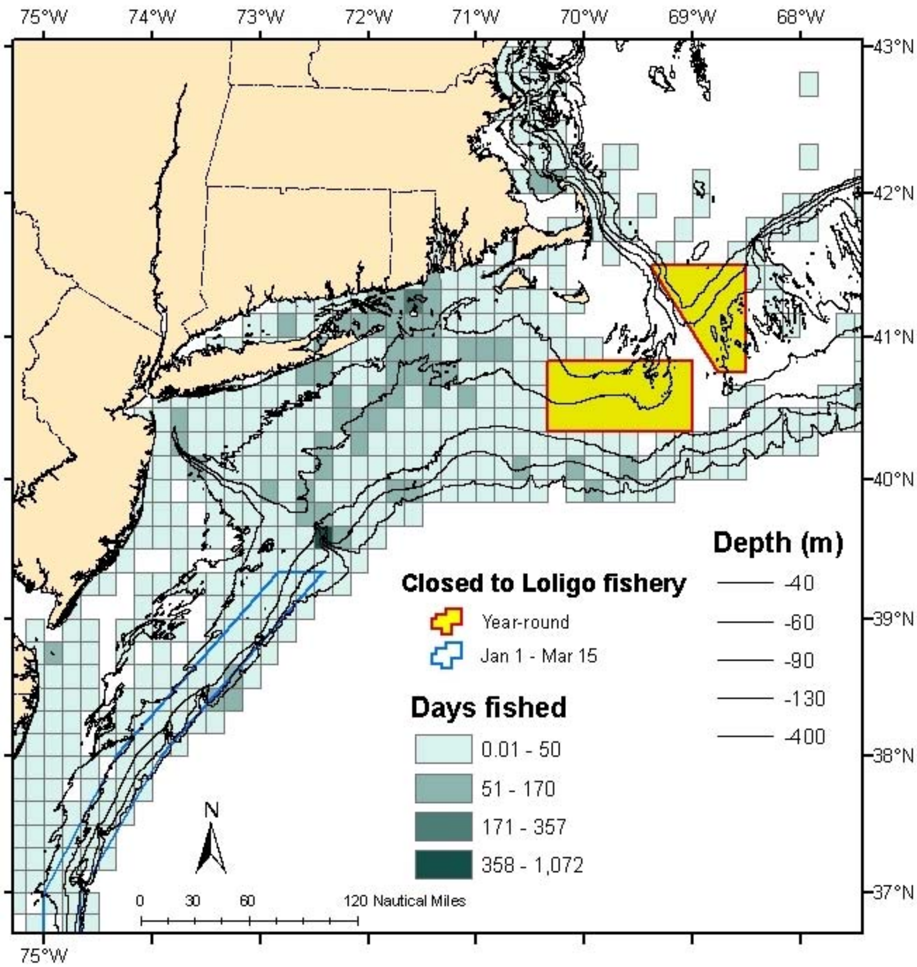


Figure 20. Distribution of Loligo effort Jul-Sep 1997-2004

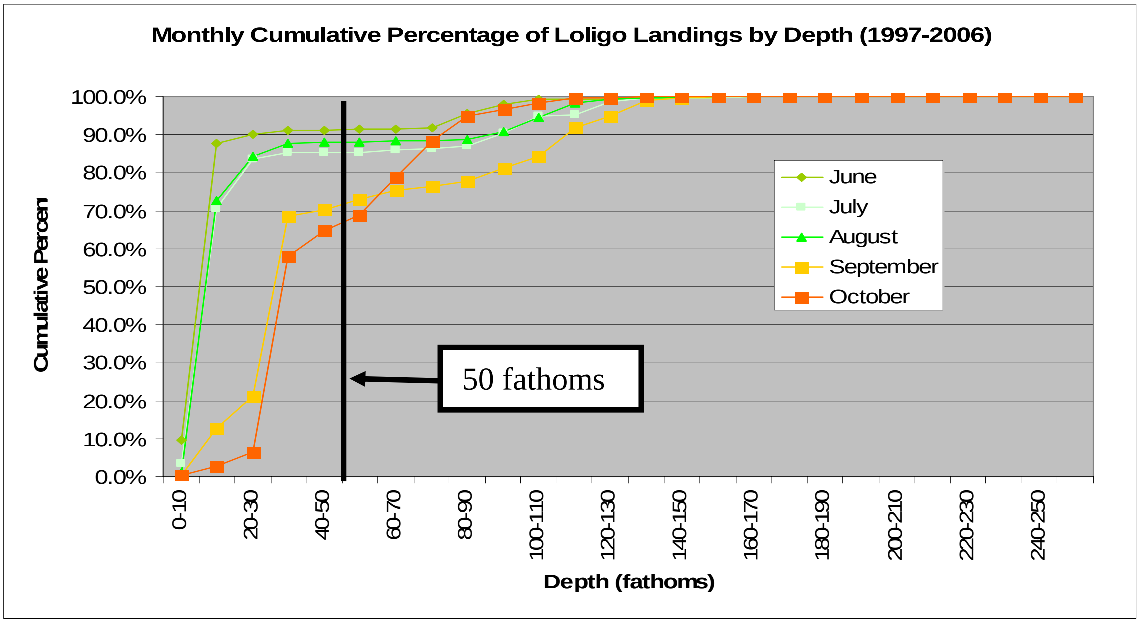


Commercial Discarding

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 21).

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 22**). In addition, depth distributions of *Illex* and *Loligo* catches in the directed fisheries indicate overlap of the two species during September and October (Figure 21). 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 of Amendment 9) indicated 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 (Table 10).



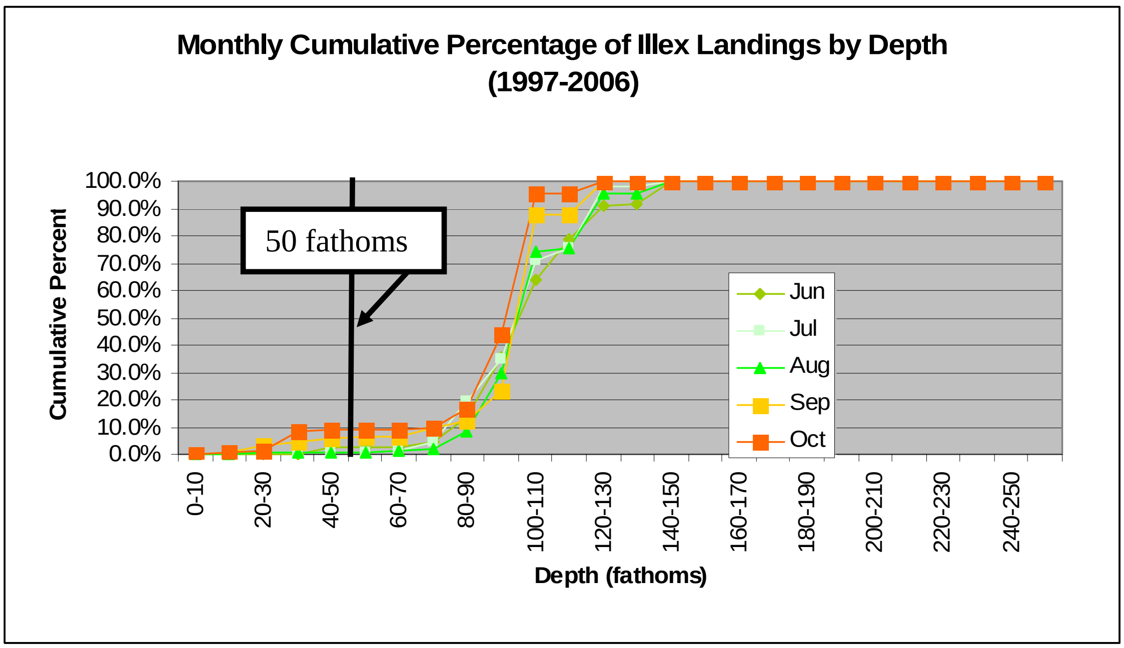


Figure 21. Distribution of *Loligo* (top) and *Illex* (bottom) landings by depth, month from 1997-2006 VTR data

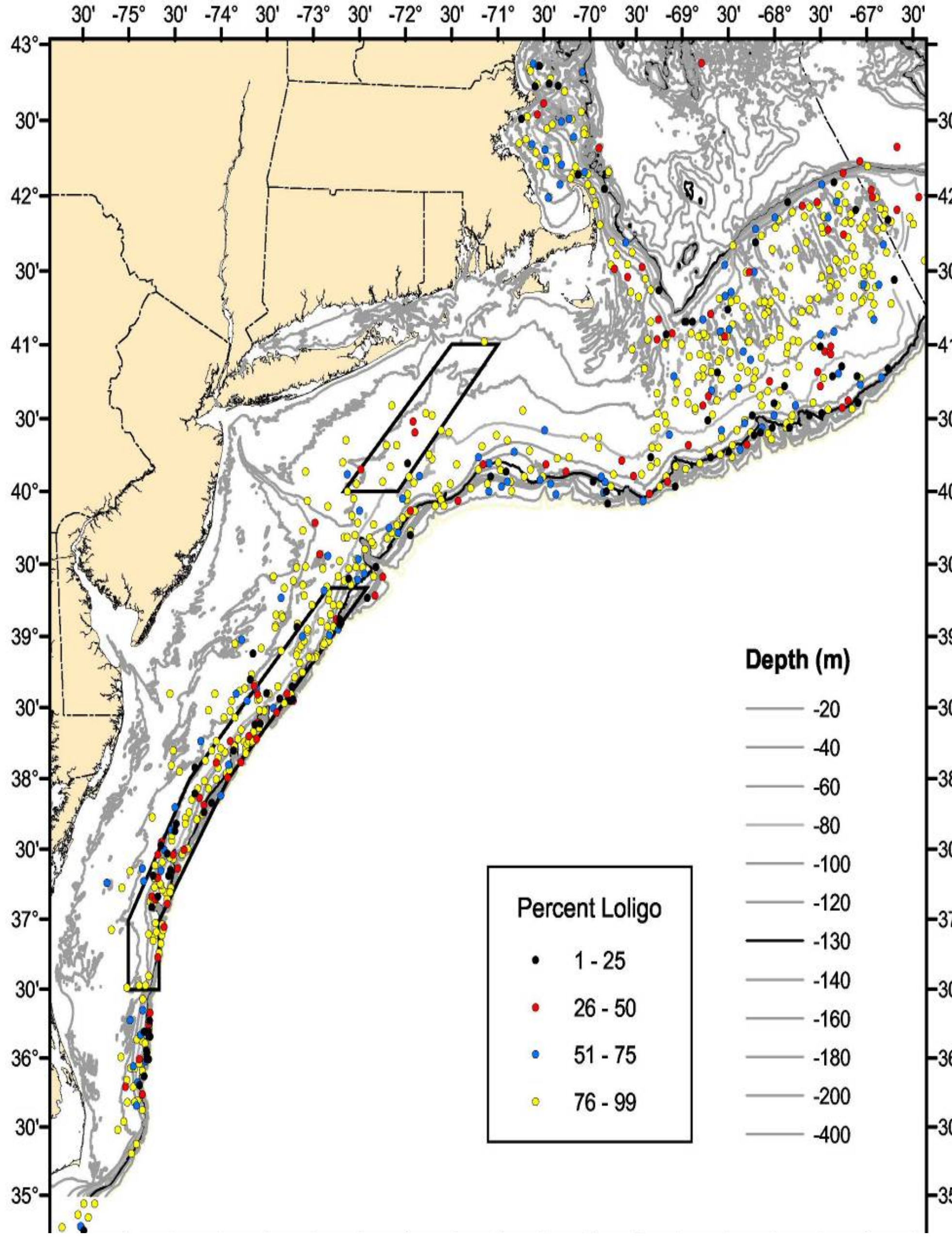


Figure 22. Co-occurrence of *Loligo* and *Illex* in NEFSC research bottom surveys during fall, 1992-2003.

Table 10. 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 target: F_{msy} = 0.38

Fishing mortality target: 75% F_{msy} = 0.28

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

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

In 2004 the 38th Northeast Regional Stock Assessment Workshop (38th SAW) Stock Assessment Review Committee (SARC) (available at: http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0403/) provided estimates of butterfish fishing mortality and stock biomass estimates through 2002, and determined that butterfish was overfished in 2002 (NEFSC 2004; see Appendix i). The estimated fishing mortality during 2002 (0.34) was near but below the F_{msy} target (F=0.38), indicating that overfishing was not occurring. 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). Although assessment stock size estimates are highly imprecise, the overfished determination was based on the fact that the 2002 biomass estimate for butterfish (7,800 mt) fell below the threshold level defining the stock as overfished (1/2 Bmsy=11,400 mt).

Butterfish discards are estimated to equal twice the annual landings (NEFSC 2004). Analyses have shown that the primary source of butterfish discards is the *Loligo* fishery because it uses small-mesh, diamond-mesh codends (as small as 1 $^{7/8}$ inches minimum mesh size) and because butterfish and *Loligo* co-occur year round. The SAW 38 assessment included the recommendation that measures be taken to reduce discarding of butterfish.

The truncated age distribution of the butterfish stock is also problematic. Historically, the stock was characterized by a broader age distribution and the maximum age was six years. The lifespan is now three years (NEFSC 2004). The truncated age structure results in reduced egg production and the reduced lifespan artificially reduces the mean generation time required to rebuild the stock. Because of the overfished determination, current federal law obligates the Council to develop and implement a stock rebuilding plan.

Data from the autumn 2003-2005 NEFSC research bottom trawl survey indicated that butterfish biomass continued to be low during that time period (Figure 23). There is no peer reviewed information available on butterfish abundance in 2008. Recent, unpublished NEFSC survey indices suggest that butterfish relative abundance may have increased in 2006 and 2007. For example, the NEFSC 2007 spring survey indices for butterfish were the second highest by number and the third highest by weight in the 40 year history of the survey time series (but should be interpreted with caution due to the influence of a single very large tow). Also, while abundance indices are certainly one component of assessments, such indices alone do not provide a point estimate of stock size or status determination, and the assessment process is much more complex than just abundance indices. It should also be noted that, historically, the spring and fall survey indices have not tracked each other. Regardless, the 2004 SAW/SARC report is the authoritative reference for stock status and current federal law obligates the Council to develop and implement a stock rebuilding plan until a peer reviewed butterfish stock assessment determines the stock is rebuilt to the B_{msy} level (the next butterfish assessment is scheduled for 2010). Also, even if butterfish abundance levels increased after higher recruitment events, the expected level of discard mortality would also increase under the no action alternative. Therefore, while temporary stock recovery could theoretically occur, the stock could quickly return to an overfished status in the absence of measures to control fishing mortality due to discarding.

Figure 23. Autumn NEFSC survey index for butterfish, 1968-2006.

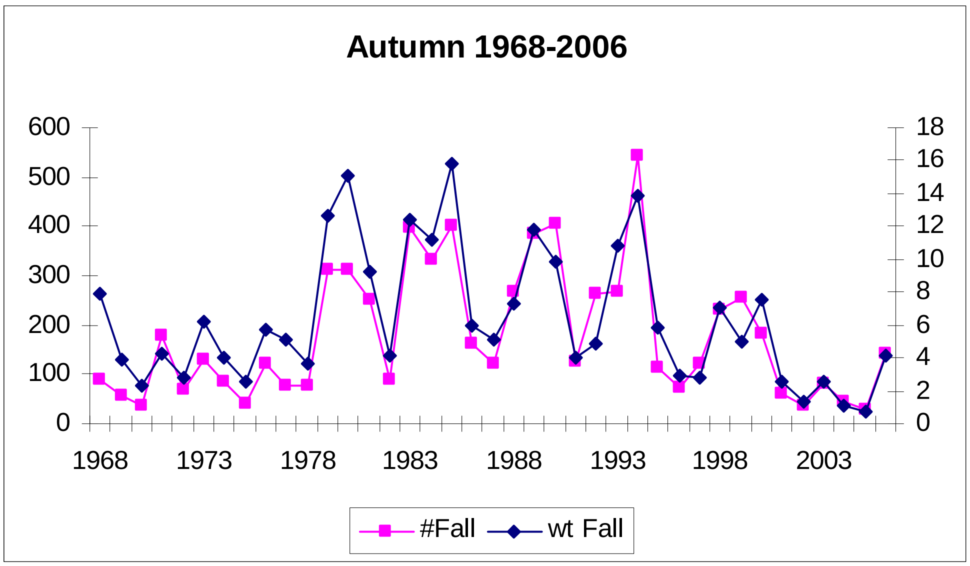
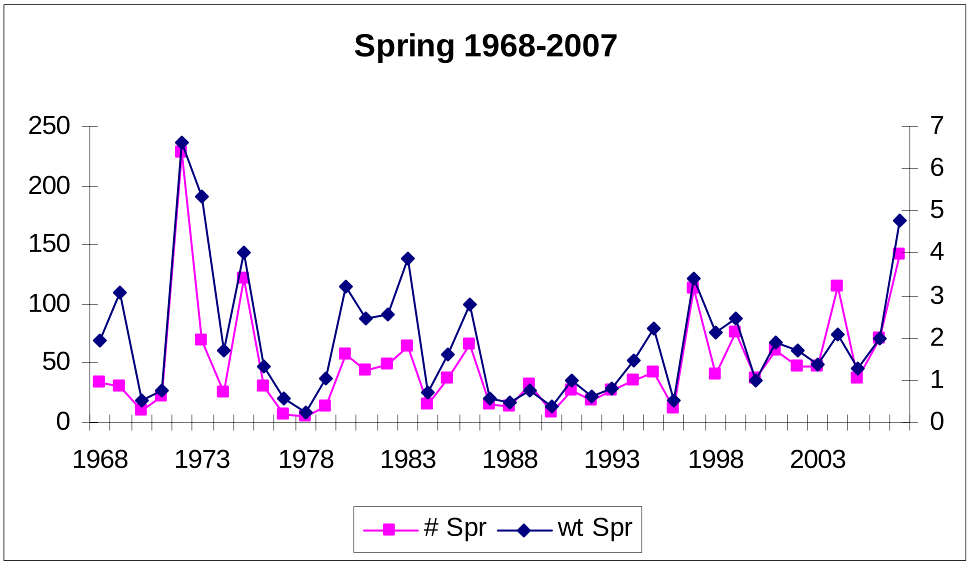


Figure 24. Spring NEFSC survey index for butterfish, 1968-2007.



Fishery Activities that Directly Affect Stock Status

<u>Commercial Butterfish Fishery</u>

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. 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 minimal directed fishing so landings have been very low, ranging from 437-554 mt during 2002-2006 (Table 11; Figure 25). Most landed butterfish are currently caught incidentally when other species, principally squid, are being targeted.

The vast majority of butterfish landings come from bottom otter trawl fishing (Table 11). Unlike the other resources managed through this FMP, landings of butterfish are generally a result of bycatch in other directed fisheries. Of the 64,088 individual hauls monitored through the NMFS observer program from 2001-2006, only 36 hauls (~ 0.06 of one percent) indicated butterfish as the primary 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 11. Commercial butterfish landings (mt) from 1982 – 2006, by major gear type, and recent quotas.

YEAR	TRAWL_OTTER_BOTTOM_FISH	All Others	Total	Quota	Percent of Quota Landed
1982	7,479	84	7,562		
1983	3,635	163	3,798		
1984	11,132	138	11,269		
1985	4,040	101	4,140		
1986	4,352	75	4,426		
1987	4,458	50	4,508		
1988	1,904	97	2,001		
1989	3,065	139	3,203		
1990	2,218	80	2,298		
1991	2,112	77	2,189		
1992	2,681	73	2,754		
1993	4,369	106	4,475		
1994	3,448	187	3,634	10,000	36%
1995	1,888	178	2,067	10,000	21%
1996	3,342	213	3,555	5,900	60%
1997	2,554	240	2,794	5,900	47%
1998	1,832	134	1,966	5,900	33%
1999	1,979	131	2,110	5,900	36%
2000	1,316	133	1,449	5,900	25%
2001	4,278	126	4,404	5,897	75%
2002	782	90	872	5,900	15%
2003	476	60	536	5,900	9%
2004	366	171	537	5,900	9%
2005	256	181	437	1,681	26%
2006	413	141	554	1,681	33%

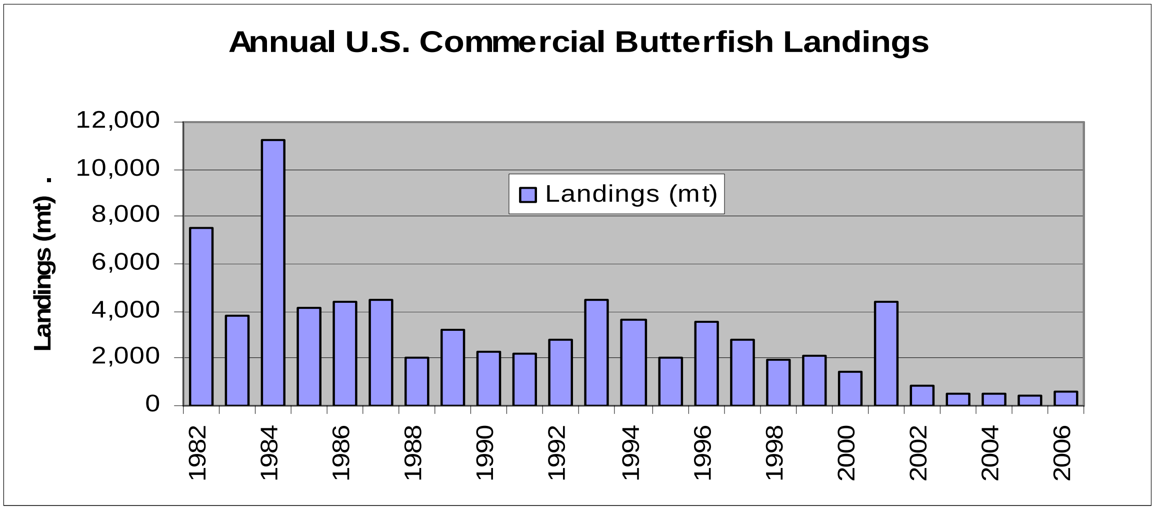


Figure 25. Annual U.S. commercial butterfish landings (mt).
Source: Unpublished NMFS dealer weighout data.

Temporal and Geographic Patterns of Commercial Butterfish Harvest

From 1997-2001 the bulk of the U.S. commercial butterfish landings occur in January-March (Figure 26). More recently 2001-2006, landings have been spread throughout the year (likely due to lack of directed effort). 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**).

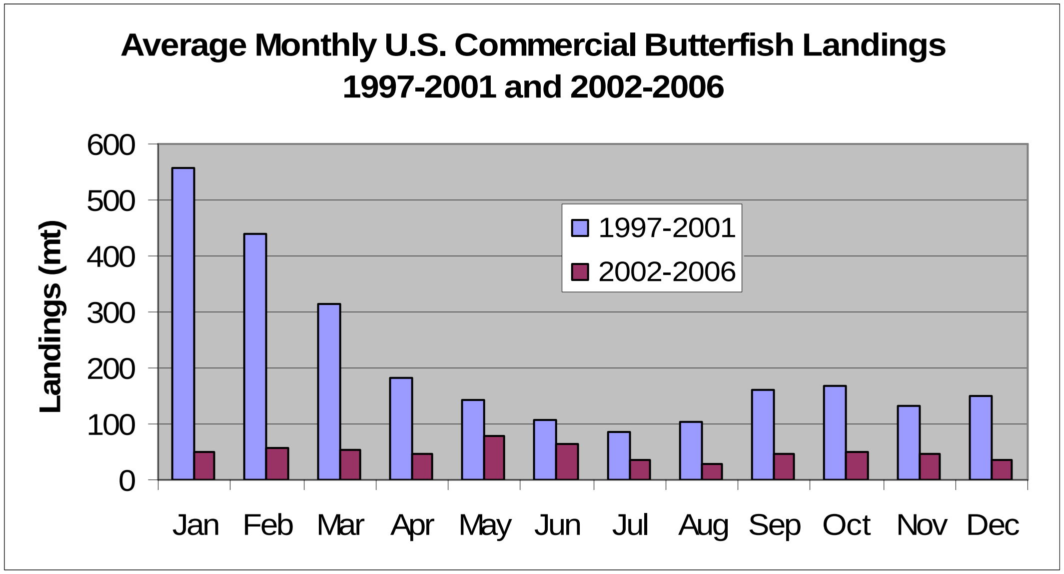


Figure 26. Average monthly U.S. Commercial Butterfish landings (mt) 1997-2001 and 2002-2006.
Source: Unpublished NMFS dealer weighout data

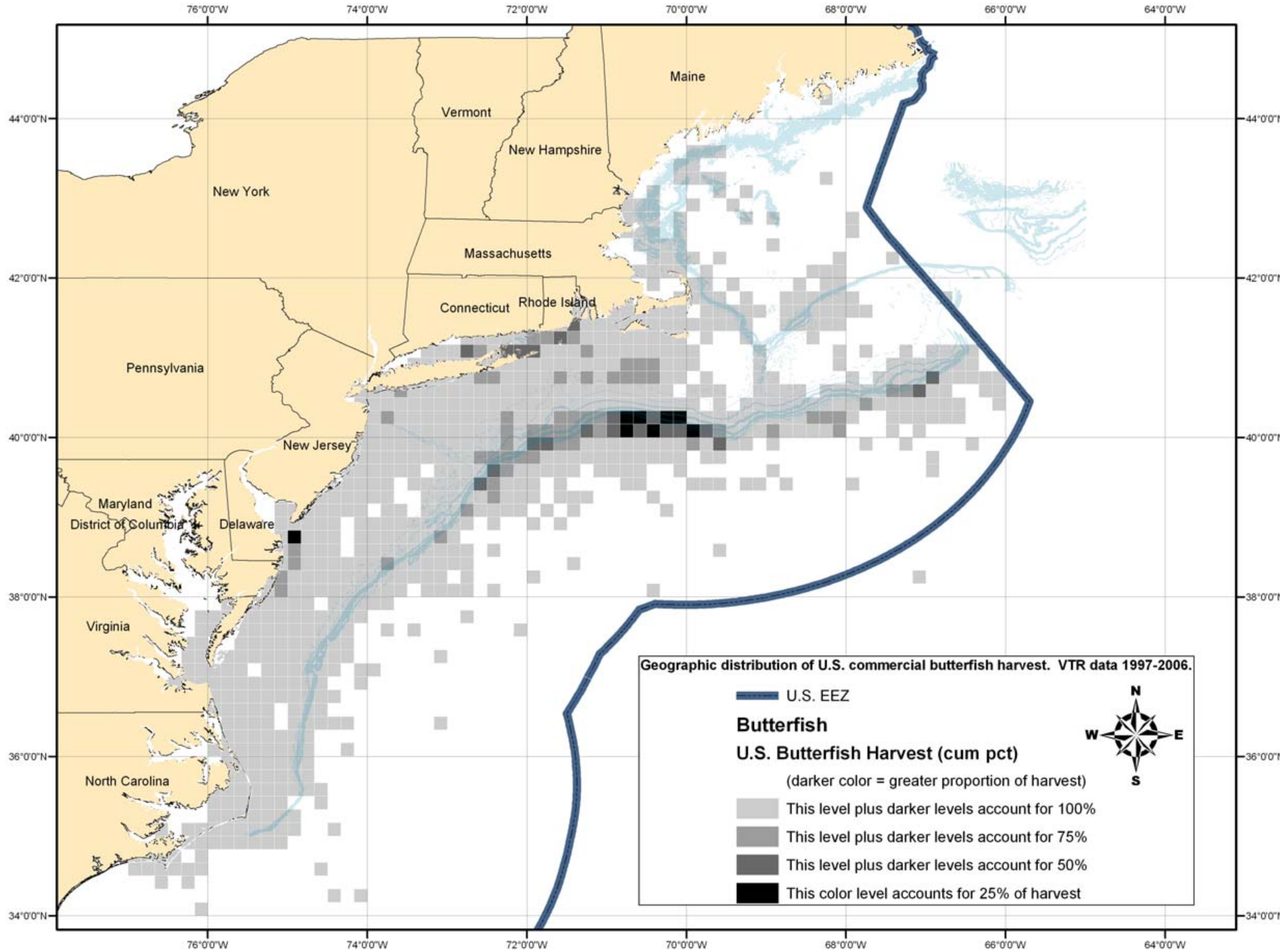
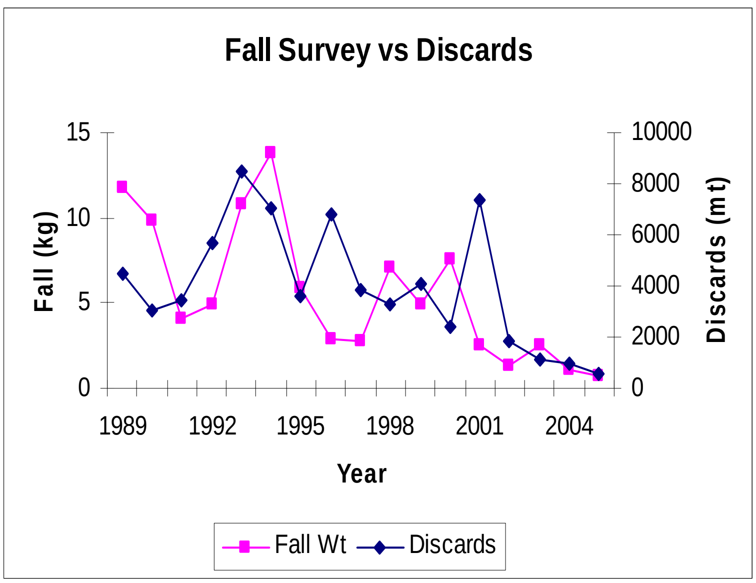


Figure 27. Geographic distribution of butterfish harvest according to VTR data (1997 – 2006).

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). Analysis of 2001-2006 unpublished NMFS Observer data shows that 81% of butterfish caught were discarded. The *Loligo* fishery accounted for 68% of all observed butterfish discards and the *Illex* fishery accounted for 7% of all butterfish discards (Table 15a). NEFSC staff have estimated total butterfish discards to be relatively low recently, but abundance has been relatively low as well (Figure 27a). Figure 30a describes the distribution of kept and discarded fish in the observer data 1996-2006.

Figure 27a. Butterfish discards and abundance.



In 1978, a minimum codend mesh size of 60 mm was required in the directed squid fisheries in U.S. waters and squid fishing was restricted to offshore fishing in specific areas (seaward of 200 fathoms) during specific months in order to reduce finfish bycatch (ICNAF 1978). Codend mesh sizes currently used in the two squid fisheries were characterized based on fisherman-reported estimates of the kept weight of each squid species (%) by codend mesh size. These data were retrieved from the Vessel Trip Report (VTR) database for 1997-2006 a period when reporting was mandatory for squid fishermen. These data were also compared to the NEFSC Observer Program data (1996-2006) because the latter data set represents actual codend mesh size measurements and catch quantification by fishery observers. Fishermen are required to report codend mesh size in inches (some individuals report to the nearest 0.1 inch) on their VTRs but the instructions do not specify whether mesh size should be reported as inside stretched mesh or knot-center-to-knot-center whereas fishery observers actually measure codend liner and cover mesh sizes as inside stretched mesh measurements.

According to actual codend mesh size measurements for all otter trawl tows sampled by the NEFSC Observer Program during 1996-2006, 89% of the butterfish discards (in terms of weight) occur with the use of codend mesh sizes ≤ 60 mm (inside stretched mesh). Both the highest percentage (45%) of butterfish discards (Figure 28 A) and the highest number of tows (frequency of encounter) containing butterfish (20%, Figure 28 B) occur with the use of 46-50 mm mesh codends (inside stretched mesh). Both the Observer Database and the VTR Database indicate a codend mesh size mode in the *Loligo* fishery of 51-55 mm, representing 30% and 34% of the *Loligo* kept weight and estimated landings, respectively (Figure 28 C). However, because of possible mesh size reporting inconsistencies related to the VTR database, codend mesh size measurements from the Observer Database must be used to characterize codend mesh sizes currently used in the *Loligo* fishery. The Observer Database indicates that most of the targeted *Loligo* catch (Figure 28 C) is obtained using the following codend mesh sizes (inside stretched mesh): (41-45 mm = 17%; 46-50 mm = 26%; 51-55 mm = 29%; 56-60 mm = 15%; 61-65 mm = 6%; 66-70 mm = 1% and 71-76 mm = 1%).

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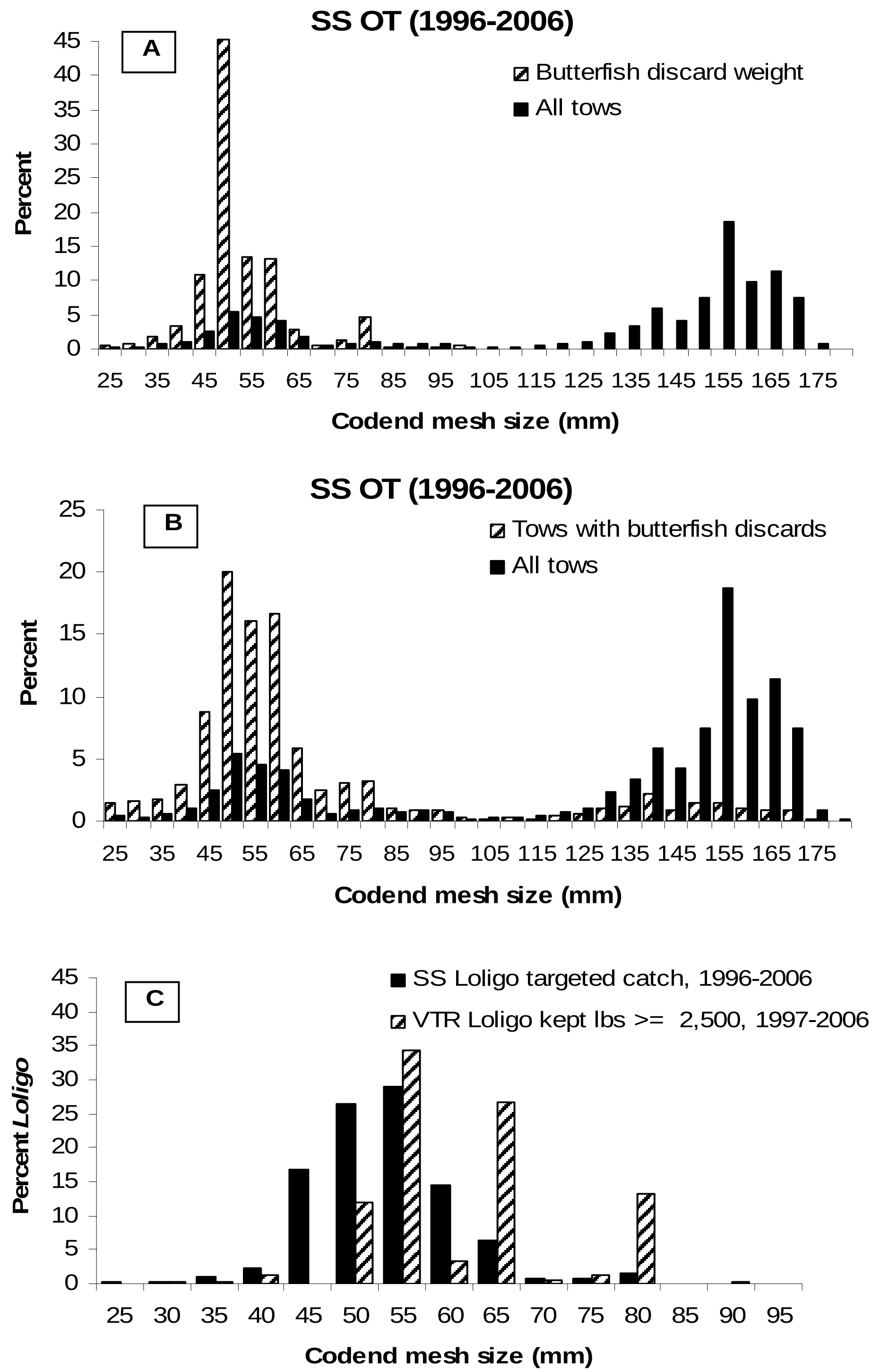


Figure 28 . Percentage of butterfish discard weight (A) and number of tows with butterfish catch (By frequency of encounter) in otter trawl tows, by codend mesh size (mm), based on data from the NEFSC Observer Program Database (1996-2006) and comparison of *Loligo* catches, by mesh size (mm) in the Observer Database versus the Vessel Trip Report Database (C).

Given the negative effect of commercial otter trawl discarding on the condition of the butterfish stock, a number of analyses were conducted for Amendment 9 in order to identify potential management solutions to the discarding problem. These analyses were presented in detail in Appendices 1 and 2 of Amendment 9; 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 29**) or 3.75-inch (**Figure 30**) 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.

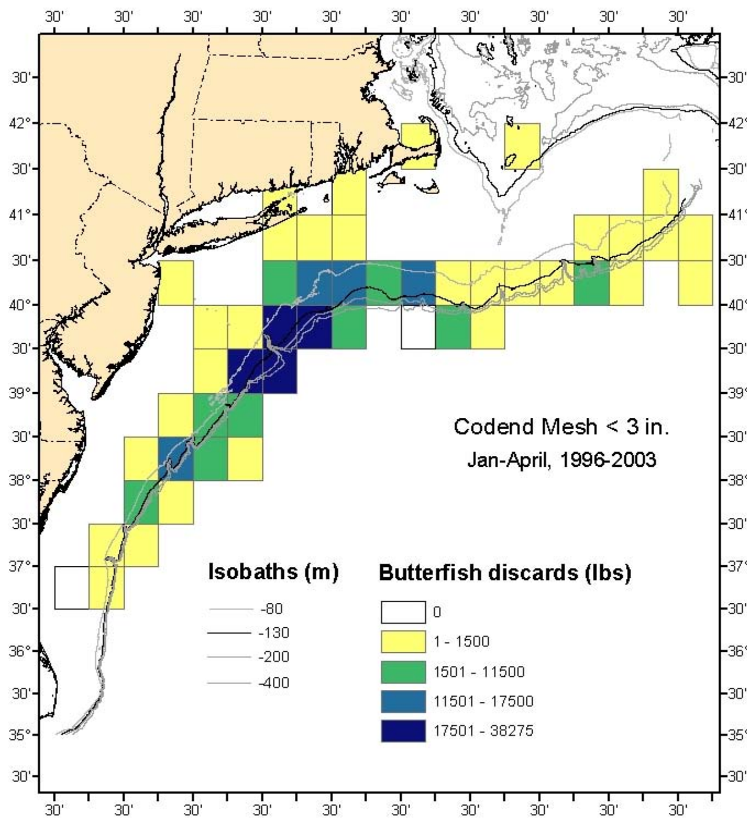


Figure 29. Observed butterfish discards, by quarter-degree square, for otter trawl fisheries using codend mesh sizes less than 3.0 inches during Jan.-April, 1996-2003

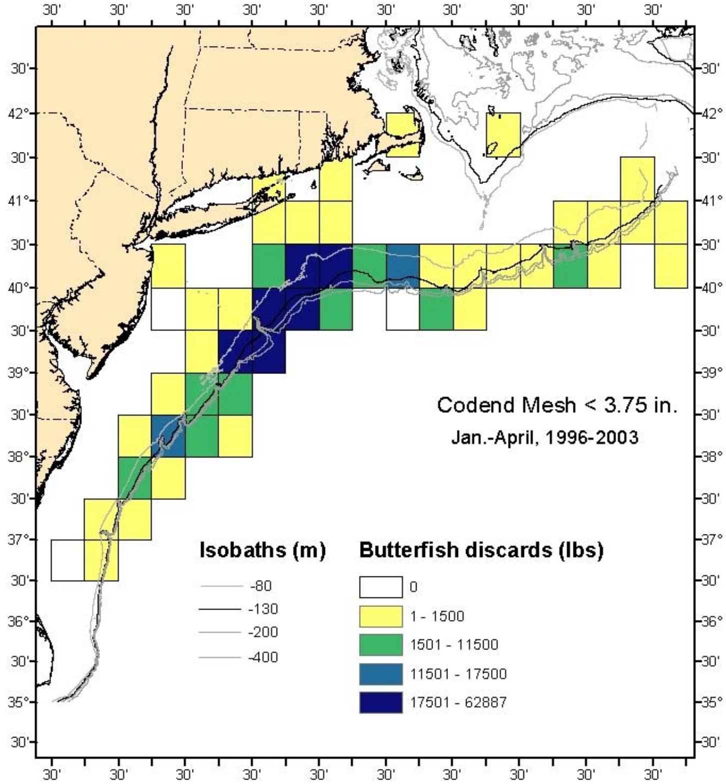


Figure 30. Observed butterfish discards, by quarter-degree square, for otter trawl fisheries using codend mesh sizes less than 3.75 inches during Jan.-April, 1996-2003.

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 boundaries of the areas resulting from this analysis which will affect butterfish discards in the areas which represent 50% and 90% for 3 inch mesh and 50% and 90% for 3.75 inch mesh are illustrated in Figures 1-4, respectively. It should be noted that the existing southern GRA, 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, the effective GRA period. In 2005, this GRA was moved westerly by 3 minutes. The technical procedure for this analysis is described in Appendix 1 of Amendment 9.

Table 11a. Ratio of butterfish caught to *Loligo* kept on trips that caught at least 2500 pounds *Loligo* (average of each trip's ratio). 1997-2006 Observer data.

MONTH	(Butterfish caught) / (Loligo kept)
Jan	0.37
Feb	0.34
Mar	0.11
Apr	0.50
May	0.04
Jun	0.03
Jul	0.03
Aug	0.16
Sep	0.30
Oct	0.26
Nov	0.33
Dec	0.07

Table 11b. Ratio of butterfish discarded to *Loligo* kept on trips that caught at least 2500 pounds *Loligo* (average of each trip's ratio). 1997-2006 Observer data.

MONTH	(Butterfish discarded) / (Loligo kept)
Jan	0.24
Feb	0.18
Mar	0.09
Apr	0.45
May	0.01
Jun	0.03
Jul	0.03
Aug	0.09
Sep	0.18
Oct	0.25
Nov	0.32
Dec	0.07

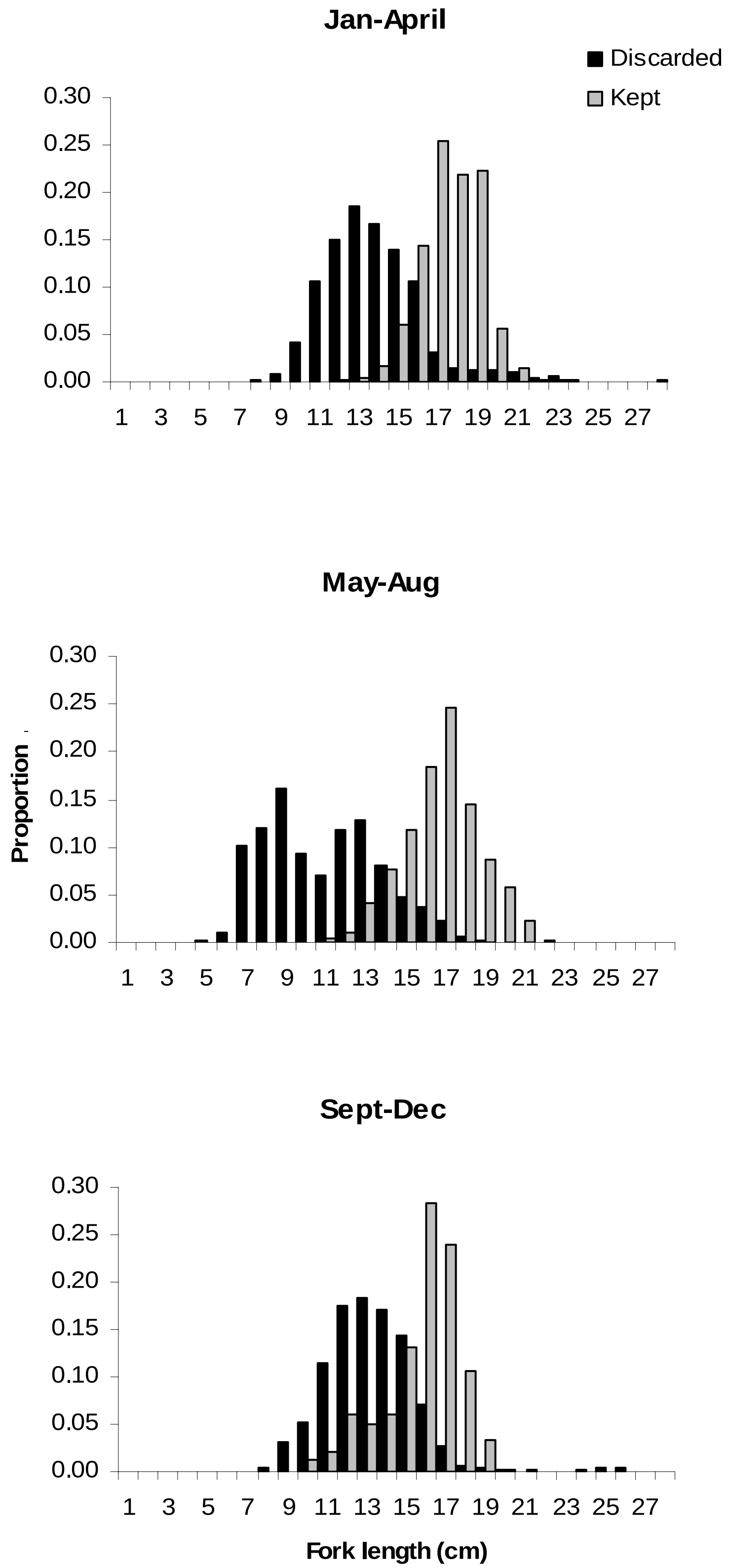
Table 11c. Trip Frequency distribution of butterfish landings. 2002-2006 NE Dealer weighout data, records with valid Federal permits. (If one vessel made two landings in one day, it is counted as one trip.)

Landing Category	Landing Category Pounds	Trips in Category	Percent of Trips in Category	Cumulative Percent of Trips	Pounds Landed (liveweight)	Percent of Landings in Category	Cumulative Percent of Landings
1	1-499	24178	92%	92%	1,760,830	36%	36%
2	500-999	1264	5%	96%	872,081	18%	54%
3	1000-1999	609	2%	99%	825,568	17%	71%
4	2000-2999	151	1%	99%	359,944	7%	79%
5	3000-3999	79	0%	100%	271,192	6%	84%
6	4000-4999	44	0%	100%	194,356	4%	88%
7	5000-9999	34	0%	100%	221,126	5%	93%
8	10,000-39,999	8	0%	100%	149,419	3%	96%
9	40,000-99,999	3	0%	100%	188,827	4%	100%

Table 11d. Frequency distribution of butterfish discarded on trips that caught at least 2500 pounds *Loligo*. 1997-2006 Observer data.

Pounds Butterfish	Trip Frequency
0	31
more than 0 to 250	148
250-500	31
500-1,000	27
1,000-5,000	56
5,000-10,000	10
10,000-25,000	14
25,000-50,000	5
50,000-100,000	1
Total	323

Figure 30a. Length composition of kept and discarded butterfish in the *Loligo* fishery 1996-2006



6.1.5 Small Mesh Multispecies

Given the overlap between effort for small-mesh multispecies fishery species and SMB species, and the potential effects on the whiting fishermen, a brief description of the whiting fishery follows.

The small-mesh multispecies fishery is managed under the Northeast Multispecies Fishery Management Plan (Multispecies FMP) for small-mesh multispecies by the New England Fishery Management Council (NEFMC). "Small-mesh multispecies" includes three species commercially harvested in gear less than the regulated mesh size required for other multispecies groundfish. They are silver hake, *Merluccius bilinearis* (commonly known as whiting), red hake, *Urophycis chuss* (commonly known as ling) and offshore hake, *Merluccius albidus* (also known as whiting but sometimes known as black-eye whiting). The NEFMC currently manages these species under the Multispecies FMP but because they are harvested differently and subject to different regulations than other multispecies groundfish species, may after consultation with NOAA manage these species in a separate FMP (http://www.nefmc.org/mesh/whiting_scoping_document.pdf). The following whiting fishery biological information was taken from the NMFS Northeast Fishery Science Center "Status of Stocks" web page: http://www.nefsc.noaa.gov/sos, where detailed references may be found

Northern Silver Hake Population

Biological Reference Points

The northern silver hake stock overfishing definition uses a relative exploitation index (total landings divided by NEFSC autumn survey biomass index) as a proxy for fishing mortality. The northern stock is considered overfished when the 3-year average biomass is less than ½ the B_{MSY} proxy (6.63 kg/tow). The 3-year average biomass has been above the ½ B_{MSY} proxy (> 3.31 kg/tow) since 1971, although the 2005 survey biomass index is below this value. Overfishing occurs when the 3-year average exploitation index is below 2.57, the F_{MSY} proxy (the average exploitation index during 1973-1982), and is used as both a target and threshold value for fishing mortality for the northern stock. Exploitation indices have been below the F_{MSY} proxy since 1978.

The Fishery

Commercial landings of silver hake from the northern stock were significantly lower than those from the southern stock during the mid and late 1960s and throughout the 1970s. In 1975, commercial landings peaked at 40,000 mt but have since progressively declined. After 1976, landings declined due to the departure of the distant water fleets. Commercial landings attained a historical low of 240 mt in 2005.

Substantial quantities of juvenile silver hake are discarded in the large mesh and small mesh otter trawl fisheries and in the northern shrimp fishery. Discard estimates during

1989-1992 range from 1,700 mt to 7,200 mt (17 million to 76 million fish) per year. High juvenile discards can diminish future yields and spawning potential.

Summary

Northern silver hake landings have decreased substantially since 1977, and are presently at a historical low. The autumn survey biomass index has fluctuated over the years, but has continuously declined since 1998, and is at a low of 1.95 kg/tow in 2005. In 2005, the 3-year average exploitation index for 2003-2005 was below the F_{MSY} proxy and the 3-year average biomass index remained above the ½ B_{MSY} proxy, indicating that the stock is not overfished and overfishing is not occurring.

Southern Silver Hake Population

Biological Reference Points

The southern silver hake stock is considered to be overfished when the three-year moving average of the NMFS autumn survey weight per tow index is less than half of the B_{MSY} proxy (1.78 kg/tow). The three-year average of the survey biomass during 2003-2005 was 1.41 kg/tow, which was above 1/2 B_{MSY} (0.89 kg/tow) but below the B_{MSY} target of 1.78 kg/tow.

Overfishing is considered to be occurring in the silver hake stock when the exploitation index (landings divided by the three-year moving average of the delta-distributed fall survey biomass index) exceeds the F_{MSY} threshold proxy of 34.39. The 2003-2005 average exploitation index of 4.67 is below the F_{MSY} threshold proxy as well as the F_{MSY} target proxy of 20.63.

The Fishery

Domestic landings from the southern silver hake stock have varied between 5,000-30,000 mt, reaching a peak of about 27,000 mt in 1964. However, between 1960 and 1980, distant-water fleet landings of southern silver hake were very high, peaking at about 280,000 mt in 1965 and around 100,000 mt in 1974. Distant-water fleet landings tapered off in the mid-1980s, and total landings have since continued to gradually decrease. In 2005, total landings were near a historic low at 7,000 mt.

As in the northern stock, significant quantities of juvenile southern silver hake are discarded in both large mesh and small mesh otter trawl fisheries. Annual discard estimates during 1989-1992 range from 1,300 mt to 10,000 mt (10 million to 81 million fish) per year. High discarding of juveniles may severely limit opportunities to rebuild the southern silver hake stock.

Summary

The southern silver hake stock is not overfished and overfishing is not occurring. However, the 2005 biomass index is less than half of the indices observed in the early 1960s, and except for 2001, the biomass index has remained below the B_{MSY} proxy since 1989. Another source of concern is that the age structure of the southern silver hake stock is severely truncated in recent years, with few fish older than age 4.

NORTHERN STOCK RED HAKE

Biological Reference Points

The overfishing definition uses a relative exploitation index (total landings/NEFSC autumn survey biomass index) as a proxy when fishing mortality is unknown (NEFMC 2003). The northern stock is considered overfished when the 3-year moving average biomass is less than the ½ BMSY proxy (1.6 kg/tow). Overfishing occurs when the exploitation ratio exceeds the proxy for F_{MSY} (0.61). The 3-year average biomass has remained above the ½ BMSY proxy since the mid-1970s. Exploitation indices have been below the FMSY proxy since 1977, as well as below the F_{proxy} target level of 0.37 since 1988.

The Fishery

The northern red hake stock had significantly lower commercial landings than the southern stock through the mid-1970s. In 1973, total commercial landings peaked at 15,281 mt but have since declined progressively. After 1976, landings declined considerably due to the withdrawal of the distant water fleet. Commercial landings attained a historical low of 130 mt in 2005.

Summary

Northern red hake landings and NEFSC autumn survey biomass indices were relatively high until the mid-1970s when the distant water fishery was at its maximum. Landings have since declined to a historical low in 2005. In 2005, the exploitation index was well below the F_{MSY} proxy of 0.65 and the 3-year average biomass index remained above the ½ B_{MSY} proxy, indicating that the stock is not overfished and overfishing is not occurring.

SOUTHERN STOCK RED HAKE

Biological Reference Points

In 1998 the Overfishing Definition Review Panel concluded that MSY and F reference points could not be determined for southern red hake because the time series of landings and survey biomass indices did not include a period of stable landings at high biomass levels. The Panel noted that discarding could be significant, especially in the scallop and trawl fisheries. Habitat destruction was also thought to be prohibiting stock recovery since juveniles rely on intact scallop beds for shelter. However, in recent years the scallop stock has been recovering, but red hake biomass indices have not increased.

The southern red hake stock is considered to be in an overfished condition when the three-year moving average weight per individual fish in the NMFS autumn survey falls below the 25th percentile of the 1963-1997 average of 0.12 kg and when the three-year moving average of the abundance of immature fish less than 25 cm in the fall survey is below the 1963-1997 median value of 4.07 immature fish per tow.

<u>The Fishery</u>

During 1962 to 1976, landings from the southern red hake stock were much higher than those from the northern stock. However, southern red hake landings decreased sharply after 1966 and also after 1976 due to restrictions on distant water fleets. The southern stock landings have continued to decrease, and reached a record low of 200 mt in 2005.

<u>Summary</u>

The 2003-2005 average fish weight of 0.068 kg was about half of the acceptable individual fish weight reference point, however the 2003-2005 recruitment index of 5.68 red hake less than 25 cm length per tow was above 4.07, the median value. Based on this, the southern red hake stock is not in an overfished condition.

Offshore Hake

The NMFS Northeast Fishery Science Center "Status of Stocks" web page does not have information on offshore hake. The following offshore hake information is taken from the February 2007 NEFMC Small Mesh Multispecies updated stock information SAFE report:
http://nefmc.org/mesh/council_mtg_docs/Stock%20status%20updates%20FEB07%20COUNCIL_feb.pdf.

<u>Biological Reference Points</u>

The current overfishing definition for offshore hake reads as follows: Offshore hake is in an overfished condition when the three year moving average weight per individual in the fall survey falls below the 25th percentile of the average weight per individual from the fall survey time series 1963-1997 (0.22) AND when the three year moving average of the abundance of immature fish less than 30 cm falls below the median value of the 1963-1997 fall survey abundance of fish less than 30 cm (0.27).

The Fishery

Offshore hake is usually landed in small amounts in combination with silver hake, and the fishing mortality rate for offshore hake remains unknown.

Summary

Based on the best available information, the offshore hake stock is not overfished. Overfishing is not occurring. However, it should be noted that the survey averages are just at the threshold level for a “not overfished/overfishing” determination. In 2006, the three-year average mean fish weight is below the threshold value, and the three-year average recruitment index is just at the threshold level. The recruitment average, however, includes an extremely low value for 2005, which may be the result of survey variability (also apparent throughout the recruitment time series). A benchmark stock assessment is needed to thoroughly evaluate the status of this stock, investigate reasons for fluctuations in recruitment and mean fish weight, and develop a more appropriate and useful overfishing definition.

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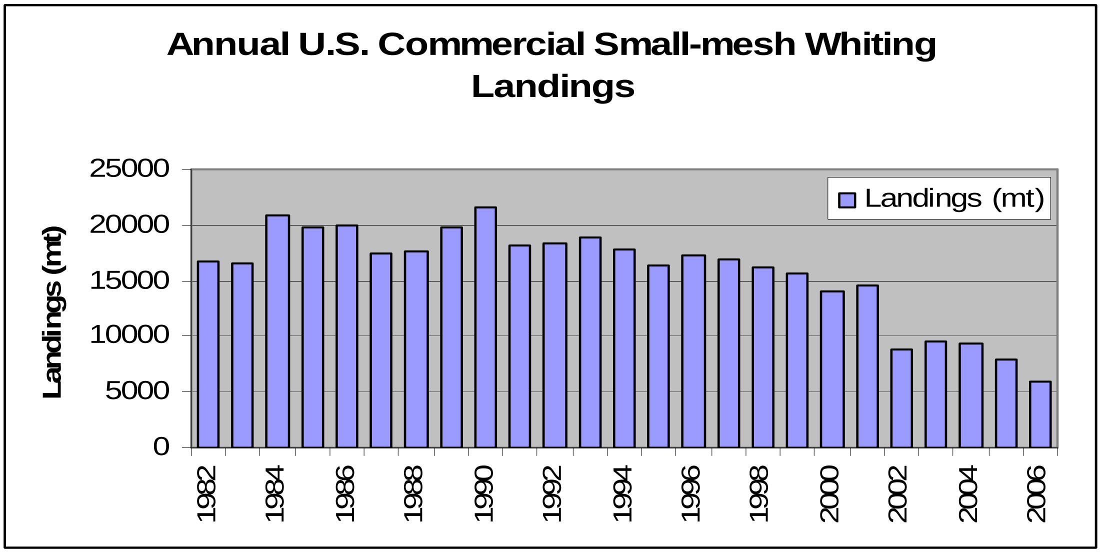
Landings

Combined landings for the three small-mesh multispecies fishery species (Silver, Red, and Offshore Hake) are found in Table 12 and Figure 31.

Table 12. Annual Small-mesh multispecies landings by gear

YEAR	TRAWL: OTTER, BOTTOM, FISH	DREDGE: OTHER	ALL OTHERS	TOTAL
1982	16,525		291	16,816
1983	16,113		439	16,551
1984	20,399		418	20,817
1985	19,007		739	19,745
1986	18,730		1,265	19,995
1987	16,583		890	17,472
1988	16,947		714	17,661
1989	19,259		498	19,757
1990	21,100		492	21,592
1991	17,762		465	18,227
1992	18,054		361	18,415
1993	17,576		1,385	18,961
1994	16,686		1,188	17,874
1995	14,154		2,212	16,366
1996	17,143		198	17,341
1997	16,657		251	16,908
1998	16,104		101	16,206
1999	15,473		117	15,590
2000	13,715		242	13,957
2001	14,418		165	14,582
2002	8,771		80	8,851
2003	9,344		117	9,461
2004	6,871	1,385	1,025	9,281
2005	5,167	1,730	1,044	7,942
2006	4,058	1,266	699	6,023

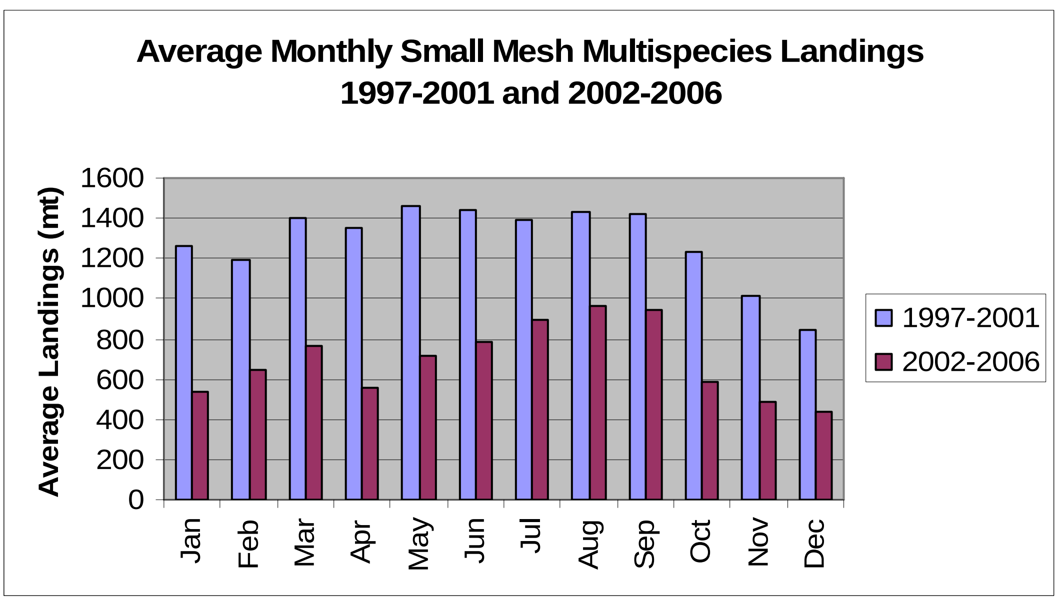
Figure 31. Annual U.S. Commercial small-mesh multispecies Landings



Temporal and Geographic Patterns of Commercial small-mesh multispecies Harvest

Combined landings of silver, red, and offshore hake are widely distributed in terms of time and space (Figure 32, Figure 33).

Figure 32. Average Monthly small-mesh multispecies (silver, red, and offshore hake) landings 1997-2001 and 2002-2006.



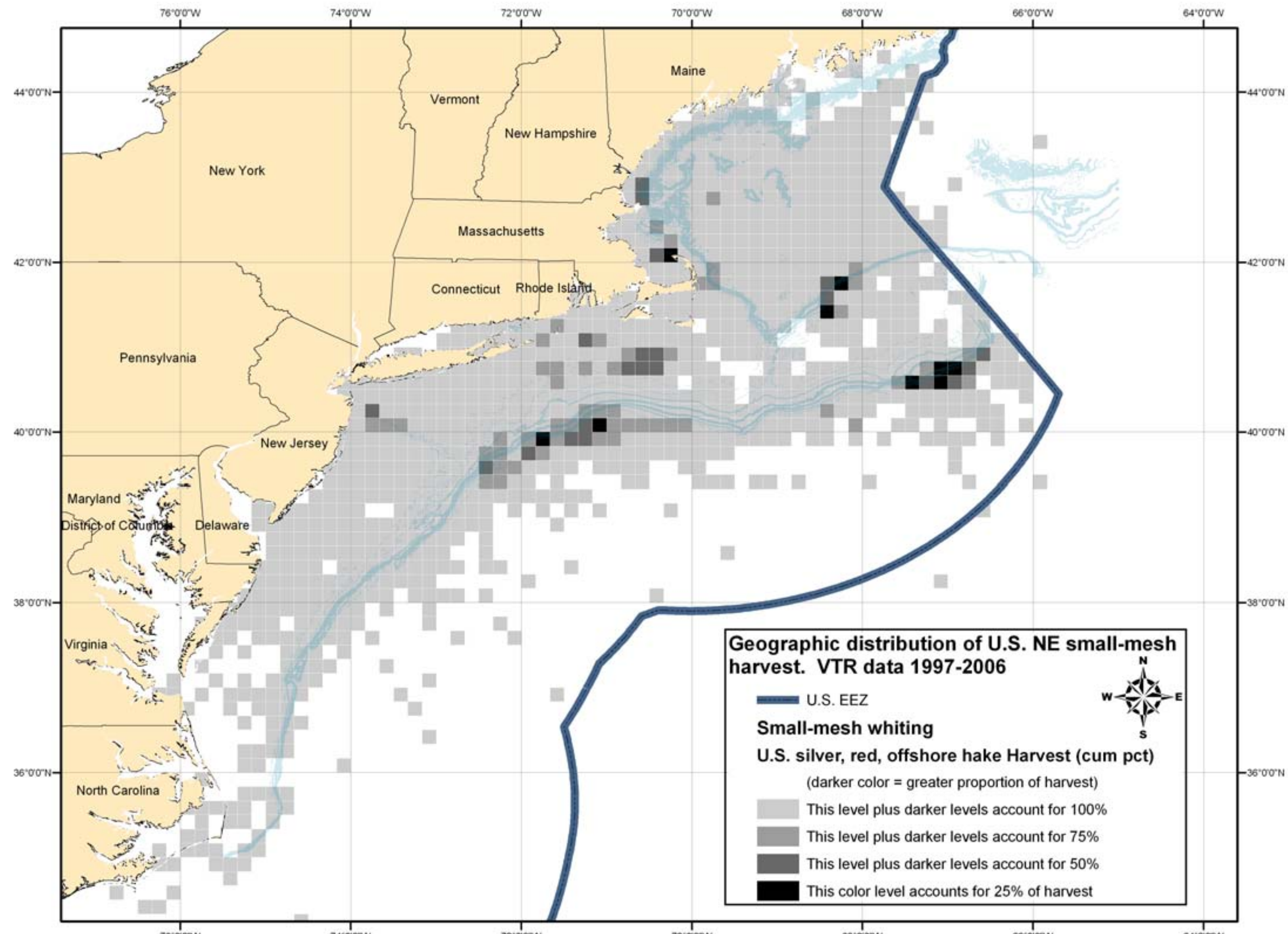


Figure 33. Geographic distribution of silver, red, and offshore hake harvest according to VTR data (1997 – 2006).

Commercial Discarding

From 2001-2006, according to unpublished NMFS Observer data, overall for silver, red, and offshore hake, 40% of fish caught (by weight) was discarded. 29% of silver hake was discarded, 77% of red hake was discarded, and 37% of offshore hake was discarded. The *Loligo* fishery accounted for most observed silver (56%) and offshore hake discards (83%). The directed *Loligo* fishery accounted for 31% of red hake discards. To further examine red hake discards, observed discards were sorted based on the first stated targeted species. Hauls targeting *Loligo* and silver hake each accounted for 38% of red hake discards by this method of analysis. The difference between the two *Loligo* percentages (31% and 38%) is a result of how directed *Loligo* trips are defined (at least 50% *Loligo* landed vs. stated targeting).

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 included in section 6.2 but is primarily addressed in the description of the managed resource VEC given above in Section 6.1. In Amendment 9 discards in the directed butterfish, *Illex, Loligo,* and Mackerel fisheries were discussed. Analysis of data and discussions with MAFMC Council members and other industry advisors has revealed that there is currently minimal directed fishing for butterfish. If a per trip landing limit of greater than 500 lbs is applied to identify directed butterfish trips, the resulting trips are really directed *Loligo* or *Illex* trips that happened to also keep 500 lbs of butterfish. Increasing the landing cutoff or using "50% of landings from butterfish" as screening criteria results in a subset of trips that is too small for meaningful analysis. For these reasons, butterfish is not included in Amendment 10 as a directed fishery for the purposes of bycatch analysis.

Table 13 A, C, and E provide lists 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 2001-2006 based on data from the NEFSC Observer Program. Table 13 B, D, and F provide lists 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 1997-2000 based on data from the NEFSC Observer Program. Directed trip criteria included: *Illex* - at least 50% *Illex* landed; *Loligo* - at least 50% *Loligo* landed; Mackerel - More than 5000 pounds mackerel landed. There was one directed *Loligo* trip that also landed more than 5000 pounds of Mackerel. This trip was not included in the Mackerel analysis because the few mackerel target tows did not have any incidental catches and the discards on this particular trip were from hauls where *Loligo* was the target. 1997 was used as the initial year because of the institution of a minimum mesh in the *Loligo* fishery and because several large vessels permanently left the fishery around 1997, changing the character of the fishery and making earlier years less representative of the current fishery. Data since 1997 was divided at 2000/2001 due to the implementation of the Scup GRAs as of 2001.

This list of species from Table 13 A-F includes: butterfish (*Peprilus triacanthus*), silver hake (*Merluccius bilinearis*), red hake (*Urophycis chuss*), spiny dogfish (*Squalus acanthias*), scup (*Stenotomus chrysops*), fourspot flounder (*Hippoglossina oblonga*), spotted hake (*Urophycis regius*), longfin inshore squid (*Loligo pealeii*), Atlantic mackerel (*Scomber scombrus*), little skate (*Leucoraja erinacea*), Atlantic herring (*Clupea harengus*), unspecified sea robins (Family Triglidae), northern shortfin squid (*Illex illecebrosus*), chub mackerel (*Scomber japonicus*), unspecified herring (Family Clupeidae), John Dory (*Zenopsis conchifera*), blueback herring (*Alosa aestivalis*), armored sea robin (*Peristedion miniatum*), striped bass (*Morone saxatilis*), northern sea robin (*Prionotus carolinus*), summer flounder (*Paralichthys dentatus*), angler (monkfish) (*Lophius americanus*), and unspecified hakes (likely Family Merlucciidae). The analysis indicates that a much smaller percentage of the total catch (in terms of weight) is discarded in the *Illex* and Atlantic mackerel fisheries than in the *Loligo* fishery. During 2001-2006, 3% of the observed catch in the *Illex* fishery was discarded, 2% of the observed catch in the mackerel fishery was discarded, and 32% of the observed catch in the *Loligo* fishery was discarded. During 1997-2000, 3% of the observed catch in the *Illex* fishery was discarded, 6% of the observed catch in the mackerel fishery was discarded, and 46% of the observed catch in the *Loligo* fishery was discarded.

Guide to Table 13 A-F (uses Table 13 A (*Illex*) as example):

***Discarded =** Observed pounds caught and discarded on observed directed *Illex* trips
***Kept =** Observed pounds caught and kept on observed directed *Illex* trips
***Total Catch =** Total observed pounds caught on observed directed *Illex* trips
***Percent of "Illex" Discards =** The species in the row (left-right) accounted for X% of observed directed *Illex* trips' overall discards.
***Percent of species discarded =** How much of the species in the row was discarded = (Discarded) divided by (Total Catch).
***D:K Ratio =** (Discarded) divided by (Kept)

Table 13 A. Discards in directed *Illex* fishery, 2001-2006 (Source: unpublished NMFS Observer data)

Illex (N= 79 observed directed trips)

Common name	Discarded	Kept	Total Catch	Percent of Illex Discards	Percent of species discarded	D:K Ratio
SQUID (*ILLEX*)	179,130	10,362,678	10,541,808	55%	2%	0.02
MACKEREL, ATLANTIC	51,180	75	51,255	16%	100%	682.40
BUTTERFISH	30,361	11,547	41,908	9%	72%	2.63
HAKE, SPOTTED	21,658	0	21,658	7%	100%	none kept
DORY, BUCKLER (JOHN)	7,087	2,656	9,744	2%	73%	2.67
DOGFISH SPINY	6,286	0	6,286	2%	100%	none kept
All other species	29,964	90,479	120,491	9%	25%	0.33
Total	325,666	10,467,435	10,793,150	100%	3%	0.03

Table 13 B: Discards in the directed *Illex* fishery , 1997-2000 (Source: unpublished NMFS Observer data)

Illex (N= 30 observed directed trips)

Common name	Discarded	Kept	Total Catch	Percent of Illex Discards	Percent of species discarded	D:K Ratio
BUTTERFISH	42,772	10,164	52,936	34%	81%	4.21
SQUID (*ILLEX*)	41,624	3,833,220	3,874,844	34%	1%	0.01
MACKEREL, CHUB	19,642	2,670	22,312	16%	88%	7.36
HAKE, SPOTTED	6,355	134	6,489	5%	98%	47.42
HAKE, SILVER	5,673	19	5,692	5%	100%	298.56
DORY, BUCKLER (JOHN)	2,068	2,012	4,080	2%	51%	1.03
All other species	6,063	56,427	62,609	5%	10%	0.11
Total	124,196	3,904,645	4,028,961	100%	3%	0.03

Table 13 C: Discards in the directed *Loligo* fishery, 2001-2006 (Source: unpublished NMFS Observer data)

Loligo (N= 320 observed directed trips)

Common name	Discarded	Kept	Total Catch	Percent of Loligo Discards	Percent of species discarded	D:K Ratio
HAKE, SPOTTED	365,408	5,573	370,980	14%	98%	65.57
HAKE, SILVER	333,616	135,001	468,616	12%	71%	2.47
BUTTERFISH	299,574	33,472	333,046	11%	90%	8.95
DOGFISH SPINY	285,390	523	285,912	11%	100%	546.20
SQUID (*ILLEX*)	260,401	36,211	296,611	10%	88%	7.19
SQUID (*LOLIGO*)	153,978	5,227,544	5,381,521	6%	3%	0.03
HAKE, RED	137,875	4,443	142,318	5%	97%	31.03
MACKEREL, ATLANTIC	122,568	92,848	215,417	5%	57%	1.32
FLOUNDER, FOURSPOT	79,332	0	79,332	3%	100%	none kept
FLOUNDER, SUMMER	57,221	94,609	151,829	2%	38%	0.60
SKATE, LITTLE	51,455	121	51,576	2%	100%	425.25
ANGLER	51,365	40,523	91,888	2%	56%	1.27
HAKE, NK	49,132	1,030	50,162	2%	98%	47.70
All other species	449,881	157,504	607,420	17%	74%	2.86
Total	2,697,195	5,829,399	8,526,629	100%	32%	0.46

Table 13 D: Discards in the directed *Loligo* fishery, 1997-2000 (Source: unpublished NMFS Observer data)

Loligo (N= 99 observed directed trips)

Common name	Discarded	Kept	Total Catch	Percent of Loligo Discards	Percent of species discarded	D:K Ratio
BUTTERFISH	245,821	20,525	266,347	20%	92%	11.98
HAKE, SILVER	227,454	66,233	293,687	19%	77%	3.43
SCUP	181,662	10,619	192,281	15%	94%	17.11
HAKE, RED	168,411	1,756	170,167	14%	99%	95.91
HAKE, SPOTTED	58,679	4,630	63,309	5%	93%	12.67
DOGFISH SPINY	42,296	4,157	46,453	4%	91%	10.17
FLOUNDER, FOURSPOT	31,841	94	31,935	3%	100%	338.73
SQUID (*LOLIGO*)	31,546	1,267,307	1,298,853	3%	2%	0.02
SEA ROBIN, NORTHERN	29,218	0	29,218	2%	100%	none kept
SQUID (*ILLEX*)	27,943	14,865	42,808	2%	65%	1.88
SKATE, LITTLE	22,487	0	22,487	2%	100%	none kept
All other species	133,578	42,478	176,373	11%	76%	3.14
Total	1,200,935	1,432,664	2,633,916	100%	46%	0.84

Table 13 E: Discards in the directed Atlantic Mackerel fishery, 2001-2006 (Source: unpublished NMFS Observer data)

Atlantic Mackerel (N= 33 observed directed trips)

Common name	Discarded	Kept	Total Catch	Percent of Mackerel Discards	Percent of species discarded	D:K Ratio
DOGFISH SPINY	71,713	5,000	76,713	36%	93%	14.34
MACKEREL, ATLANTIC	60,472	9,877,594	9,938,066	30%	1%	0.01
HERRING, ATLANTIC	49,139	1,644,897	1,694,036	25%	3%	0.03
HERRING, BLUE BACK	8,344	67,932	76,276	4%	11%	0.12
SCUP	3,201	1	3,202	2%	100%	3200.50
All other species	5,562	24,501	30,748	3%	18%	0.23
Total	284,668	11,619,924	11,819,039	100%	2%	0.02

Table 13 F: Discards in the directed Atlantic Mackerel fishery, 1997-2000 (Source: unpublished NMFS Observer data)

Atlantic Mackerel (N= 10 observed directed trips)

Common name	Discarded	Kept	Total Catch	Percent of Mackerel Discards	Percent of species discarded	D:K Ratio
HERRING, ATLANTIC	52,611	386,880	439,491	33%	12%	0.14
MACKEREL, ATLANTIC	47,044	2,102,533	2,149,577	30%	2%	0.02
HERRING, BLUE BACK	16,150	13,250	29,400	10%	55%	1.22
SCUP	11,985	2,795	14,780	8%	81%	4.29
BUTTERFISH	7,153	2,386	9,539	5%	75%	3.00
HAKE, RED	6,425	99	6,524	4%	98%	64.90
DOGFISH SPINY	5,099	0	5,099	3%	100%	none kept
BASS, STRIPED	4,022	0	4,022	3%	100%	none kept
HERRING (NK)	2,753	0	2,753	2%	100%	none kept
All other species	4,169	6,888	11,114	3%	38%	0.61
Total	157,411	2,514,831	2,672,299	100%	6%	0.06

(Note the managed resources are included in these lists (grayed out in Table 13 A-F)).

The Northeast Fishery Observer Program (NEFOP) database was also queried to identify the sharks, rays and large pelagic finfish species discarded versus kept in the SMB fisheries, during 1997-2006, based on the captain's designation of the target species prior to conducting each tow. Sampling effort by year (number of tows) is also presented (Table 14). Discards of sharks, rays, and large pelagics in the butterfish fishery is not included in the table because there has been no directed butterfish fishery since 2001 and only limited targeting of butterfish by a few vessels during 1997-2001. The discards of large pelagics in the Atlantic mackerel fishery during 1997-2006 are unknown due to the inability of the observers to view these discards because large-bodied species are prevented from entering the pump, which sends the catch directly from the codend into the hold, and are discarded while the codend is submerged. Only some mackerel fishing vessels that pump also shoot and haul their nets from reels.

Discarding of several species that are overfished or are rebuilding occur in both the *Loligo* and *Illex* fisheries. These species include: dusky shark (Carcharinus obscurus), porbeagle shark (Lamna nasus), Atlantic swordfish (Xiphias gladius), and bigeye tuna (Thunnus obsesus). In addition, the sandbar shark (Carcharinus plumbeus) is discarded in the *Loligo* fishery. Most species of sharks, rays and large pelagic species that are incidentally caught in the two squid fisheries are discarded (Table 14). Of all the species discarded in the *Loligo* fishery, the largest numbers of discarded individuals are torpedo rays (Torpedo nobiliana) which were consistently discarded (ranging from 3-44 individuals) each year during 2001-2006. The largest numbers of large pelagic commercial finfish that are discarded in both squid fisheries are swordfish with most being discarded in the *Illex* fishery which occurs near the shelf edge during the summer and fall. Swordfish were discarded in the *Illex* fishery every year during 1997-2006 (no sampling occurred in the *Illex* fishery during 2002) and discards ranged from 3 to 28 individuals per year. A portion of these swordfish discards constitute regulatory discards because of limitations on the size and number of swordfish that can be kept by a vessel captain with an incidental catch permit. However, the incidental retention limits for vessels involved in the squid trawl fisheries (when it has no commercial fishing gear other than trawls on board, and when squid constitute not less than 75% by weight of the total fish on board or offloaded) were raised from three to fifteen fish per trip in July of 2007(http://www.nmfs.noaa.gov/MSA/hms/Swordfish/SWO%20Rule%20Q%20&%20A %20Compliance%20Guide.pdf). The Atlantic swordfish stock is in year seven of a ten-year rebuilding plan (NMFS 2006c). In 2006, the North Atlantic swordfish stock was determined to be almost fully rebuilt and fishing mortality was low (http://www.epa.gov/fedrgstr/EPA-IMPACT/2007/June/Day-07/i10727.htm).

Table 14. 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.

Table 14. 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, 1997-2006. These discard values are subsamples and do not represent total discards because they have not been scaled up to the total landings of each SMB fishery by year. Highlighted species are those with stocks that are overfished and/or for which overfishing is occurring and/or the stock is subject to a rebuilding plan. (note: the annual number kept is not provided)

***Loligo* Fishery**

Common Name	Scientific Name	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total Number Disc.	Total Number Kept	Total Weight Disc. (lbs)	Total Weight Kept (lbs)
Number of tows sampled		255	253	401	259	335	216	231	1,090	933	724				
AMBERJACK, NK	*SERIOLA SP*							1				1	1	1	3
BARRACUDA, NK	*SPHYRAENIDAE*									1	3	4		7	
BONITO, ATLANTIC	*SARDA SARDA*			1	1		1					3	5	6	37
COBIA	*RACHYCENTRON CANADUM*												1		15
GROUPER, NK	*EPINEPHELUS, MYCTEROPERCA*									1		1	8	11	116
MOLA, OCEAN SUNFISH	*MOLA MOLA*					2	1		3	2		8		2,700	
NEEDLEFISH, ATLANTIC	*STRONGYLURA MARINA*								3			3		1	
OILFISH	*RUVETTUS PRETIOSUS*								1			1		23	
RAY, BULLNOSE	*MYLIOBATIS FREMINVILLEI*							1				1		2	
RAY, BUTTERFLY, SPINY	*GYMNURA ALTAVELA*									2		2		78	
RAY, NK	*RAJIFORMES*							1	1	1		3		134	
RAY, TORPEDO	*TORPEDO NOBILIANA*					12	3	14	34	44	24	131		3,507	
SHARK, ATL ANGEL	*SQUATINA DUMERILI*			3				1	3		1	8		90	
SHARK, BASKING	*CETORHINUS MAXIMUS*	2	1			8	1		2	5	3	22		81,550	
SHARK, BLUE (BLUE DOG)	*PRIONACE GLAUCA*	1	1	2					1			5		520	
SHARK, BULL	*CARCHARHINUS LEUCAS*												4		34
SHARK, DUSKY	*CARCHARHINUS OBSCURUS*									5	2	7	1	490	42
SHARK, HAMMERHEAD, SCALLOPED	*SPHYRNA LEWIN*			2	3							5		1,600	

SHARK, HAMMERHEAD,NK	*SPHYRNIDAE*			5					5			10		2,490	
SHARK, MAKO, NK	*ISURUS SP*			1								1	1	3	65
SHARK, NIGHT	*CARCHARHINUS SIGNATUS*					1						1		10	
SHARK, NK	*SQUALIFORMES*								4	2		6		320	
SHARK, PORBEAGLE (MACKEREL SHARK)	*LAMNA NASUS*		1	1							1	3		380	
SHARK, SAND TIGER	*ODONTASPIS TAURUS*										1	1		34	
SHARK, SANDBAR (BROWN SHARK)	*CARCHARHINUS PLUMBEUS*	1							12	1	1	15		1,419	
SHARK, THRESHER	*ALOPIAS VULPINUS*			1			1					2	1	105	11
SHARK, THRESHER, BIGEYE	*ALOPIAS SUPERCILIOSUS*	1										1		80	
STINGRAY, ATLANTIC	*DASYATIS SABINA*					1					1	2		40	
STINGRAY, NK	*DASYATIDAE*								1			1		9	
STINGRAY, PELAGIC	*DASYATIS VIOLACEA*									1		1		10	
STINGRAY, ROUGHTAIL	*DASYATIS CENTROURA*					2		2	16	2		22		2,825	
STURGEON, ATLANTIC	*ACIPENSER OXYRHYNCHUS*					4			7			11		571	
SWORDFISH	*XIPHIAS GLADIUS*			19	1	1	2		6	7		36	30	1,282	1,186
TUNA, BIG EYE	*THUNNUS OBESUS*						1					1		1	
TUNA, BLUEFIN	*THUNNUS THYNNUS*								2	2		4		178	
TUNA, LITTLE (FALSE ALBACORE)	*EUTHYNNUS ALLETTERATUS*			5	5	1				6		17	4	139	44
TUNA, NK	*EUTHYNNUS THUNNUS SP*					1						1		1	
TUNA, YELLOWFIN	*THUNNUS ALBACARES*									2		2	1	3	28
WRECKFISH	*POLYPRION AMERICANUS*												4		41

Table 14 continued: *Illex* Fishery

Illex **Fishery**

Common Name	Scientific Name	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total Number Discarded	Total Number Kept	Total Weight Discarded (lbs)	Total Weight Kept (lbs)
Number of tows sampled		127	36	37	124	56	0	159	175	61	201				
GROUPER, NK	*EPINEPHELUS, MYCTEROPERCA*												5		219
MOLA, OCEAN SUNFISH	*MOLA MOLA*					3		10	1	2	4	20		4,544	
RAY, NK	*RAJIFORMES*									3		3		1,000	
RAY, TORPEDO	*TORPEDO NOBILIANA*							3	2		3	8		91	
RAY,MANTA, ATLANTIC	*MANTA BIROSTRIS*					1		2				3		1,200	
SHARK, ATL ANGEL	*SQUATINA DUMERILI*				2							2		24	
SHARK, BASKING	*CETORHINUS MAXIMUS*			1				1				2		10,500	
SHARK, BIGEYE SAND TIGER	*ODONTASPIS NORONHAI*							1				1		150	
SHARK, BIGNOSE	*CARCHARHINUS ALTIMA*				16							16		186	
SHARK, BLACK TIP	*CARCHARHINUS LIMBATUS*				1	1						2		24	
SHARK, BLUE (BLUE DOG)	*PRIONACE GLAUCA*	1										1		300	
SHARK, CARCHARHIN,NK	*CARCHARHINUS SP*			3	1	1						5		118	
SHARK, DUSKY	*CARCHARHINUS OBSCURUS*				7	6		2				15		314	
SHARK, FINETOOTH	*APRIONODON ISODON*							1				1		19	
SHARK, HAMMERHEAD, GREAT	*SPHYRNA MOKARRAN*				6				1			7		2,000	
SHARK, HAMMERHEAD, SCALLOPED	*SPHYRNA LEWIN*			1	15			4	1			21		4,976	
SHARK, HAMMERHEAD,NK	*SPHYRNIDAE*				3					1		4		1,400	
SHARK, NIGHT	*CARCHARHINUS SIGNATUS*								1			1		23	
SHARK, NK	*SQUALIFORMES*			1	1							2		99	
SHARK, PORBEAGLE (MACKEREL SHARK)	*LAMNA NASUS*										1	1		7	
SHARK, SILKY	*CARCHARHINUS FALCIFORMIS*		1									1		21	
SHARK, THRESHER, BIGEYE	*ALOPIAS SUPERCILIOSUS*	1										1		300	

Table 14 continued: *Illex* continued

***Illex* Fishery**															
Common Name	Scientific Name	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total Number Discarded	Total Number Kept	Total Weight Discarded (lbs)	Total Weight Kept (lbs)
Number of tows sampled		127	36	37	124	56	0	159	175	61	201				
SHARK, TIGER	*GALEOCERDO CUVIER*									1		1		800	
SKATE, LITTLE	*RAJA ERIANCEA*				1							1		250	
STINGRAY, ROUGHTAIL	*DASYATIS CENTROURA*								2			2		500	
SWORDFISH	*XIPHIAS GLADIUS*	6	3	28	20	5		10	16	7	10	105	90	4,374	7,683
TUNA, BIG EYE	*THUNNUS OBESUS*												2		400
TUNA, BLUEFIN	*THUNNUS THYNNUS*												1		100
TUNA, YELLOWFIN	*THUNNUS ALBACARES*			1								1	4	25	190

The relative contribution of SMB fisheries to the total observed discards of the species listed in Table 13A-F 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* fishery. During 2001-2006, the *Loligo* fishery was responsible for 8%, 56%, 31%, and 10% of all Observer Program discards of scup, silver hake, red hake, and spiny dogfish, respectively. During 1997-2000, the *Loligo* fishery was responsible for 78%, 69%, 48%, and 12% of all Observer Program discards of scup, silver hake, red hake, and spiny dogfish, respectively. Both scup and the southern silver hake stocks are in the process of rebuilding (NMFS 2006). **Table 15**a and **Table 15**b detail the contribution of directed SMB fisheries to total NMFS Observer program observed discards. It is important to use caution in interpreting these percentages and the percentages in the following tables, and to recognize that these percentages are only relative to other fisheries. In other words, if discarding went down in the *Loligo* fishery but down more in other fisheries, the *Loligo* fishery's share would go up even though actual discards went down. Vice versa, if discarding went up in the *Loligo* fishery but up more in other fisheries, the *Loligo* fisheries' share would go down even though actual discards went up.

Table 15a. Average contribution of species discarded in the SMB fisheries in relation to total observer program discards of these species, by SMB fishery, from 2001-2006.

	Directed SMB Fishery 2001-2006			
Non-Target Species	***Illex***	***Loligo***	**Mackerel**	**Total SMB**
Common_Name				
ANGLER	0%	6%	0%	6%
BASS, STRIPED	na	8%	1%	9%
BUTTERFISH	7%	68%	0%	75%
DOGFISH SPINY	0%	10%	2%	13%
DORY, BUCKLER (JOHN)	44%	52%	na	95%
FLOUNDER, FOURSPOT	0%	24%	0%	24%
FLOUNDER, SUMMER	0%	7%	0%	7%
HAKE, NK	5%	83%	na	88%
HAKE, RED	0%	31%	0%	32%
HAKE, SILVER	1%	56%	0%	57%
HAKE, SPOTTED	5%	83%	0%	87%
HERRING (NK)	na	86%	1%	87%
HERRING, ATLANTIC	0%	13%	25%	38%
HERRING, BLUE BACK	0%	23%	16%	39%
MACKEREL, ATLANTIC	20%	47%	23%	91%
MACKEREL, CHUB	91%	9%	na	100%
SCUP	0%	8%	1%	9%
SEA ROBIN, ARMORED	1%	77%	na	77%
SEA ROBIN, NK	0%	51%	na	51%
SEA ROBIN, NORTHERN	0%	4%	0%	4%
SKATE, LITTLE	0%	0%	0%	0%
SKATE, NK	0%	0%	na	0%
SQUID (*ILLEX*)	35%	51%	0%	86%
SQUID (*LOLIGO*)	0%	84%	0%	84%

Source: unpublished NMFS observer program data

Table 15b. Average contribution of species discarded in the SMB fisheries in relation to total observer program discards of these species, by SMB fishery, from 1997-2000.

Directed SMB Fishery 1997-2000				
Non-Target Species	***Illex***	***Loligo***	**Mackerel**	**Total SMB**
Common Name				
ANGLER	1%	8%	0%	9%
BASS, STRIPED	na	3%	14%	17%
BUTTERFISH	10%	56%	2%	68%
DOGFISH SPINY	0%	12%	1%	14%
DORY, BUCKLER (JOHN)	37%	52%	0%	90%
FLOUNDER, FOURSPOT	0%	35%	0%	35%
FLOUNDER, SUMMER	na	16%	1%	16%
HAKE, NK	8%	55%	na	63%
HAKE, RED	0%	48%	2%	50%
HAKE, SILVER	2%	69%	0%	71%
HAKE, SPOTTED	7%	64%	0%	71%
HERRING (NK)	0%	13%	10%	23%
HERRING, ATLANTIC	0%	4%	28%	33%
HERRING, BLUE BACK	0%	8%	47%	56%
MACKEREL, ATLANTIC	0%	24%	68%	92%
MACKEREL, CHUB	100%	na	na	100%
SCUP	0%	78%	5%	83%
SEA ROBIN, ARMORED	5%	86%	na	91%
SEA ROBIN, NK	0%	18%	na	18%
SEA ROBIN, NORTHERN	0%	43%	0%	44%
SKATE, LITTLE	0%	3%	0%	3%
SKATE, NK	na	5%	na	5%
SQUID (*ILLEX*)	54%	36%	0%	90%
SQUID (*LOLIGO*)	3%	63%	1%	66%

Source: unpublished NMFS observer program data

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). 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.

Because *Loligo* has been identified as the primary discard problem in terms of SMB fisheries, further analysis was conducted on the *Loligo* fishery. The following graphs look at the pounds of fish caught (=kept+discarded) per hour of observed trawl time on observed directed *Loligo* trips (>= 50%) in the Observer Data, over the available time series. Note the sometimes small annual "Ns" as shown in Figure 34. The idea behind this analysis was to examine if the directed *Loligo* fishery is getting cleaner or dirtier over time. Some species appear characterized by a lot of variation while others may show some trending. However, the trending may just be related to availability/abundance rather than gear performance.

Figure 34. Number of observed directed Loligo trips over time.

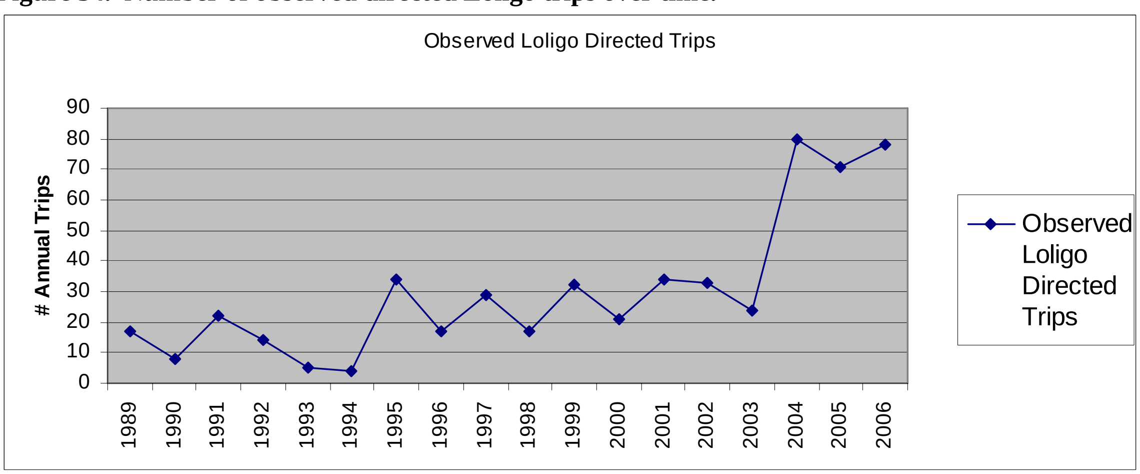


Figure 35. Butterfish catch rates 1989-2006 on directed Loligo trips (>= 50% Loligo landed) Source: Unpublished NMFS Observer program data.

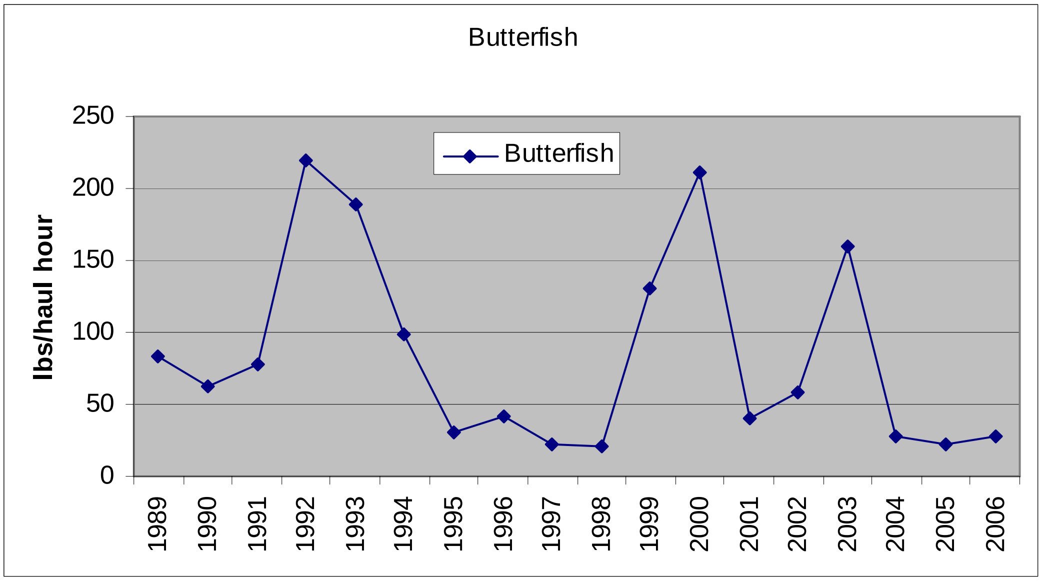


Figure 36. Silver Hake catch rates 1989-2006 on directed Loligo trips (>= 50% Loligo landed) Source: Unpublished NMFS Observer program data.

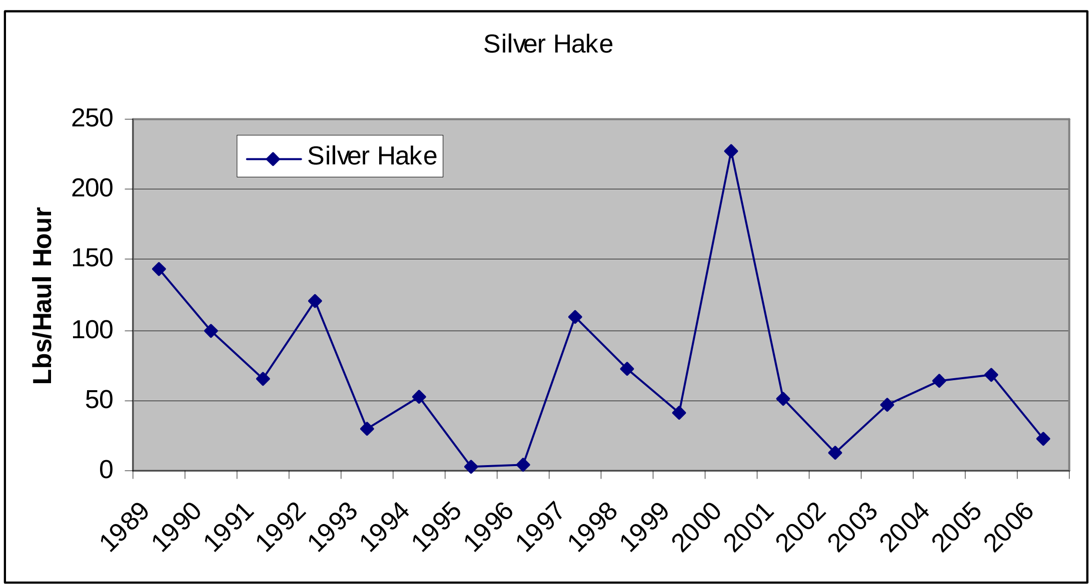


Figure 37. Spiny dogfish catch rates 1989-2006 on directed Loligo trips (>= 50% Loligo landed) Source: Unpublished NMFS Observer program data.

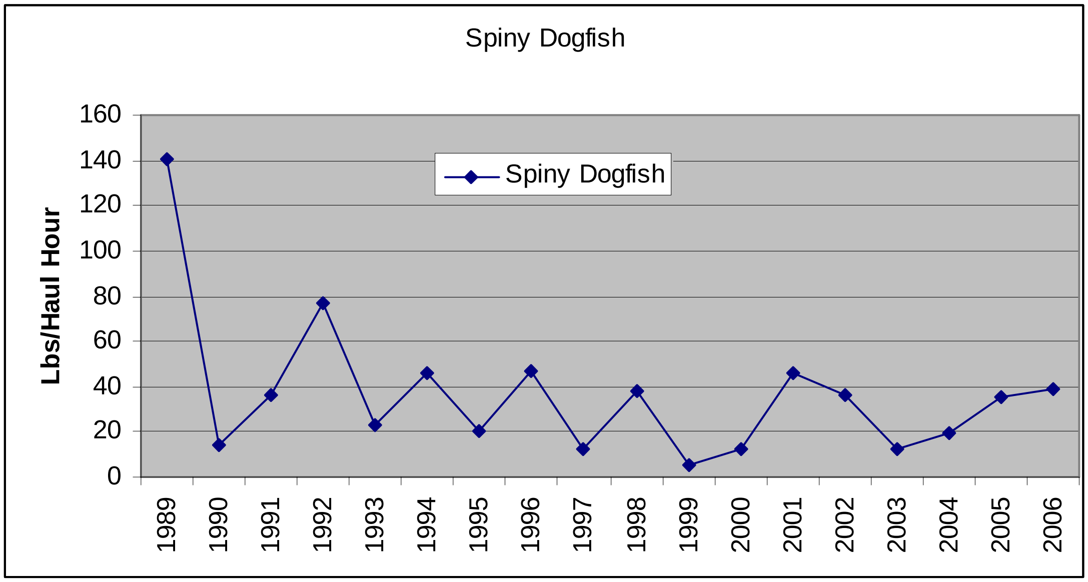


Figure 38. Red Hake catch rates 1989-2006 on directed Loligo trips (>= 50% Loligo landed) Source: Unpublished NMFS Observer program data.

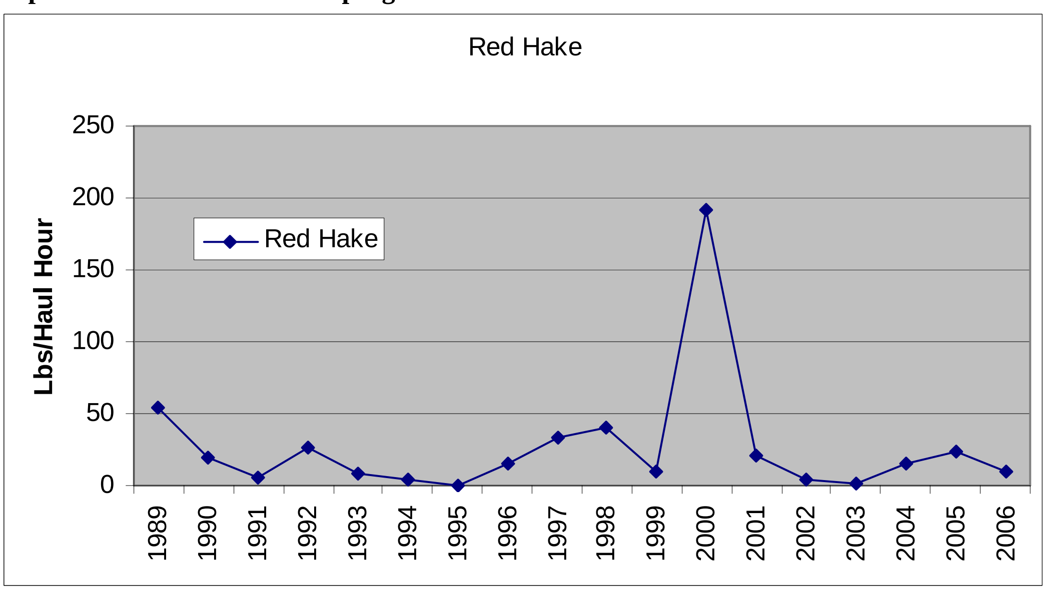


Figure 39. Scup catch rates 1989-2006 on directed Loligo trips (>= 50% Loligo landed) Source: Unpublished NMFS Observer program data.

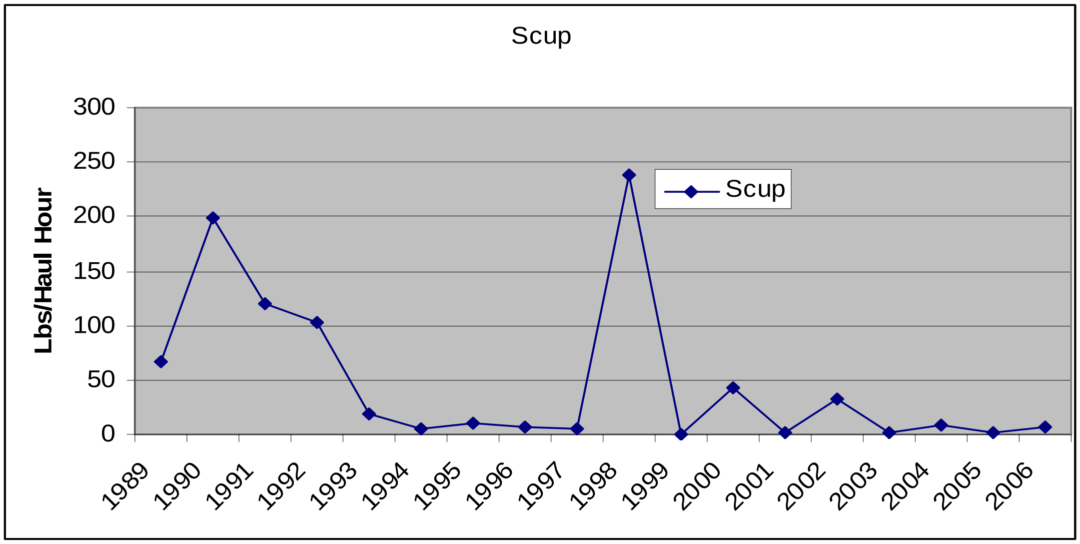


Figure 40. Little skate catch rates 1989-2006 on directed Loligo trips (>= 50% Loligo landed) Source: Unpublished NMFS Observer program data.

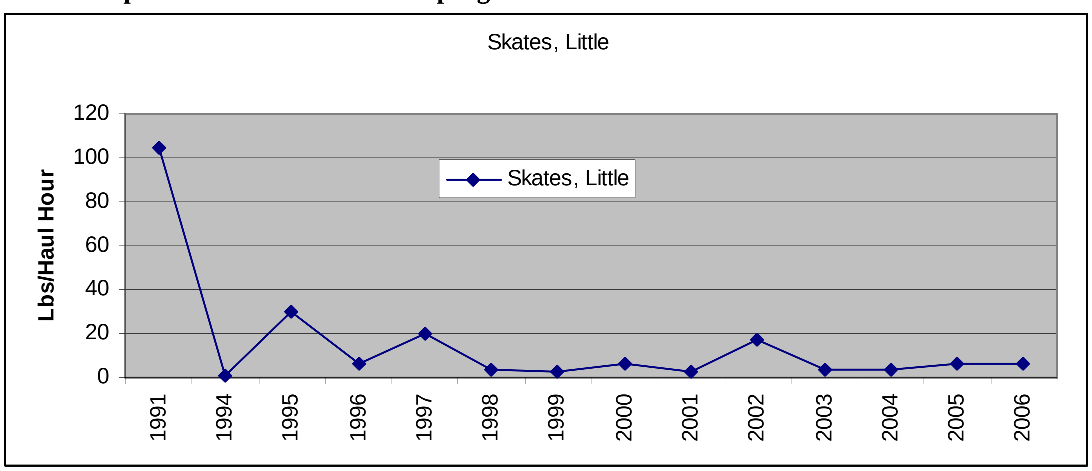


Figure 41. Angler (monkfish) catch rates 1989-2006 on directed Loligo trips (>= 50% Loligo landed) Source: Unpublished NMFS Observer program data.

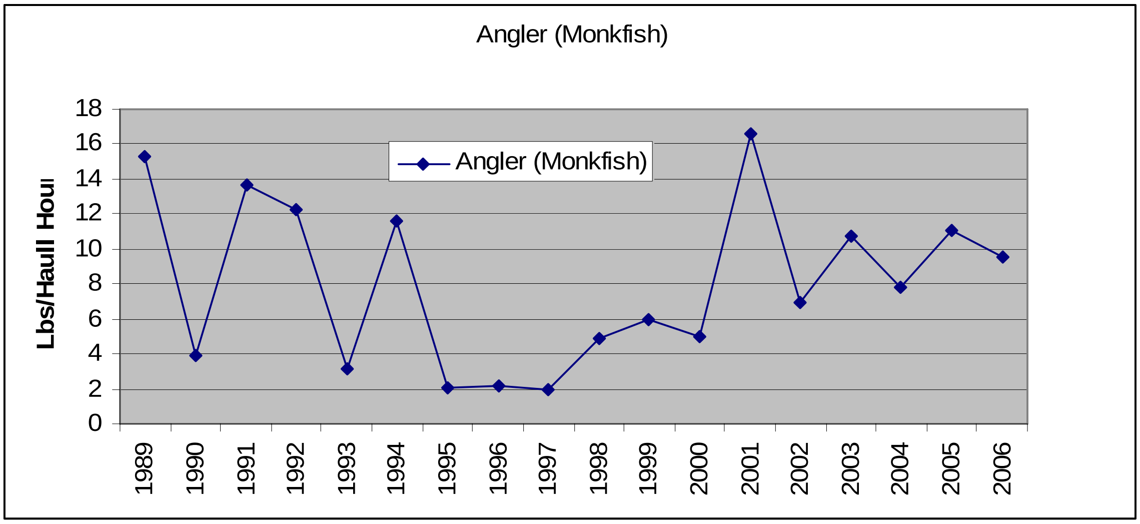
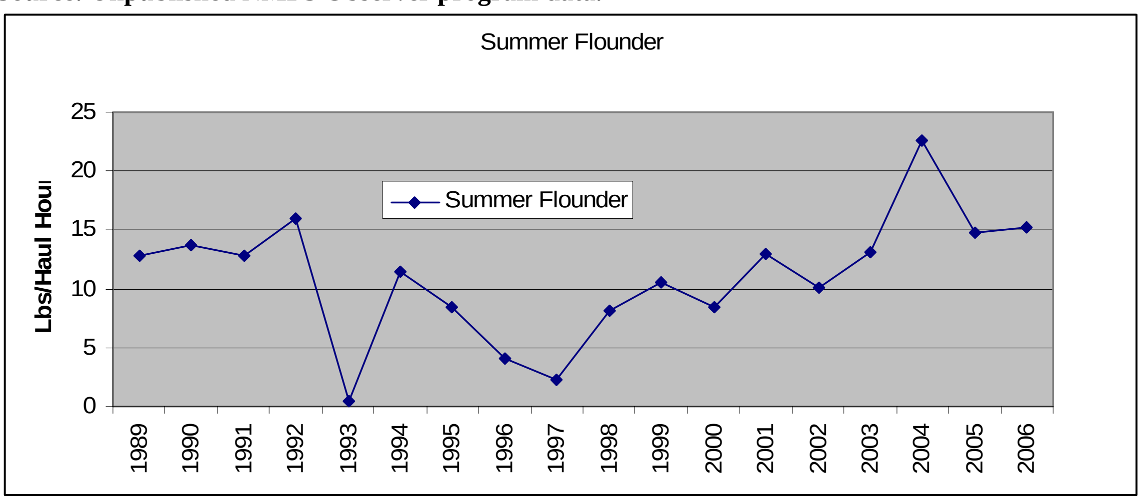


Figure 42. Summer Flounder catch rates 1989-2006 on directed Loligo trips (>= 50% Loligo landed) Source: Unpublished NMFS Observer program data.



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 9 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), "Essential Fish Habitat Source Document: Northern Shortfin Squid, *Illex illecebrosus*, Life History and Habitat Characteristics" (Hendrickson and Holmes 2004), "Essential Fish Habitat Source Document: Longfin Inshore Squid, *Loligo pealeii*, Life History and Habitat Characteristics", and "Essential Fish Habitat Source Document: Butterfish, *Peprilus triacanthus*, Life History and Habitat Characteristics" (Cross et al. 1999). 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 in Amendment 9. 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 10, 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 Passamaquoddy Bay, Maine to James River, Virginia. Generally, Atlantic mackerel eggs are collected from shore to 50 ft and temperatures between 41^{o} F and 73^{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 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 Passamaquoddy Bay, Maine to James River, Virginia. Generally, Atlantic mackerel larvae are collected in depths between 33 ft and 425 ft and temperatures between 43^{o} F and 72^{o} 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 Passamaquoddy Bay, Maine to James River, Virginia. Generally, juvenile Atlantic mackerel are collected from shore to 1050 ft and temperatures between 39^{o} F and 72^{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 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 Passamaquoddy Bay, Maine to James River, Virginia. Generally, adult Atlantic mackerel are collected from shore to 1250 ft and temperatures between 39^{o} F and 61^{o} 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^{o} F and 73^{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 *Illex* were collected in the NEFSC trawl surveys. Generally, recruited *Illex* are collected from shore to 600 ft and temperatures between 39^{o} F and 66^{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 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 were included in Amendment 9 and are available in the Description of Alternatives in section 5.4 of the FSEIS for Amendment 9. The definition based on Alternative 4b in Amendment 9 (chosen by the Council and submitted to the Secretary of Commerce for approval/disapproval), if approved, would be as follows:

Primarily coastal bottom substrates from Georges Bank southward to Cape Hatteras. *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 Passamaquoddy 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 of the FESIS for Amendment 9, 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 FSEIS Amendment 9 which was recently completed satisfied 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".

General descriptions of the primary gears used in these fisheries are provided in the EFH sections of Amendment 9, 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 were 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 nm/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 of Amendment 9, 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

Section 6.3.5 of the FESIS for Amendment 9 provides an overlap analysis which was conducted 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 was built off the evaluation of gear impacts (section 6.3.4) in Amendment 9 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 were presented in section 6.3.4 of the FSEIS for Amendment 9. Based on descriptions of habitat impacts by gear types for all four species (section 6.3.3 of Amendment 9), 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 and accounts for a small percentage of landings relative to bottom otter trawls. 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.

Based on these conclusions, bottom otter trawls were identified as the gear most likely to have adverse impacts on benthic EFH in the FSEIS for Amendment 9. Therefore trips that used bottom otter trawls were used to define the effort component used in the overlap analysis. A complete description of the overlap analysis can be found in Section 6.3.5 of Amendment 9.

6.3.5.1 Potential Adverse Fishing Impact Areas

Potential Adverse Fishing Impact Areas Identified by Overlap Analysis

Based on the overlap analysis conducted in Amendment 9, 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. There did not appear to be extensive bottom otter trawling activity in the Atlantic mackerel and *Illex* directed fisheries in these areas. 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. 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. This was also clearly shown in the composite landings as well, therefore the mouth of Hudson Canyon was 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.

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 was identified in Amendment 9. This area was 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. Amendment 9 included alternatives to close these areas. 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. Analyses presented in Amendment 9 concluded that 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.

6.4 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 and Great South Channel

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 U.S. 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.

Marine Mammal Stock Assessment Reports:

As required by the Marine Mammal Protection Act (MMPA), NMFS has incorporated earlier public comments into revisions of marine mammal stock assessment reports. These reports contain information regarding the distribution and abundance of the stock, population growth rates and trends, the stock's Potential Biological Removal level, estimates of annual human-caused mortality and serious injury from all sources, descriptions of the fisheries with which the stock interacts, and the status of the stock. The MMPA requires these assessments to be reviewed at least annually for strategic stocks and stocks for which significant new information is available, and at least once every 3 years for non-strategic stocks.

The final 2006 individual stock assessment reports, as well as regional compilations, are available at http://www.nmfs.noaa.gov/pr/sars/. The "U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments -- 2006" report is also available online at: http://www.nefsc.noaa.gov/nefsc/publications/tm/tm201/. For more information, read the Federal Register notice http://a257.g.akamaitech.net/7/257/2422/01jan20071800/edocket.access.gpo.gov/2007/pdf/E7-4956.pdf

NMFS elevated the (mid-water) SMB fishery to Category I in the 2001 LOF but it was reduced to a Category II fishery in 2007 (see discussion below describing the Atlantic Trawl Gear Take Reduction Plan). 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. The reduction in interactions documented between the SMB fisheries and several species/stocks of marine mammals compared to previous years led to the re-classification. The proposed List of Fisheries for 2008 is now available at the following internet website address: http://www.nmfs.noaa.gov/pr/interactions/lof/#lof). No changes which would affect the classification of the fisheries managed under this FMP are proposed for 2008.

Based on data presented in the 2006 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 2006 SAR average annual mortality of common dolphins was unknown, while estimates for white-sided dolphins was zero and for pilot whales was nine (Waring *et al.* 2007).

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 200-2000 m 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

The following information was taken from the latest stock assessment for common dolphin contained in Waring *et al.* (2007) which summarizes incidental mortality of this species through 2004.

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 zero between 1999-2003. 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.

Mid-Atlantic Bottom Tra**wl**

Three common dolphins were observed taken in the mid-Atlantic bottom trawl fishery in 2000, two in 2001, and nine in 2004 (Waring *et al*, 2007).

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 Jeffrey's 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

The following information was taken from the latest stock assessment for white-sided dolphin contained in Waring *et al* (2007) which summarizes incidental mortality of this species through 2004.

Illex squid

According to Waring *et al*. (2007), no white-sided dolphin takes have been observed taken incidental to *Illex* squid fishing operations since 1996.

Loligo squid

According to Waring *et al*. (2007), no white-sided dolphin takes have been observed taken incidental to *Loligo* squid fishing operations since 1996.

Atlantic mackerel

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.

Northeast Mid-water Trawl Fishery (Including Pair Trawl)

The two most commonly targeted fish in this fishery are herring (94% of VTR records) and mackerel (0.4%). The observer coverage in this fishery was highest during 2003 and 2004, although a few trips in earlier years were observed. A white-sided dolphin was observed taken in the single trawl fishery on the northern edge of Georges Bank during July 2003 in a haul targeting herring. A bycatch rate model fit to all observed mid-water trawl data (including paired and single, and Northeast and mid-Atlantic mid-water trawls, that targeted either herring or mackerel and were observed between 1999 and 2004 (NMFS unpublished data)) provided the following annual fishery-related mortality (CV in parentheses) estimates: 4.3 (0.74) in 1999, 4.5 (0.74) in 2000, 8.9 (0.74) in 2001, 14 (0.44) in 2002, 2.0 (0.74) in 2003, and 0.5 (0.5) in 2004. According to Waring *et al*. (2007), the average annual estimated fishery-related mortality during 2002-2004 was 6.0 (0.33).

Mid-Atlantic Mid-water Trawl Fishery (Including Pair Trawl)

The two most commonly targeted fish in this fishery are herring (54% of VTR records) and mackerel (26%). The observer coverage in this fishery was highest during 2000, 2003 and 2004, although a few trips in other years were observed. A white-sided dolphin was observed taken in the pair trawl fishery near Hudson Canyon (off New Jersey) during February 2004 in a haul targeting mackerel (but landing nothing). A bycatch rate model fit to all observed mid-water trawl data (including paired and single, and Northeast and mid-Atlantic mid-water trawls, which targeted either herring or mackerel and were observed between 1999 and 2004 (NMFS unpublished data)) provided the following annual fishery-related mortality (CV in parentheses) estimates: 0 (0.55) in 1999, 0 (0.55) in 2000, 0 (0.55) in 2001, 9.4 (0.55) in 2002, 73 (0.55) in 2003, and 31 (0.55) in 2004). According to Waring *et al*. 2007, the average annual estimated fishery-related mortality during 2000-2004 was 23 (0.39).

Mid-Atlantic Bottom Trawl Fishery

One white-sided dolphin incidental take was observed in 1997. Recently observer coverage for this fishery has been about 1%, except for 2004 when it was 3% (Waring *et al*. 2007).

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 U.S. 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

The following information was taken from the latest stock assessment for pilot whales contained in Waring *et al.* (2007) which summarizes incidental mortality of these species through 2004.

<u>*Illex* Squid</u>

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).

<u>*Loligo* Squid</u>

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.

<u>Atlantic Mackerel</u>

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.

Mid-Atlantic Bottom Trawl

Two pilot whales were taken in the Gulf of Maine in 2000.

Northeast Mid-Water Trawl – Including Pair Trawl

The two most commonly targeted fish in this fishery are herring (94% of VTR records) and mackerel (0.4%). Thus, the observer coverage and bycatch estimates are only for these two sub-fisheries. The observer coverage in this fishery was highest during 2003 and 2004, though a few trips in earlier years were observed. A pilot whale was observed taken in the single trawl fishery on the northern edge of Georges Bank in a haul targeting herring. Due to small sample sizes, the bycatch rate model used all observed mid-water trawl data, including paired and single, and Northeast and mid-Atlantic mid-water trawls, that targeted either herring or mackerel and were observed between 1999 and 2004 (NMFS unpublished data). The model that best fit these data was a binomial logistic regression model that included target species and bottom slope as significant explanatory variables, and soak duration as the unit of effort. Estimated annual fishery-related mortalities (CV in parentheses) were 4.6 (0.74) in 2000, 11 (0.74) in 2001, 8.9 (0.74) in 2002, 14 (0.74) in 2003, and 5.8 (0.74) in 2004 . The average annual estimated fishery-related mortality during 2002-2004 was 8.9 (0.35).

6.4.2 Atlantic Trawl Gear Take Reduction Plan

The NMFS convened an Atlantic Trawl Gear Take Reduction Team (ATGTRT) in 2006 as part of a settlement agreement with Center for Biological Diversity. The ATGTRT was convened with the goal of developing consensus recommendations to guide NMFS in creating a Take Reduction Plan (TRP). The TRP focuses on reducing serious injury and mortality (bycatch) of long-finned pilot whales (*Globicephala melas*), short-finned pilot whales (*Globicephala macrorhynchus*), white-sided dolphins (*Lagenorhynchus acutus*), and common dolphins (*Delphinus delphis*) in several trawl gear fisheries in the Atlantic Ocean. These marine mammal species are known to interact with the Mid-Atlantic Mid-water Trawl fishery, which was classified in the MMPA List of Fisheries (LOF) as a Category I fishery (i.e., one that has frequent incidental mortalities or serious injuries of marine mammals) at the time the ATGRT was convened in 2006. These marine mammal species are also known to interact with the Mid-Atlantic Bottom Trawl, Northeast Mid-water Trawl, and the Northeast Bottom Trawl fisheries, which are classified as Category II fisheries (i.e., those that have annual mortality and serious injury greater than 1 percent and less than 50 percent of the PBR level) on the MMPA LOF.

Under the framework of section 118 of the Marine Mammal Protection Act (MMPA), the ATGTRT will aim to draft a TRP that reduces bycatch of these stocks to insignificant levels approaching a zero mortality and serious injury rate (known as the Zero Mortality

Rate Goal, or ZMRG), taking into account the economics of the fishery, the availability of existing technology, and existing state or regional fishery management plans, within five years of implementation. NMFS has identified ZMRG as ten percent of the Potential Biological Removal (PBR) rate, which is defined as the maximum level of mortality (excluding natural deaths) that will not harm a particular stock. The ATGTRT is in the unique situation of designing a take reduction plan for cetacean populations that are currently below their respective PBR levels; thus, rather than working to achieve PBR within six months of implementing the TRP, the Team can focus on the five-year goal of reaching ZMRG. Another unique characteristic of the Team is that it is gear-based rather than species-based. Although white-sided dolphins were not originally included in the settlement agreement, when looking at the data, NMFS found that the bycatch rate of this species was below PBR, but above the insignificant threshold, similar to the other species addressed in the settlement agreement. NMFS decided to include white-sided dolphins in the list of stocks under the ATGTRT's purview to proactively address bycatch of this stock before it potentially exceeds PBR.

The first meeting of the ATGTRT was held on September 19-22, 2006 in Providence, RI. The team received summary information on available data relating to abundance and mortality of the four species included in the TRP. ATGTRT members asked NMFS to reevaluate the classification of the mid-water trawl fishery as a Category I fishery based on the most recent estimates of bycatch. At that meeting, NMFS noted that the tier analysis that supported the mid-water trawl fishery's elevation to Category I was based on the average takes over the most recent five year period. During this period one of the years utilized for the mid-water trawl fishery elevation included an increase in marine mammal bycatch that appeared to drive the fisheries Category I classification. Because the increase in marine mammal takes that resulted in the elevation of the mid-Atlantic mid-water trawl fishery to Category I is no longer part of the 5-year average considered in the tier-analysis, the TRT requested that NMFS re-evaluate the classification of the mid-Atlantic mid-water trawl fishery as a Category I fishery. The tier analysis requested by the ATGTRT resulted in a reclassification of the mid-water trawl fishery to Category II in the MMPA List of Fisheries (LOF) for 2007.

A second meeting of the ATGTRT was convened in Baltimore, MD on April 25-26, 2007. NMFS scientists presented new PBR data for white-sided dolphin and explained how updated abundance estimates for those species were used to determine the new PBR. Abundance estimates, and therefore also PBR, were not updated for common dolphin, and pilot whales because the data for those species was collected in 2004 and were still considered current. Updated results on bycatch estimates by species were also presented.

In addition to presenting biological and economic information updates, NMFS briefed the ATGTRT on the timeline and requirements for developing a TRP for non-strategic stocks in Category II fisheries. A NOAA General Counsel (GC) guidance memo indicated that there is no timeline within the MMPA requiring the ATGTRT to submit a draft TRP because all the fisheries affected by the ATGTRT are Category II fisheries and none of the stocks under the ATGTRP are strategic at this time. While the GC guidance memo indicated that there is no timeline contained within the MMPA requiring the TRT to submit a draft TRP, NMFS requested that the TRT move forward and make the best effort possible to meet the 11 month obligation to develop a TRP. While unable to agree on whether to develop a TRP within the 11 month timeframe, TRT members did agree that developing a research plan would maintain progress towards obtaining the ultimate goal of reducing the serious injury and mortality of marine mammals in Atlantic trawl fisheries. By the conclusion of the meeting the ATGTRT finalized a consensus research strategy to present to NMFS. The strategy stated the following:

The Atlantic Trawl Take Reduction Team (ATGTRT) recommends, by consensus, the following strategies for Atlantic Trawl Fisheries. The ATGTRT does not intend for these recommendations to be considered as a TRP for the purposes of the MMPA at this time.

Education & Outreach:

- *Operate this as an Education & Outreach Subgroup so we can include all stakeholders to inform captains/crewmen/company owners on this process.*
- *2-sided laminated placard for captains and crews to reference while at sea, that provides the following information:*
    - *Make fishermen aware of hotspots (statistical area, time, etc. . .) where observers have seen elevated interaction with marine mammals – so they can be informed of voluntary measures (i.e. reduce the number of turns and tow times while fishing at night). The Subgroup should determine whether this is applicable for bottom trawl operations.*
    - *Encourage recording and reporting of sighting of marine mammals and behavior in and around fishing operations. Hopefully these data can eventually move beyond the level of anecdotal information to become part of assessment processes.*

NMFS Assistance:

- *Develop species identification placard.*
- *Clarify takes between pair- and single- mid-water trawls and various bottom trawl fisheries.*
- *Resolve white-sided dolphin assessment uncertainty – why is there so much variation in the white-sided dolphin abundance estimates and determine stock structure?*
- *Elucidate fishery characteristics (i.e. revenue valuation, trawl and trip volumes, etc. . .) of trawl fisheries. Document the social and economic value of the trawl fisheries before mitigation.*
- *Observer program to clarify kite v. transducer panel in the pair-trawl fishery. Additional investigation is needed on whether there are kites in the pair trawl fishery (observer confusion? Given different names by captains?). Why do the pair trawls labeled this way have higher bycatch rates?*
- *Update Pilot Whale abundance estimates with 2006 survey data. Determine if this is applicable to other stocks.*
- *Generate maps from Maine to the North Carolina/South Carolina border that encompass all of the closures and gear modification areas affecting these trawl fisheries (MMPA, National Marine & Horseshoe Crab Sanctuaries, Magnuson, etc).*

- *Convene Industry/NMFS workshop to help differentiate the various bottom trawl fisheries in New England and the Mid-Atlantic, based on fishing practices.*
- *Add info on kites to bottom trawl observer logs.*
- *Provide more observer coverage in the Mid-Atlantic.*
- *For mid-water trawl, between 38 – 39 lat, more observer coverage is needed to see if the elevated bycatch rate there really exists or is just due to very low coverage.*
- *More observer coverage is needed in 622 and 627 for bottom trawls, to see what is going on there.*

Research & Gear Mitigation

- *Operate this as a Research & Gear Mitigation Subgroup so we can include all stakeholders.*
- *Convene Industry Workshop to build on the 2006 workshop in Atlantic City, NJ which reviewed the characteristics of trawl fisheries with takes, and early field research.*
- *Phased Research Plan:*
    - *Step 1*
        - *Industry video of normal trawl operations.*
        - *Industry video and sonar of mammals interacting with gear (in consultation with NEFSC, SEFSC – Pascagoula Lab, industry consultants, etc).*
    - *Step 2*
        - *Field experimentation with various excluder devices and other gear modifications (w/ NEFSC, SEFSC – Pascagoula Lab, industry consultants, etc. . .).*
        - *Observations of fishing practice modifications.*
    - *Step 3*
        - *Industry and partners bring results of research to Research & Gear Mitigation Subgroup to discuss the information and how to move forward.*

Caveats and needs that apply to the Research & Gear Mitigation component of the Strategy:

- *Funding for video equipment, vessel use, lost revenues*
- *Marine mammal takes occurring in NMFS-sanctioned experiments not be extrapolated into the fishery. [NMFS will investigate various options against takes counting for PBR.]*
- *NMFS reviews videos and provides confidentiality protection for video materials.*
- *Expeditiously process necessary permits.*
- *No loss of days at sea for vessel participation.*

Other Research Recommendations

- *Additional information is needed on the annual distribution of these marine mammals. General research on seasonal overlap of the mammals and the fisheries will be helpful.*
- *NMFS work expeditiously to differentiate pilot whales and takes by species.*
- *Why is there a correlation between vessel horsepower and vessel bycatch? NMFS can analyze the data they have to see why vessel horsepower is important (size of boat, speed, size of net, noise, etc). It would also be good to brainstorm with industry to get their thoughts on this.*

Review observer data to look for correlations in regards to marine mammal takes, diet and discards.

Additional background information on the ATGTRP, including complete meeting summaries, is available at the following website: http://www.nero.noaa.gov/prot_res/atgtrp/index.html.

6.4.3 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 reduces the likelihood for one or more of these nesting populations to survive and recover in the wild would reduce the species' likelihood of survival and recovery.

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 off the coast of New Jersey 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. No leatherback turtles have been observed in the SMB fisheries since the 2001 observation described above ((based on unpublished NMFS unpublished at-sea observer data through February 2007). An estimate of total bycatch of this species is not available as the rate of interaction is low.

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. In addition, there been no loggerhead turtles observed to be captured in the *Illex* fishery since the 1995 observation (based on unpublished NMFS unpublished at-sea observer data through February 2007).

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. Five turtles (one loggerhead and four unknown) were taken by the *Loligo* fishery off New Jersey and Rhode Island during September and October 2002. 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 attributable to the *Loligo* fishery. In addition, there have been no loggerhead turtles observed to be captured in the *Loligo* fishery since the 2004 observation (based on unpublished NMFS unpublished at-sea observer data through February 2007). An estimate of total bycatch of this species is not available as the rate of interaction is low.

6.5 HUMAN COMMUNITIES

Overview of SMB Fishing

Amendment 9 contained extensive narrative based on interviews with SMB fishermen in order to give some perspective on the lives and day to day operations involved in making a living from the harvest of the managed resources. Information in the following two paragraphs was compiled from interviews carried out in June, 2005 with MAFMC advisors: James Ruhle, Lars Axelson, and Geir Monsen. A more formal description of the Ports and Communities and Economic Environment is provided in subsequent sections (6.5.1 and 6.5.2, respectively).

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 size classes: 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 refrigerated 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.

6.5.1 Key Ports and Communities

Ten locations landing more that $500,000 annually in SMB species were identified as key ports or communities prosecuting the *Loligo, Illex,* Atlantic mackerel, and butterfish fisheries (Figure 43). These key ports and communities were selected based on NMFS landings data from 2004-2006 (Table 16).

Figure 43. Key ports and communities for the Atlantic mackerel, squid, and butterfish fisheries based on NMFS landings data from 2004-2006.

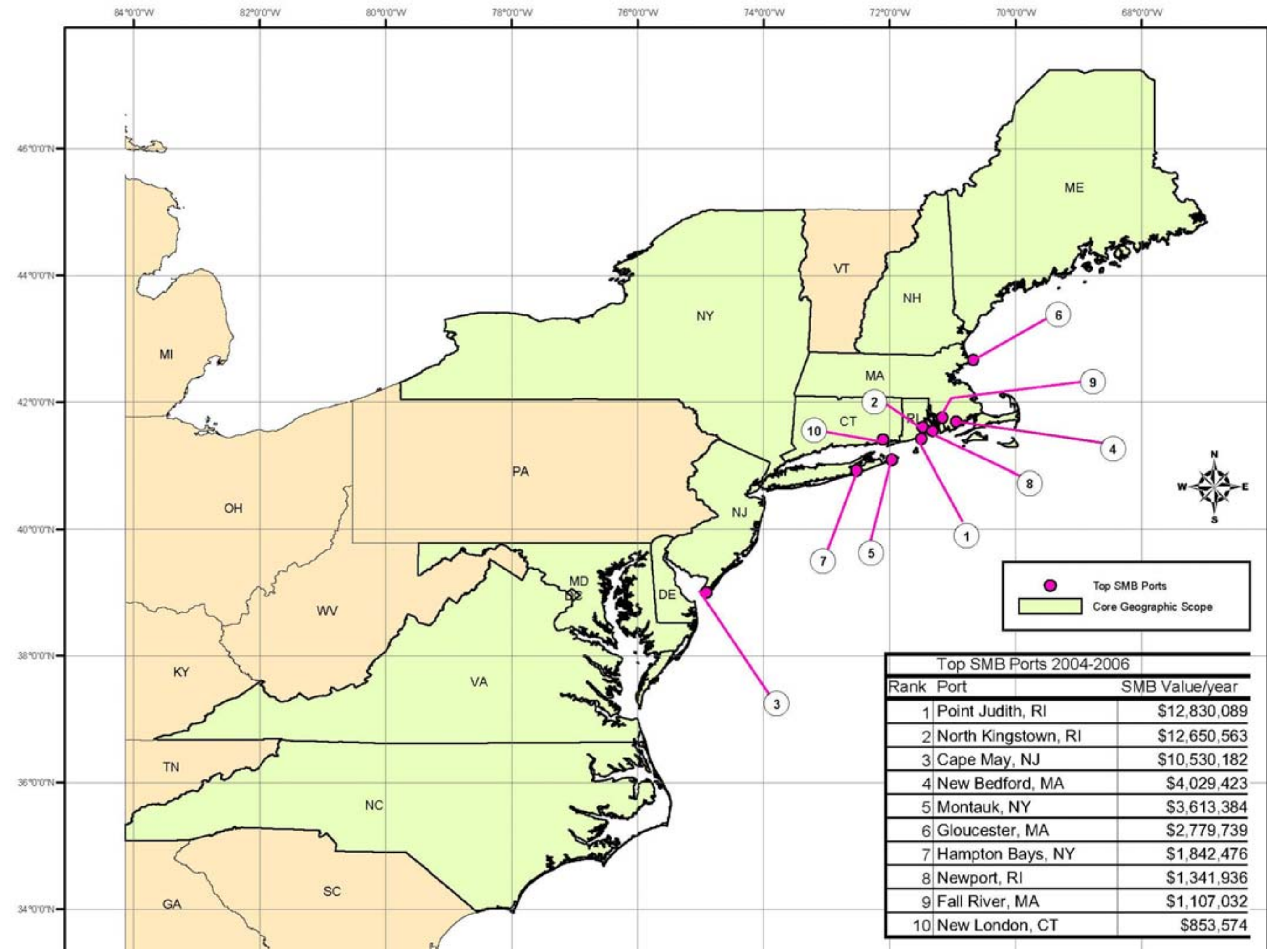


Table 16. Ranking of total landings value, SMB landings value, and relative SMB value (SMB value/total value) for major[1] SMB fishing ports

Port	State	Total Landings Value Per Year	SMB Landings Value Per Year	Percent of Total Landings from SMB	Rank: SMB Value/year	Rank: Percent of Total Landings from SMB
POINT JUDITH	RI	40,422,523	12,830,089	32%	1	2
NORTH KINGSTOWN	RI	14,341,172	12,650,563	88%	2	1
CAPE MAY	NJ	55,730,322	10,530,182	19%	3	5
NEW BEDFORD	MA	256,667,961	4,029,423	2%	4	10
MONTAUK	NY	15,443,799	3,613,384	23%	5	4
GLOUCESTER	MA	45,371,919	2,779,739	6%	6	9
HAMPTON BAYS	NY	7,045,714	1,842,476	26%	7	3
NEWPORT	RI	14,573,477	1,341,936	9%	8	8
FALL RIVER	MA	6,356,176	1,107,032	17%	9	6
NEW LONDON	CT	5,410,648	853,574	16%	10	7

Source: Unpublished NMFS NE Dealer weigh-out data.

[1] Major SMB fishing ports are defined as those ports where the value of SMB landings was at least $500,000 per year over 2004-2006.

The ten key ports and communities with the largest squid, Atlantic mackerel, butterfish values (SMB Value) were identified by averaging NMFS dealer weighout data from 2004-2006. While a port that generally lands significant quantities of any SMB species is likely to be impacted by regulations for any SMB fishery, the effects will likely depend on which specific SMB species are landed. Table 17-Table 20 list the top ports for each species. Cut-offs were based on average annual landings by value over 2004-2006. Cut-offs for each species were as follows: butterfish - $25,000; *Illex* - $100,000; *Loligo* and mackerel - $250,000. A CI means that there were less than 3 vessels or dealers at a given port so the information can not be disclosed because it is proprietary **C**onfidential **I**nformation (CI).

Table 17. Top mackerel ports ranked by 2004-2006 average landings value.

Port	State	Total Landings Value Per Year ($)	Mackerel Landings Value Per Year ($)	Percent of Total Value of Landings from Mackerel	Rank: Mackerel Value/year	Rank: Percent of Total Landings from Mackerel
CAPE MAY	NJ	55,730,322	5,513,192	10%	1	3
NORTH KINGSTOWN	RI	14,341,172	CI	CI	2	1
NEW BEDFORD	MA	256,667,961	2,968,449	1%	3	5
GLOUCESTER	MA	45,371,919	2,776,377	6%	4	4
FALL RIVER	MA	6,356,176	1,104,299	17%	5	2
POINT JUDITH	RI	40,422,523	257,547	1%	6	6

Table 18. Top *Illex* ports ranked by 2004-2006 average landings value.

Port	State	Total Landings Value Per Year ($)	Illex Landings Value Per Year ($)	Percent of Total Value of Landings from Illex	Rank: Illex Value/year	Rank: Percent of Total Landings from Illex
NORTH KINGSTOWN	RI	14,341,172	CI	CI	1	CI
CAPE MAY	NJ	55,730,322	3,400,054	6%	2	CI
POINT JUDITH	RI	40,422,523	664,846	2%	3	CI
WANCHESE	NC	13,288,201	CI	CI	4	CI
HAMPTON	VA	19,331,867	221,136	1%	5	CI

Table 19. Top *Loligo* ports ranked by 2004-2006 average landings value.

Port	State	Total Landings Value Per Year ($)	Loligo Landings Value Per Year ($)	Percent of Total Value of Landings from Loligo	Rank: Loligo Value/year	Rank: Percent of Total Landings from Loligo
POINT JUDITH	RI	40,422,523	11,696,638	29%	1	2
MONTAUK	NY	15,443,799	3,406,219	22%	2	4
HAMPTON BAYS	NY	7,045,714	1,791,169	25%	3	3
CAPE MAY	NJ	55,730,322	1,596,670	3%	4	7
NEWPORT	RI	14,573,477	1,229,008	8%	5	6
NEW BEDFORD	MA	256,667,961	1,043,569	0%	6	9
NEW LONDON	CT	5,410,648	CI	CI	7	5
PT. PLEASANT	NJ	21,169,837	387,323	2%	8	8
POINT LOOKOUT	NY	778,749	308,852	40%	9	1
NORTH KINGSTOWN	RI	14,341,172	CI	CI	CI	CI

(North Kingstown is one of the top ten but the order can not be given.)

Table 20. Top butterfish ports ranked by 2004-2006 average landings value.

Port	State	Total Landings Value Per Year	Butterfish Landings Value Per Year	Percent of Total Landings from Butterfish	Rank: Butterfish Value/year	Rank: Percent of Total Landings from Butterfish
POINT JUDITH	RI	40,422,523	211,059	1%	1	5
MONTAUK	NY	15,443,799	168,752	1%	2	3
NEW LONDON	CT	5,410,648	CI	CI	3	CI
AMMAGANSETT	NY	485,115	40,823	8%	4	1
GREENPORT	NY	763,444	38,979	5%	5	2
HAMPTON BAYS	NY	7,045,714	35,822	1%	6	6
NEWPORT	RI	14,573,477	25,795	0%	7	7

NMFS has been working on a project to describe all major ports, and NMFS staff provided drafts of their port descriptions for this amendment to describe the top ten SMB ports, in order of their average annual SMB landings value.

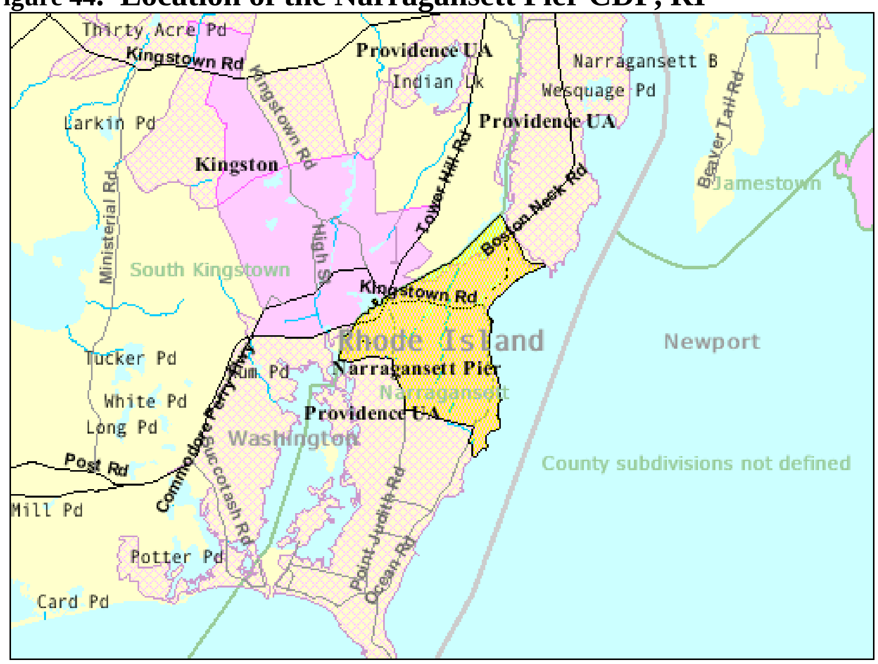
1. POINT JUDITH

2004-2006 Average Landings Value per Year = $ 40.4 mil
2004-2006 Average SMB Landings Value Per Year = $ 12.8 mil
Percent of Total Landings Value from SMB = 32%

Regional orientation

Narragansett (41.45°N, 71.45°W) is located in Washington County, 30 miles south of Providence. 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, within the Census Designated Place (CDP) of Narragansett Pier. Point Judith itself is not a CDP or incorporated town, and as such has no census data associated with it. Thus, this profile provides census data from Narragansett Pier CDP and other data from both Point Judith itself and Narragansett.

Figure 44. Location of the Narragansett Pier CDP, RI



Historical/Background

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. By the 1930's wharves were constructed to facilitate large ocean-going fishing vessels. At this point the port became important to the entire region's economy. Today, Point Judith is not only an active commercial fishing port, but it supports a thriving tourism industry that includes restaurants, shops, whale watching, recreational fishing, and a ferry to Block Island.

Involvement in Northeast Fisheries

Commercial

The number of commercial vessels in port in 2003 was 224. Vessels ranged from 45-99 feet, with most being groundfish trawlers. Of these, 55 were between 45 and 75 feet, and 17 over 75 feet. In 2001, Point Judith was ranked 16th in value of landings by port (fourth on the East Coast).

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 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.

Over the ten year period from 1997-2006, the value of landings in Point Judith varied but seemed to show a declining trend between 1997-2006, from a high of just over $51 million to a low of $31 million in 2002-2003. However, in 2004 the landings value began to increase again, back to just under $47 million in 2006. The landings value for the squid, mackerel, and butterfish species grouping was higher in 2006 than the average value for 1997-2006 (see Table 21). The value of lobster in 2006, second most valuable in terms of landings, was lower in 2006 than the average value for the same time period. In general, the number of vessels home ported in Point Judith (see Table 23), far exceeded the number of vessels listed in this category for Narragansett (see Table 22). However, there are no vessel owners listed for Point Judith (because the name refers only to the port), indicating that many fishermen live in the Narragansett area and fish out of Point Judith.

Landings by Species

Table 21. Value ($) of federally managed groups of landings in Point Judith, RI.

	Average from 1997-2006	2006 only
Squid, Mackerel, Butterfish	11,298,781	13,188,211
Lobster	11,022,301	8,675,086
Summer Flounder, Scup, Black Sea Bass	4,718,136	6,495,568
Smallmesh Groundfish	2,816,677	1,799,479
Monkfish	2,687,563	2,110,227
Largemesh Groundfish	2,451,647	3,383,452
Other	2,056,576	2,697,425
Scallop	1,457,702	7,420,396
Skate	618,033	604,990
Herring	470,065	376,506
Tilefish	230,142	32,985
Bluefish	112,378	118,466
Dogfish	48,031	45,000
Red Crab	9,593	0

Vessels by Year

Table 22. Vessels and All columns represent vessel permits or landings value between 1997 and 2006 (for Narragansett)

Year	# Vessels (home ported)	# Vessels (owner's city)	Level of fishing home port ($)	Level of fishing landed port ($)
1997	21	61	5,629,991	0
1998	25	55	5,926,038	0
1999	27	60	7,650,042	0
2000	32	61	7,902,294	0
2001	30	62	6,194,920	0
2002	29	53	7,935,212	0
2003	30	52	9,218,945	0
2004	32	51	8,987,817	0
2005	29	52	7,633,761	0
2006	22	51	6,448,654	0

Table 23. All columns represent vessel permits or landings value between 1997 and 2006 (for Point Judith)

Year	# Vessels (home ported)	# Vessels (owner's city)	Level of fishing home port ($)	Level of fishing landed port ($)
1997	160	0	27,391,809	47,529,746
1998	150	0	26,944,185	42,614,251
1999	154	0	28,674,140	51,144,479
2000	152	0	26,009,364	41,399,853
2001	156	0	23,926,615	33,550,542
2002	150	0	22,079,497	31,341,472
2003	143	0	23,574,480	31,171,867
2004	142	0	28,070,205	36,016,307
2005	142	0	29,516,480	38,259,922
2006	146	0	34,572,493	46,947,791

(Note: # Vessels home ported = No. of permitted vessels with location as homeport
 # Vessels (owner's city) = No. of permitted vessels with location as owner residence
Level of fishing home port ($) = Landed value of fisheries associated with home ported vessels
Level of fishing landed port ($) = Landed value of fisheries landed in location)

Recreational

Rhode Island marine waters also support a sizable recreational fishing sector. While complete data on this component is lacking, it is estimated that in the year 2000, some 300,000 saltwater anglers, most from out-of-state, made 1 million fishing trips. This indicates that the recreational component is significant both in terms of the associated revenues generated (support industries) and harvesting capacity. Between 2001- 2005, there were 66 charter and party vessels making 7,709 total trips registered in logbook data by charter and party vessels in Point Judith carrying a total of 96,383 anglers (MRFSS data). A 2005 survey by the RI Dept. of Environmental Management showed Point Judith to be the most popular site in the state for shore based recreational fishing.

Future

Point Judith fishermen are not very positive about the future of Point Judith as a fishing port. Besides the main concern of stringent fishing regulations Point Judith fishermen also must contend with the ever increasing tourism at the port. This has caused parking issues and rent increases.

Oceanlinx Limited (formerly Energetech Australia) is a wave power company working on a pilot project to build and install a wave power plant off Point Judith. Called “Project GreenWave”, the effort is a non-profit pilot, with funding from Massachusetts, Rhode Island and Connecticut and would become the first wave power installation in the U.S. if successful. As the effort is a first, there has been confusion over whether the regulatory jurisdiction is state or federal, which has slowed the projects commencement. “The station would be located just outside the Point Judith breakwater and about a mile offshore. Care is being taken not to disrupt commercial ship traffic or recreational boaters. The station will be designed to: withstand ‘100 year storm criteria’, be easily towed to port, make 100 times less noise than an outboard motor; and have only one moving part — the turbine.”

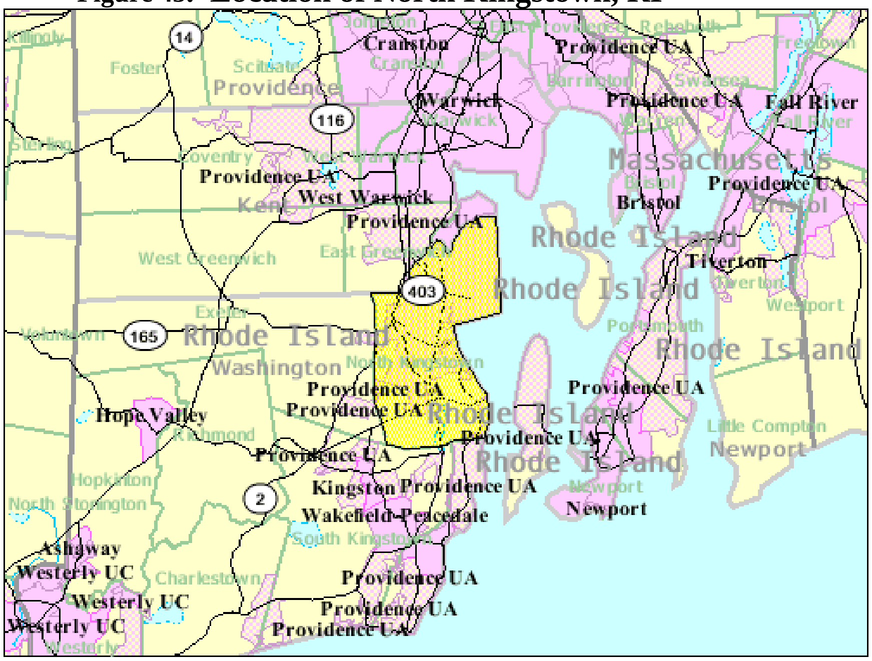
2. NORTH KINGSTOWN

2004-2006 Average Landings Value per Year = $ 14.3 mil
2004-2006 Average SMB Landings Value Per Year = $ 12.7 mil
Percent of Total Landings Value from SMB = 88%

Regional orientation

North Kingstown (41.55°N, 71.46°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, 23 miles from Providence, 73 miles from Boston, MA, and 170 miles from New York City. The town is sometimes referred to as North 'Kingston'.

Figure 45. Location of North Kingstown, RI



Historical/Background

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 known as Rhode Island's sea town. Kings Towne was incorporated in 1674, and included what is now known as Narragansett County. North Kingstown and South Kingstown were the same town until they split in 1723. World War II dramatically changed the economy of North Kingstown. Quonset Naval Air Station and the Davisville Construction Training Center were built in an area north of Wickford village and used as a site to protect the Northeast coast during the war. Today, North Kingstown has strong economic growth potential due to a deep-water port, rail lines, the state's longest runway, and its natural harbor and beaches which make it famous as a summer resort.

Involvement in Northeast Fisheries

Commercial

North Kingstown's highest landed values for 1997-2006 were from the squid, mackerel, and butterfish species grouping, followed by "other" species and herring (see Table 24). In 2006, the value of landings for squid, mackerel, and butterfish was much higher than the ten-year average values, while the landings values of "other" species and herring had declined. North Kingstown has a diverse fishery with landings from a wide variety of species groupings. The number of vessels whose home port was North Kingstown was significantly lower than the number of vessels whose owner's city was North Kingstown over the 1997-2006 time period. While home port vessel numbers ranged from 2-3, the owner's city vessels ranged from 15-23 (see Table 25). A number of home ported vessels were also listed for Davisville, a village located within the town of North Kingstown (see Table 26).

Landings by Species

Table 24. Rank Value of Landings for Federally Managed Groups*

Species	Rank Value of Average Landings from 1997-2006
Squid, Mackerel, Butterfish	1
Other	2
Herring	3
Lobster	4
Summer Flounder, Scup, Black Sea Bass	5
Monkfish	6
Largemesh Groundfish	7
Smallmesh Groundfish	8
Bluefish	9
Surf Clams, Ocean Quahog	10
Skate	11
Scallop	12
Tilefish	13
Dogfish	14

***Due to dealer confidentiality, exact dollar values cannot be supplied. Thus, only rankings are given.**

Vessels by Year

Table 25. Federal Vessel Permits Between 1997-2006 in North Kingstown

Year	# Vessels (home ported)	# Vessels (owner's city)
1997	3	23
1998	2	20
1999	3	21
2000	3	23
2001	2	21
2002	2	22
2003	2	20
2004	3	18
2005	3	15
2006	3	15

Table 26. Federal Vessel Permits Between 1997-2006 in Davisville

Year	# Vessels (home ported)	# Vessels (owner's city)
1997	2	0
1998	6	1
1999	7	1
2000	7	1
2001	4	1
2002	3	1
2003	3	1
2004	3	1
2005	3	1
2006	3	1

(Note: # Vessels home ported = No. of permitted vessels with location as homeport,
 # Vessels (owner's city) = No. of permitted vessels with location as owner residence)

Recreational

Narragansett Bay attracts a variety of recreational fishermen. These fishermen target many species, but primarily quahogs and bluefish. Rhode Island recreational anglers spent $138,737,000 in 1998.

Future

The 2001 Town of North Kingstown Comprehensive Plan 5-Year Update (2006 update not yet available) notes that in a 1999 survey, North Kingstown residents were asked what type of additional economic development they prefer. The top four responses were: industrial development within Quonset Point Davisville 86.3%; aquaculture 78.8%; tourism-based industry 77.3% ; and commercial fishing 64.8%. Thus the Plan’s objectives include: improved water quality for recreational and commercial fishing activities, and boating; improvement of the Jamestown Bridge fishing pier; and maintenance of fishing-related trades at the Quonset Point/Davisville Pier.

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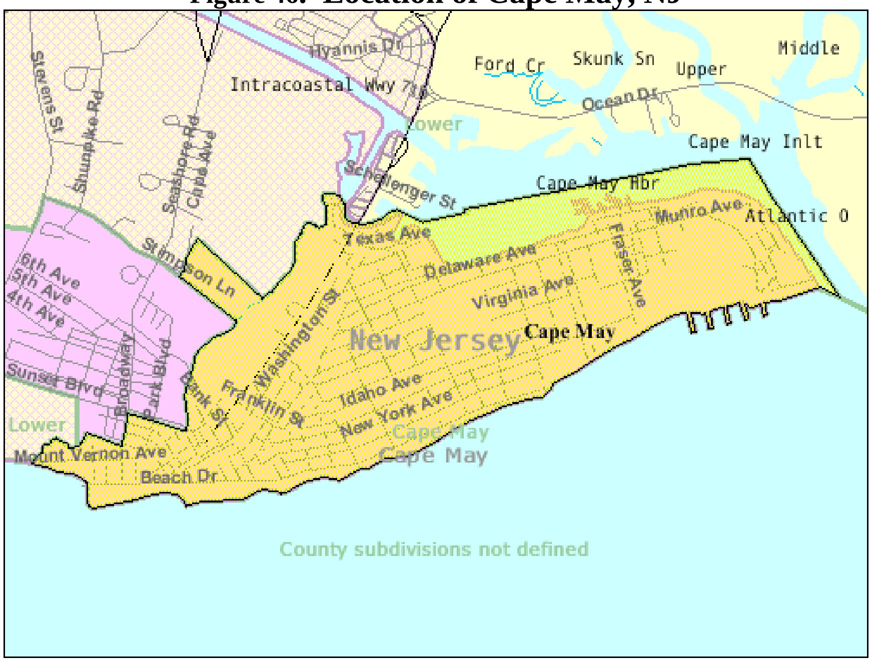
3. CAPE MAY

2004-2006 Average Landings Value per Year = $ 55.7 mil
2004-2006 Average SMB Landings Value Per Year = $ 10.5 mil
Percent of Total Landings Value from SMB = 19%

Regional orientation

The city of Cape May, New Jersey (38.94°N, 74.91°W), is located in Cape May County. It is at the southern tip of the state of New Jersey on Cape Island at the end of Cape May Peninsula, with the Atlantic Ocean to the east and Delaware Bay to the west.

Figure 46. Location of Cape May, NJ



Historical/Background

Cape May is part of Cape Island at the southern tip of Cape May Peninsula. The island was artificially created in 1942 when the U.S. Army Corps of Engineers dredged a canal that passes through to the Delaware Bay. Fishing and farming have been important in this area since its beginnings, and whaling, introduced by the Dutch, was a significant industry in Cape May for roughly a century beginning in the mid-1600s. In the 18th century, this area became a summer resort for wealthy residents of Philadelphia wishing to escape the crowded city during the summer months, and is known as "America's oldest seaside resort". Because of this history and because of a fire that destroyed much of the city in 1878, Cape May has numerous Victorian homes and hotels, and was declared a National Historic Landmark City in 1976. "Today commercial fishing is still the backbone of the county and is the second largest industry in Cape May County.

Involvement in Northeast Fisheries
Commercial

The combined port of Cape May/Wildwood is the largest commercial fishing port in New Jersey and is one of the largest on the East Coast. Cape May/Wildwood is the center of fish processing and freezing in New Jersey. Some of the largest vessels fishing on the East Coast are home ported here. Cape May fishing vessels have frequently been responsible for developing new fisheries and new domestic and international markets. The targeted species are diverse; fisheries focus on squid, mackerel, fluke, sea bass, porgies, lobsters and menhaden. Some of the boats out of Wildwood are also targeting surf clams and ocean quahogs.

F.H. Snow's Canning Co./Doxsee is a large clam cannery based in Cape May, and the only domestic manufacturer to harvest its own clams. Snow's/Doxsee possesses the nation's largest allocation for fishing and harvesting ocean clams. Established in 1954 in Cape May, Lund's Fisheries, Inc. is a freezer plant and a primary producer of various species of fish found along the Eastern Seaboard of the USA. It is also a member of the Garden State Seafood Association. There are also two other exporters of seafood in Cape May, the Atlantic Cape Fisheries Inc. exporting marine fish and shellfish, oysters, scallops, clams and squids, and the Axelsson and Johnson Fish Company Inc. exporting shad, marine fish, conch, American lobster, lobster tails, scallops and whole squid.

The top species landed in Cape May in 2006 were scallops (over $23 million), squid, mackerel, butterfish (over $12 million) and summer flounder, scup, and black sea bass (over $1.9 million) (see Table 27). Between 1997 and 2006 home ported vessels increased from 109 to 184 while the number of vessels whose owner's city was Cape May also increased from 73 to 88 vessels. Additionally, home port value and landed port value also steadily increased over the same time period, with the exception of a decline in the later category in 2006 (see Table 28).

Landings by Species

Table 27. Dollar value of Federally Managed Groups of landings for Cape May

	Average from 1997-2006	**2006 only**
Scallop	22,263,937	23,677,160
Squid, Mackerel, Butterfish	7,584,550	12,375,958
Summer Flounder, Scup, Black Sea Bass	2,044,420	1,979,899
Other	1,696,617	1,637,321
Surf Clams, Ocean Quahog	588,296	0
Lobster	420,312	8,861
Herring	412,103	2,896,122
Monkfish	322,895	397,841
Red Crab	40,358	0
Smallmesh Groundfish	23,939	2,997
Bluefish	20,626	4,267
Skate	12,299	4,387
Largemesh Groundfish	8,067	3,705
Dogfish	6,574	0
Tilefish	597	1,230

Vessels by Year

Table 28. All columns represent vessel permits or landings value combined between 1997-2006

Year	# Vessels (home ported)	# Vessels (owner's city)	Level of fishing home port ($)	Level of fishing landed port ($)
1997	109	73	27,687,667	23,636,983
1998	105	68	27,614,763	25,770,007
1999	106	72	29,153,706	22,353,284
2000	116	74	30,488,271	23,936,235
2001	116	71	32,923,798	27,155,864
2002	118	72	34,529,920	28,312,296
2003	129	78	42,777,501	36,372,658
2004	135	73	62,308,441	60,630,752
2005	155	82	69,641,897	63,298,068
2006	184	88	75,058,370	42,989,748

 # Vessels home ported = No. of permitted vessels with location as homeport
 # Vessels (owner's city) = No. of permitted vessels with location as owner residence
Level of fishing home port ($) = Landed value of fisheries associated with home ported vessels
Level of fishing landed port ($) = Landed value of fisheries landed in location

Recreational

The Cape May County Party and Charter Boat Association lists several dozen charter and party vessels based out of the City of Cape May. There are 35 vessels listed carrying 1-6 passengers, six vessels which can carry more than six passengers, and three party boats. The Miss Chris fleet of party boats makes both full- and half-day trips, targeting largely fluke and stripers for most of the year. The Porgy IV, another party boat, targets sea bass, blackfish, and flounder. Many of the charter boats go offshore canyon fishing. Between 2001- 2005, there were 56 charter and party vessels making 6,599 total trips registered in NMFS logbook data by charter and party vessels in Cape May, carrying a total of 116,917 anglers (NMFS VTR data). There are several fishing tournaments held throughout the year sponsored by the Cape May Tuna and Marlin Club.

Future

Information on planned future activities in Cape May has not yet been compiled.

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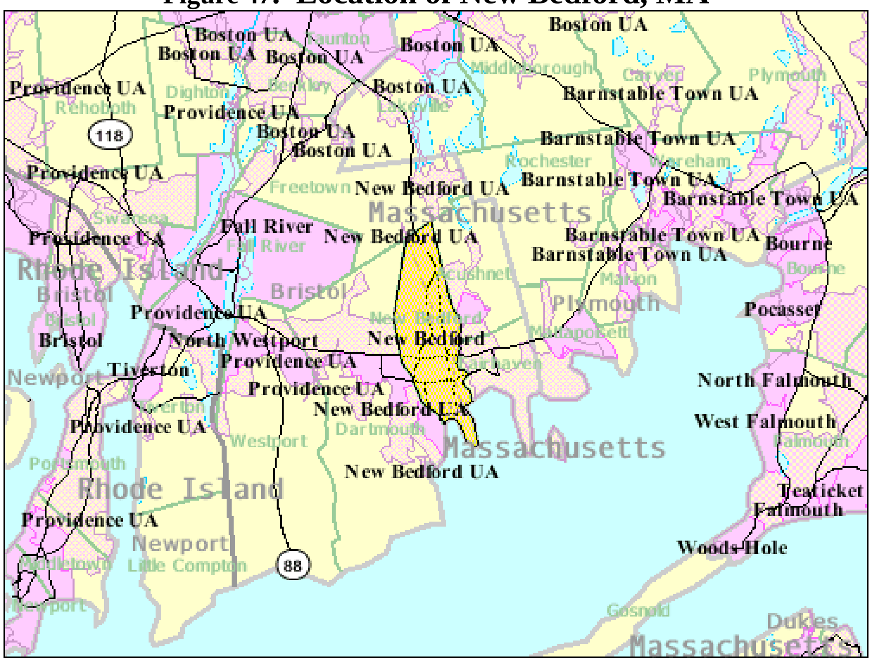
4. NEW BEDFORD

2004-2006 Average Landings Value per Year = $ 256.7 mil
2004-2006 Average SMB Landings Value Per Year = $ 4.0 mil
Percent of Total Landings Value from SMB = 2%

Regional orientation

New Bedford is the fourth largest city in the commonwealth of Massachusetts. It is situated on Buzzards Bay, located in the southeastern section of the state in Bristol County. New Bedford is bordered by Dartmouth on the west, Freetown on the north, Acushnet on the east, and Buzzards Bay on the south. The city is 54 miles south of Boston, and has a total area of 24 mi², of which about 4 mi² (16.2%) is water.

Figure 47. Location of New Bedford, MA



Historical/Background

New Bedford, originally part of Dartmouth, was settled by Plymouth colonists in 1652. Fishermen established a community in 1760 and developed it into a small whaling port and shipbuilding center within five years. By the early 1800s, New Bedford had become one of the world's leading whaling ports. Over one half of the U.S. whaling fleet, which totaled more than 700 vessels, was registered in New Bedford by the mid 1800s. However, the discovery of petroleum greatly decreased the demand for sperm oil, bringing economic devastation to New Bedford and all other whaling ports in New England. The last whale ship sailed out of New Bedford in 1925. In attempts to diversify its economy, the town manufactured textiles until the southeast cotton boom in the 1920s. Since then, New Bedford has continued to diversify, but the city is still a major commercial fishing port. It consistently ranks in the top two ports in the U.S. for landed value.

Involvement in Northeast Fisheries
Commercial

In the 1980s, fishermen experienced high landings and bought new boats due to a booming fishing industry. In the 1990s, however, due to exhausted fish stocks, the fishing industry experienced a dramatic decrease in groundfish catches and a subsequent vessel buyback program, and strict federal regulations in attempts to rebuild the depleted fish stocks. A new decade brought more changes for the fishing industry. By 2000 and 2001 New Bedford was the highest value port in the U.S. (generating $150.5 million in dockside revenue).

The range of species landed in New Bedford is quite diverse and can be separated by State (see Table 29) and Federal (see Table 30) permits. According to State permits, the largest landings were of cod, haddock, and lobster, and with impressive representation by a number of different species. According to the federal commercial landings data, New Bedford's most successful fishery in the past ten years has been scallops, followed by groundfish. Scallops were worth significantly more in 2006 than the 1997-2006 average values, and the total value of landings for New Bedford generally increased over the same time period. The value of groundfish in 2006, however, was considerably less than the ten-year average value. The number of vessels whose home port was New Bedford increased somewhat between 1997 and 2006, while the value of fishing for home port vessels more than doubled from $80 million to $184 million over the same time period. The number of vessels whose owner's city was New Bedford fluctuated between 137 and 199 vessels, while the value of landings in New Bedford tripled from $94 million in 1998 to and $281 million in 2006 (see Table 31).

New Bedford has approximately 44 fish wholesale companies, 75 seafood processors, and some 200 shore side industries. Maritime International has one of the largest U.S. Department of Agriculture-approved cold treatment centers on the East Coast. Its terminal receives approximately 25 vessels a year, most carrying about 1,000 tons of fish each.

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Landings by Species

Table 29. Landings in pounds for state-only permits

	Pounds landed
Cod**	6,311,413
Haddock**	5,949,880
Lobster***	1,168,884
Scup**	593,394
Fluke**	480,165
Crab***	315,395
Loligo squid**	207,769
Striped bass**	189,055
Quahog (littleneck)*	147,249
Monkfish	137,300
Conch*	136,276
Skate	121,522
Quahog (cherrystone)	113,341
Black sea bass**	113,071
Pollock	65,500
Quahog (chowder)*	64,999
Bluefish**	44,045
Quahog (mixed)*	11,513
Red hake	10,100
Cusk	1,880
Illex squid**	1,305
Soft shell clam*	985
Dab (Plaice)	870
Dogfish**	537
Winter flounder	500
Yellowtail flounder	383
Gray sole (witch)	200

Asterisks indicate data sources: MA DMF has 2 gear-specific catch reports: Gillnet & Fish Weirs. All state-permitted fish-weir and gillnet fishermen report landings of all species via annual catch reports. NOTE: Data for these species do not include landings from other gear types (trawls, hook & line, etc.) and therefore should be considered as a subset of the total landings. (Massachusetts Division Marine Fisheries).

***** All state-permitted fishermen catching shellfish in state waters report landings of all shellfish species to us via annual catch reports. NOTE: These data do not include landings from non-state-permitted fishermen (federal permit holders fishing outside of state waters), nor do they include landings of ocean quahogs or sea scallops.)

****** These species are quota-managed and all landings are therefore reported by dealers via a weekly reporting phone system (IVR).

******* All lobstermen landing crab or lobster in MA report their landings to us via annual catch reports.

Table 30: Dollar value of Federally Managed Groups of landings in New Bedford

	Average from 1997-2006	2006 only
Scallop	108,387,505	216,937,686
Largemesh Groundfish	30,921,996	23,978,055
Monkfish	10,202,039	8,180,015
Surf Clams, Ocean Quahog	7,990,366	9,855,093
Lobster	4,682,873	5,872,100
Other	4,200,323	2,270,579
Skate	2,054,062	3,554,808
Squid, Mackerel, Butterfish	1,916,647	5,084,463
Summer Flounder, Scup, Black Sea Bass	1,481,161	2,227,973
Smallmesh Groundfish	897,392	1,302,488
Herring	767,283	2,037,784
Red Crab	740,321	0
Dogfish	89,071	13,607
Bluefish	25,828	10,751
Tilefish	2,675	1,084

Vessels by Year

Table 31: All columns represent vessel permits or landings value combined between 1997-2006

Year	# Vessels (home ported)	# Vessels (owner's city)	Level of fishing home port ($)	Level of fishing landed port ($)
1997	244	162	80,472,279	103,723,261
1998	213	137	74,686,581	94,880,103
1999	204	140	89,092,544	129,880,525
2000	211	148	101,633,975	148,806,074
2001	226	153	111,508,249	151,382,187
2002	237	164	120,426,514	168,612,006
2003	245	181	129,670,762	176,200,566
2004	257	185	159,815,443	206,273,974
2005	271	195	200,399,633	282,510,202
2006	273	199	184,415,796	281,326,486

(Note: # Vessels home ported = No. of permitted vessels with location as homeport
 # Vessels (owner's city) = No. of permitted vessels with location as owner residence
Level of fishing home port ($) = Landed value of fisheries associated with home ported vessels
Level of fishing landed port ($) = Landed value of fisheries landed in location)

Recreational

While recreational fishing in New Bedford Harbor is discouraged due to heavy metal contamination, a number of companies in New Bedford offer the public recreational fishing excursions including boat charters. There are also several bait and tackle stores, many of which serve as official state fishing derby weigh-in stations. “In 1999 there were approximately 950 slips in New Bedford Harbor and 85% were visitor based. According to FXM Associates, marina operators agreed that an additional 200 slips could be filled. A few owners of fishing boats in the 45 to 50 foot range have obtained licenses for summer party boat fishing. Tuna is a popular object for recreational fishing as are stripped bass. ”

Future

For several years, work was underway to construct the New Bedford Oceanarium that would include exhibits on New Bedford’s history as a whaling and fishing port, and was expected to revitalize the city’s tourist industry and create jobs for the area. The Oceanarium project failed to receive its necessary funding in 2003 and 2004, and while the project has not been abandoned, it seems unlikely the Oceanarium will be built anytime in the near future.

According to a 2002 newspaper article, many fishermen believe that based on the quantity and ages of the species they catch, the fish are coming back faster than studies indicate. While most admit that regulations have worked, they believe further restrictions are unnecessary and could effectively wipe out the industry.

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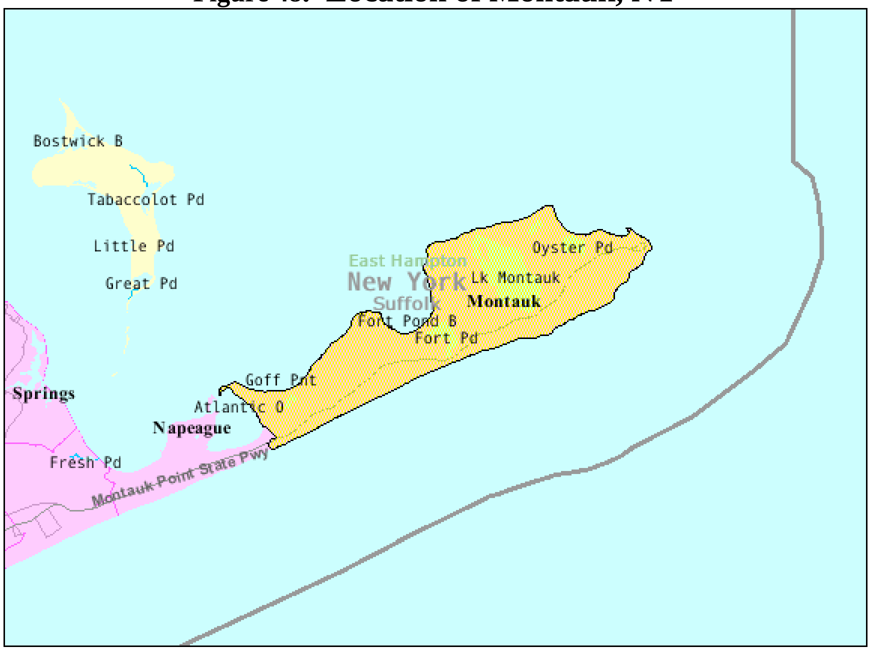
5. MONTAUK

2004-2006 Average Landings Value per Year = $ 15.4 mil
2004-2006 Average SMB Landings Value Per Year = $ 3.6 mil
Percent of Total Landings Value from SMB = 23%

Regional orientation

Montauk (41.00°N, 71.57°W) is located in Suffolk County at the eastern tip of the South Fork of Long Island in New York. It is situated between the Atlantic Ocean to the south, and Block Island Sound to the north, about 20 miles off the Connecticut coast. The total area of Montauk is about 20mi², of which 2.3 mi² of it (11.5%) is water.

Figure 48. Location of Montauk, NY



Historical/Background

Montauk was originally inhabited by the Montauket tribe, who granted early settlers permission to pasture livestock here, essentially the only function of this area until the late 1800s. The owner of the Long Island Railroad extended the rail line here in 1895, hoping to develop Montauk "the first port of landing on the East Coast, from which goods and passengers would be transported to New York via the rail. While his grandiose vision was not fulfilled, the rail provided the necessary infrastructure for the transportation of seafood, and Montauk soon became the principal commercial fishing port on the East End. In the early 1900s, the railroad also brought recreational fishermen to the area from the city by the car-load aboard the 'Fishermen's Special', depositing them right at the dock where they could board sport fishing charter and party boats." Montauk developed into a tourist destination around that time, and much of the tourism has catered to the sport fishing industry since.

Involvement in Northeast Fisheries

Commercial

The village of Montauk is the largest fishing port in the state of New York. Montauk's main industry has been fishing since colonial times, and it continues to be an important part of its economy and traditions. Montauk is the only port in New York still holding on to a commercial fishing industry. Montauk's location naturally provides a large protected harbor on Lake Montauk and is close to important fishing grounds for both commercial and recreational fishermen.

Montauk has a very diverse fishery, using a number of different gear types and catching a variety of species; in 1998, there were a total of 90 species landed in Montauk. According to NMFS Landings Data, the top three valued fisheries in 2003 were Squid ($2.3million), Golden Tilefish ($2.1million), and Silver Hake ($2.1million). There was a striking difference between the 2006 scallop landings value and the value for the 1997-2006 average. The 2006 values were over $1.5 more than the nine year average (see Table 32).

There used to be a number of longline vessels that fish out of Montauk, including 4-5 fishing for tilefish and up to 8 fishing for tuna and swordfish. Additionally, a number of longline vessels from elsewhere in New York State and New Jersey sometimes land their catch at Montauk. As of April 2007, there were 3 tilefish longliners in Montauk, one of which has bought out a fourth. There were also 35-40 trawlers based in Montauk, with a number of others that unload their catch here, and between 10-15 lobster vessels. The six owners of Inlet Seafood each own 1-2 trawlers. There are also a number of baymen working in the bays around Montauk catching clams, scallops, conch, eels, and crab as well as some that may fish for bluefish and striped bass. However, these baymen may move from one area to another depending on the season and fishery, and as a result may not be a part of the permanent fleet here.

The number of vessels home ported in Montauk showed a slightly decreasing trend between 1997 and 2006, while the number of vessels whose owner's city was Montauk showed a slight increasing trend over the same time period. Both the level of fishing home port and landed port also stayed fairly consistent, with a jump in 2005, but generally ranging from over $9 million to over $16 million for the 1997-2006 year period (see Table 33).

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Landings by Species

Table 32. Dollar value of Federally Managed Groups of landing in Montauk

	Average from 1997-2006	2006 only
Squid, Mackerel, Butterfish	3,146,620	3,640,565
Tilefish	2,366,489	2,942,310
Smallmesh Groundfish	2,028,574	1,198,711
Summer Flounder, Scup, Black Sea Bass	1,964,880	3,900,690
Other	1,652,214	1,379,958
Largemesh Groundfish	646,634	426,272
Lobster	585,627	613,598
Monkfish	373,486	643,731
Scallop	366,169	1,869,196
Bluefish	91,346	123,277
Skate	29,360	40,981
Dogfish	9,895	1,323
Herring	413	874
Surf Clams, Ocean Quahog	20	150
Salmon	9	90
Red Crab	5	16

Vessels by Year

Table 33. All columns represent vessel permits or landings value combined between 1997-2006

Year	# Vessels (home ported)	# vessels (owner's city)	Level of fishing home port ($)	Level of fishing landed port ($)
1997	165	89	9,222,288	13,556,572
1998	146	88	9,652,978	12,080,693
1999	158	98	10,863,508	12,124,707
2000	166	103	10,286,306	13,139,382
2001	160	103	12,302,916	13,231,619
2002	153	99	11,981,882	11,131,789
2003	152	104	12,405,663	11,033,366
2004	152	98	11,243,881	13,061,890
2005	144	96	14,104,902	16,475,642
2006	145	96	13,517,890	16,781,742

 # Vessels home ported = No. of permitted vessels with location as homeport
 # Vessels (owner's city) = No. of permitted vessels with location as owner residence
Level of fishing home port ($) = Landed value of fisheries associated with home ported vessels
Level of fishing landed port ($) = Landed value of fisheries landed in location

Recreational

Montauk is the home port of a large charter and party boat fleet, and a major site of recreational fishing activity. The facilities supporting the recreational fishing industry include six bait and tackle shops and 19 fishing guide and charter businesses.

According to one website there are at least 27 fishing charters in Montauk. Montauk has been called the "sport fishing capital of the world", and even has its own magazine dedicated to Montauk sport fishing. Between 2001- 2005, there were 122 charter and party vessels making 18,345 total trips registered in logbook data by charter and party vessels in Montauk carrying a total of 185,164 anglers.

Future

The comprehensive plan for the town of East Hampton recognizes the importance of the commercial and recreational fishing industries here, and includes a commitment to supporting and retaining this traditional industry. There has been discussion of developing a large wholesale seafood market on Long Island similar to the Fulton Fish Market so that fish caught here could be sold directly on Long Island rather than being shipped to New York city.

Nonetheless Erik Braun, the port agent for this part of New York, was not hopeful about the future of the fishing industry. He said there are no new fishermen getting into commercial fishing, and that even those who have done well are not encouraging their children to get into the industry. Much of the fishing infrastructure is disappearing, and those who own docks can make much more by turning them into restaurants. Montauk is the one port still holding on to a commercial fishing industry, however.

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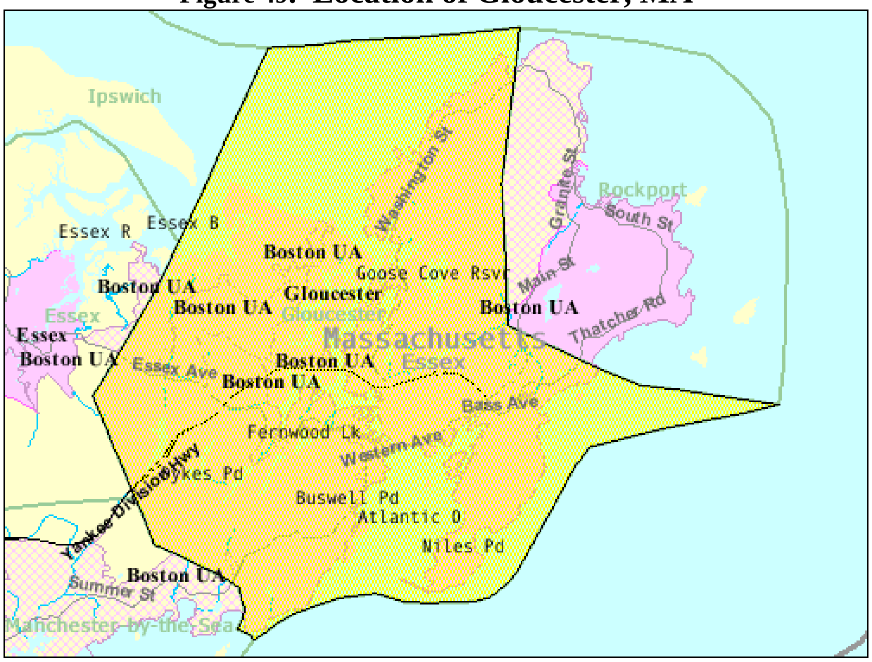
6. GLOUCESTER

2004-2006 Average Landings Value per Year = $ 45.4 mil
2004-2006 Average SMB Landings Value Per Year = $ 2.8 mil
Percent of Total Landings Value from SMB = 6%

Regional orientation

The city of Gloucester (42.62°N, 70.66°W) is located on Cape Ann, on the northern east coast of Massachusetts in Essex County. It is 30 miles northeast of Boston and 16 miles northeast of Salem. The area encompasses 41.5 square miles of territory, of which 26 square miles is land.

Figure 49. Location of Gloucester, MA



Historical/Background

The history of Gloucester has revolved around the fishing and seafood industries since its settlement in 1623. Part of the town's claim to fame is being the oldest functioning fishing community in the United States. It was established as an official town in 1642 and later became a city in 1873. By the mid 1800s, Gloucester was regarded by many to be the largest fishing port in the world.

In 1924 a town resident developed the first frozen packaging device, which allowed Gloucester to ship its fish around the world without salt. The town is still well-known as the home of Gorton's frozen fish packaging company, the nation's largest frozen seafood company.

As in many communities, after the U.S. passed and enforced the Magnuson Act and foreign vessels were prevented from fishing within the country's EEZ (Exclusive Economic Zone), Gloucester's fishing fleet soon increased -- only to decline with the onset of major declines in fish stocks and subsequent strict catch regulations. For more detailed information regarding Gloucester's history see Hall-Arber et al. (2001).

Involvement in Northeast Fisheries

Commercial

Although there are threats to the future of Gloucester's fishery, the fishing industry remains strong in terms of recently reported landings. Gloucester's commercial fishing industry had the 13th highest landings in pounds (78.5 million) and the nation's ninth highest landings value in 2002 ($41.2 million). In 2003 recorded state landings totaled 11.6 million pounds, with catches of lobster, cod, and haddock at 2.0 million, 4.7 million, and 2.6 million pounds landed, respectively. In 2002 Gloucester had the highest landings value of lobster in Massachusetts with the state-only landings worth $2 million and the combined state and federal landings recorded from federally permitted vessels was just over $10 million.

SMB species were the 6th most important segment of Gloucester's landings by value. Gloucester's federally managed group with the highest landed value was large mesh groundfish with nearly $20 million in 2006 (Table 34). Lobster landings were second in value, bringing in more than $10 million in 2006, a significant increase from the 1997-2006 average value of just over $7 million. Monkfish and herring were also valuable species; both had more valuable landings in 2006 than the ten year average values. The number of vessels home ported (federal) increased slightly from 1997 to 2006, but there was a slight reduction for the years 1998, 1999, and 2000 (Table 35).

Landings by Species

Table 34. Dollar value of Federally Managed Groups of landing in Gloucester

	Average from 1997-2006	**2006 only**
Largemesh Groundfish	17,068,934	19,577,975
Lobster	7,036,231	10,179,221
Monkfish	3,556,840	4,343,644
Other	3,246,920	1,906,551
Herring	3,127,523	5,623,383
Squid, Mackerel, Butterfish	1,065,567	3,692,506
Scallop	735,708	1,113,749
Smallmesh Groundfish	732,353	254,287
Dogfish	375,972	316,913
Red Crab	127,997	0
Skate	63,488	27,334
Tilefish	52,502	245,398
Surf Clams, Ocean Quahog	29,033	77,805
Bluefish	21,672	18,116
Summer Flounder, Scup, Black Sea Bass	1,286	603
Salmon	0	0

Vessels by Year

Table 35. All columns represent vessel permits or landings value combined between 1997 and 2006

Year	# Vessels (home ported)	# Vessels (owner's city)	Level of fishing home port ($)	Level of fishing landed port ($)
1997	277	216	15,483,771	23,497,650
1998	250	196	18,078,326	28,394,802
1999	261	199	18,396,479	25,584,082
2000	261	202	19,680,155	41,929,807
2001	295	230	18,614,181	37,961,334
2002	319	247	21,316,029	37,795,464
2003	301	225	22,451,526	37,795,464
2004	298	227	24,531,345	42,760,975
2005	287	217	34,319,544	45,966,974
2006	284	213	34,255,146	47,377,485

(Note: # Vessels home ported = No. of permitted vessels with location as homeport
 # Vessels (owner's city) = No. of permitted vessels with location as owner residence
Level of fishing home port ($) = Landed value of fisheries associated with home ported vessels
Level of fishing landed port ($) = Landed value of fisheries landed in location)

Recreational

Gloucester is home to roughly a dozen fishing charter companies and party boats fishing for bluefin tuna, sharks, striped bass, bluefish, cod, and haddock. Between 2001- 2005, there were 50 charter and party vessels making 4,537 total trips registered in logbook data by charter and party vessels in Gloucester carrying a total of 114,050 anglers (NMFS VTR data). Some of the charter and party boats may be captained by part-time fishermen that needed a new seasonal income.

Future

The Massachusetts Department of Housing and Community Development recognizes that the fishing industry is changing. The city must adapt to these major economic changes. Although the city is preparing for other industries, such as tourism, they are also trying to preserve both the culture of fishing and the current infrastructure necessary to allow the fishing industry to continue functioning. The city is also currently working with the National Park Service to plan an industrial historic fishing port, which would include a working fishing fleet. This would preserve necessary infrastructure for the fishing industry and preserve the culture to further develop tourism around fishing.

According to newspaper articles and city planning documents, residents have conflicting visions for the future of Gloucester. Many argue that the fishing industry is in danger of losing its strength. For example an anthropological investigation of the fishing infrastructure in Gloucester found that the port is in danger of losing its full-service status if some of the businesses close down. With stricter governmental regulations on catches to rebuild declining and depleted fish stocks, many residents are choosing to find other livelihood strategies, such as tourism or other businesses. In 1996, the NMFS piloted a vessel buyback program to decrease the commercial fishing pressure in the northeast. Of the 100 bids applying to be bought by the government, 65 were from Gloucester fishermen. This could be taken as an indication that these fishermen do not see any future in fishing for themselves in the Northeast. NMFS adjusted this program to just buy back permits rather than vessels. Massachusetts had the highest sale of permits, though the number of Gloucester permits could not be obtained at this time.

On the other hand, there are fishermen who claim the fishing and seafood industries will remain strong in the future, despite the pessimistic forecasts. The Gloucester Seafood Festival and Forum is one example of celebrating and promoting Gloucester seafood industry.[40]

7. HAMPTON BAYS

2004-2006 Average Landings Value per Year = $ 7.0 mil
2004-2006 Average SMB Landings Value Per Year = $ 1.8 mil
Percent of Total Landings Value from SMB = 26%

Regional orientation

Hampton Bays and Shinnecock here are considered to be the same community, though there are separate NE dealer weighout data for Shinnecock not included in the above statistics. Shinnecock is the name of the fishing port located in Hampton Bays on the barrier island next to Shinnecock Inlet, and does not actually refer to a geopolitical entity. Fishermen use either port name in reporting their catch, but they are considered to be the same physical place.

The hamlet of Hampton Bays is located on the southern coast of Long Island, NY in the town of Southampton. Southampton is a very large township, encompassing 128 square miles. Hampton Bays is on the west side of Shinnecock Bay, a bay protected from the Atlantic by a barrier island and accessed through Shinnecock Inlet. The Shinnecock Canal connects Shinnecock Bay with Great Peconic Bay to the north, allowing vessels to pass between the southern and northern sides of Long Island without having to travel east around Montauk.

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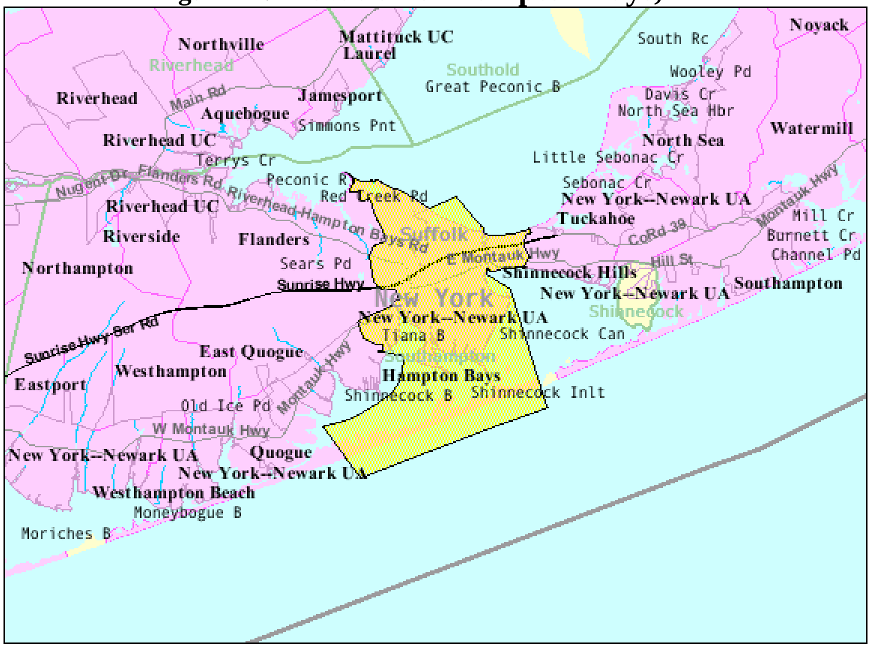
Figure 50. **Location of Hampton Bays, NY**



Historical/Background

The first inhabitants of this area were Native Americans from the Shinnecock tribe, people who still reside in Southampton today on the Shinnecock Reservation. The first European settlers arrived here in 1640, from Lynn, Massachusetts. Sag Harbor in Southampton was an important whaling port early on, and along with agriculture was the town's primary industry. Starting in the 18th century, residents would dig inlets between Shinnecock Bay and the Atlantic Ocean to allow water in the Bay to circulate, and to increase fish and shellfish productivity in the bay.

Involvement in Northeast Fisheries

Commercial

Hampton Bays/Shinnecock is generally considered the second largest fishing port in New York after Montauk. The combined ports of Hampton Bays/Shinnecock had more landings of fish and shellfish in 1994 than at any other commercial fishing port in New York. Combined landings of surf clams and ocean quahogs were worth roughly $1.6 million in 1994, and squid was at the time the most valuable species here. A 1996 report from the New York Seafood Council listed the following vessels for the combined port of Hampton Bays/Shinnecock: 30-35 trawlers, 2-8 clam dredge vessels, 1-2 longline vessels, 1-3 lobster boats, 4-5 gillnetters, as well as 10-15 fulltime baymen and at least 100 part-time baymen. As of 2005, there was one longline vessel here and many of the trawlers were gone.

Hampton Bays/Shinnecock had at one time a significant surf clam and ocean quahog fishery, evident in the 1997 data, which by 2006 had completely disappeared. (see Table 36 and Table 38) Oles notes that surf clam and ocean quahog landings in the past had been from transient vessels landing their catch here. The level of home port fishing declined over the period from 1997 – 2006 for vessels listed with either Hampton Bays or Shinnecock as their home port, with the exception of Hampton Bays in 2006 which showed an increase over previous years (see Table 37 and Table 39). In 2006, for Hampton Bays, the value of landings by species was either less than or roughly equal to the ten year average for 1997-2006, with the exception of scallops and bluefish, which was higher.

For Shinnecock, the opposite was true, with the 2006 values generally greater than the ten year averages for all species.

There are a number of baymen who work in Shinnecock Bay, through permits granted by the town of Southampton, fishing for eels, conch, razor clams, scallops, and oysters, among other species. The Shinnecock Indians had an aquaculture facility for cultivating oysters in the bay, but the oyster beds were largely destroyed through pollution and nutrient-loading; they are once again starting to recreate the oyster beds.

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Hampton Bays
Landings by Species

Table 36. Dollar value by Federally Managed Groups of landings for Hampton Bays

	Average from 1997-2006	2006 only
Squid, Mackerel, Butterfish	2,648,123	1,988,103
Summer Flounder, Scup, Black Sea Bass	1,188,720	1,137,077
Smallmesh Groundfish	1,032,997	285,632
Other	932,451	1,487,435
Monkfish	651,115	487,717
Largemesh Groundfish	480,007	267,673
Tilefish	471,080	347,026
Scallop	417,215	1,010,941
Bluefish	220,089	237,108
Skate	71,631	40,015
Dogfish	48,849	498
Lobster	25,708	17,937
Herring	389	1,738
Surf Clams, Ocean Quahog	43	0

Vessels by Year

Table 37. All columns represent vessel permits or landings value combined between 1997-2006

Year	# Vessels (home ported)	# Vessels (owner's city)	Level of fishing home port ($)	Level of fishing landed port ($)
1997	22	38	3,369,876	9,165,830
1998	24	30	4,141,886	9,658,169
1999	24	32	4,040,706	8,442,274
2000	22	31	3,242,978	9,471,461
2001	20	36	2,543,274	9,218,194
2002	18	35	2,139,557	8,290,341
2003	16	33	1,495,549	6,512,301
2004	13	32	736,299	6,428,282
2005	13	37	347,063	7,388,417
2006	18	42	1,348,990	7,308,900

Shinnecock

Landings by Species

Table 38. Dollar value by Federally Managed Groups of landings for Shinnecock

	Average from 1997-2006	2006 only
Surf Clams, Ocean Quahog	56,665	0
Scallop	53,549	216,853
Summer Flounder, Scup, Black Sea Bass	39,929	185,031
Squid, Mackerel, Butterfish	27,791	51,099
Monkfish	19,486	164,243
Other	11,494	37,598
Tilefish	3,187	30,275
Skate	2,222	19,749
Smallmesh Groundfish	1,428	3,929
Bluefish	1,131	3,972
Largemesh Groundfish	758	3,807
Lobster	18	0
Herring	3	0
Dogfish	3	0

Vessels by year

Table 39. All columns represent vessel permits or landings value combined between 1997-2006

Year	# Vessels (home ported)	# Vessels (owner's city)	Level of fishing home port ($)	Level of fishing landed port ($)
1997	43	0	4,825,722	588,841
1998	36	0	3,898,164	13,523
1999	34	0	5,132,086	3,100
2000	36	0	5,118,783	1,270
2001	37	0	5,054,994	1,560
2002	33	0	4,857,274	4,202
2003	33	0	3,795,887	16,158
2004	38	0	3,675,793	162,183
2005	37	0	4,519,204	669,241
2006	36	0	3,581,923	716,556

 # Vessels home ported = No. of permitted vessels with location as homeport
 # Vessels (owner's city) = No. of permitted vessels with location as owner residence
Level of fishing home port ($) = Landed value of fisheries associated with home ported vessels
Level of fishing landed port ($) = Landed value of fisheries landed in location

Recreational

Recreational fishing is an important part of the tourist industry in Hampton Bays. The marinas here are well positioned for both inshore fishing in Shinnecock Bay and offshore fishing, and there are numerous charter and party boats that go fishing in both areas. Many of those who own second homes in Southampton also own private boats for recreational fishing, and this contributed substantially to the marinas and other marine industries. A website dedicated to fishing striped bass lists a number of locations in Hampton Bays for catching striped bass from on shore. One report estimated the value of recreational fishing at between $32 million and $66.8 million for the town of Southampton, which far exceeds the value of commercial fishing here. Recreational shellfishing is a popular activity in the area; at one time it was estimated that 50 percent of shellfishing in Southampton was done recreationally, both by residents and tourists.

Future

The master plan for the Town of Southampton includes a commitment to preserving the town's fisheries by protecting the industry from growth and development pressures, recognizing the importance of fisheries to both the economy and character of the area. The Master Plan, adopted in 1999, includes a plan to expand the town's commercial fishing dock.

"The resilience of the commercial fishing industry in Hampton Bays is threatened by the cumulative effects of fisheries management and the forces of gentrification that are sweeping the area". One potentially positive note for the fishing industry is that the barrier island and beach where the commercial fishing industry is located are owned by Suffolk County and cannot be developed, so there is less direct competition for space here.

Erik Braun, the port agent for this part of New York, was not hopeful about the future of the fishing industry. He said there are no new fishermen getting into commercial fishing, and that even those who have done well are not encouraging their children to get into the industry. The fleet is badly aging and much of it is in disrepair. Much of the infrastructure here is also gone, and those who own docks can make much more by turning them into restaurants.

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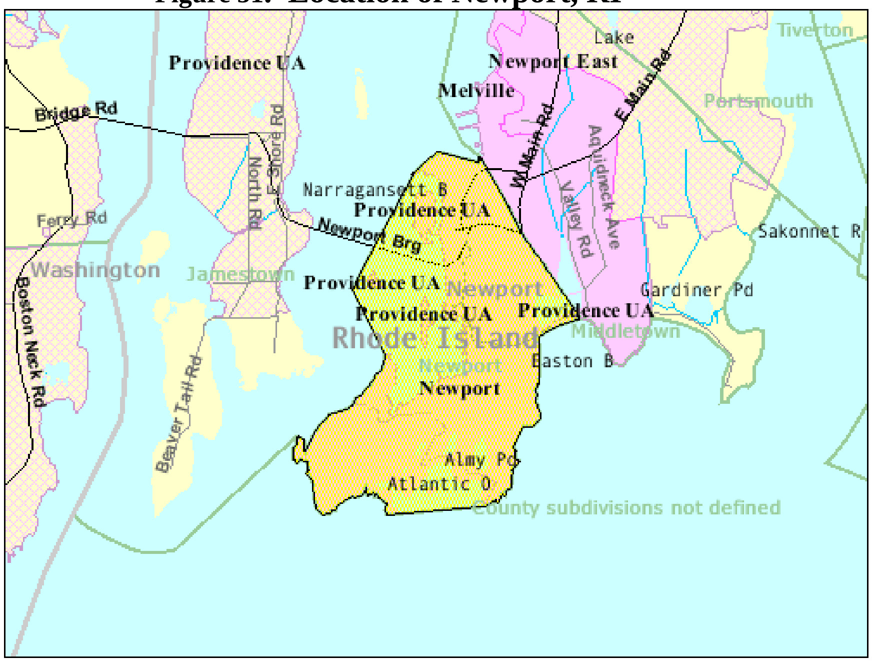
8. NEWPORT

2004-2006 Average Landings Value per Year = $ 14.6 mil
2004-2006 Average SMB Landings Value Per Year = $ 1.3 mil
Percent of Total Landings Value from SMB = 9%

Regional orientation

Newport, Rhode Island (41.50°N, 71.30°W) is located at the southern end of Aquidneck Island in Newport County. The city is located 11.3 miles from Narragansett Pier, 59.7 miles from Boston, MA, and 187 miles from New York City.

Figure 51. Location of Newport, RI



Historical/Background

English settlers founded Newport in 1639. Although Newport's port is now mostly dedicated to tourism and recreational boating, it has had a long commercial fishing presence. In the mid 1700s, Newport was one of the five largest ports in colonial North America and until Point Judith's docking facilities were developed it was the center for fishing and shipping in Rhode Island.

Between 1800 and 1930, the bay and inshore fleet dominated the fishing industry of Newport. Menhaden was the most important fishery in Newport and all of Rhode Island until the 1930s when the fishery collapsed. At this time the fishing industry shifted to groundfish trawling. The use of the diesel engine, beginning in the 1920s, facilitated fishing farther from shore than was done in prior years.

Involvement in Northeast Fisheries

Commercial

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 metric tons of herring in 2003. Maine had the highest reported landings (46%) in 2003, followed by Massachusetts (38%), New Hampshire (8%), and Rhode Island (7%).

Newport has a highly diverse fishery. Of the federal landed species, scallop had the highest value in 2006, at over $13 million. The average value of scallop landings for 1997-2006 was just over $2.5 million; 2006 landings represent a more than five-fold increase over this average value. Lobster was the most valuable species on average, worth more than $2.7 million on average, and close to $3 million in 2006. The squid, mackerel, and butterfish grouping, largemesh groundfish, and monkfish were all valuable fisheries in Newport (see Table 40). The value of landings for home ported vessels in Newport was relatively consistent from 1997-2006, with a high of just under $8 million in 2003 (see Table 41). The level of landings in Newport was steady from 1997-2004, and then saw enormous increases in 2005 and 2006, to almost $21 million in 2006. Home ported vessels in Newport declined from a high of 59 in 2000 to 48 in 2006, while the number of vessels with owners living in Newport increased from 13 in 1997 to 18 in 2006; this implies that most vessels home ported in Newport have owners residing in other communities.

Landings by Species

Table 40. Dollar value by Federally Managed Groups of Landings in Newport

	Average from 1997-2006	**2006 only**
Lobster	2,758,908	2,971,680
Scallop	2,528,448	13,267,494
Squid, Mackerel, Butterfish	1,425,947	1,315,229
Largemesh Groundfish	1,039,962	445,273
Monkfish	878,265	1,068,547
Summer Flounder, Scup, Black Sea Bass	739,880	815,918
Other	334,103	401,779
Smallmesh Groundfish	179,296	43,165
Skate	58,481	224,184
Herring	42,538	267,164
Dogfish	26,441	6,037
Red Crab	15,560	0
Bluefish	11,759	9,878
Tilefish	9,230	1,213

Vessels by Year

Table 41. All columns represent Federal Vessel Permits or Landings Value between 1997 and 2006

Year	**# Vessels (home ported)**	**# Vessels (owner's city)**	**Level of fishing home port ($)**	**Level of fishing landed port ($)**
1997	52	13	5,130,647	7,598,103
1998	52	16	6,123,619	8,196,648
1999	52	14	6,313,350	8,740,253
2000	59	14	6,351,986	8,296,017
2001	52	15	5,813,509	7,485,584
2002	55	17	6,683,412	7,567,366
2003	52	16	7,859,848	9,082,560
2004	52	15	5,951,228	8,402,556
2005	54	17	6,012,472	14,281,505
2006	48	18	6,811,060	20,837,561

(Note: # Vessels home ported = No. of permitted vessels with location as homeport
 # Vessels (owner's city) = No. of permitted vessels with location as owner residence
Level of fishing home port ($) = Landed value of fisheries associated with home ported vessels
Level of fishing landed port ($) = Landed value of fisheries landed in location)

Recreational

There is a large recreational fishing sector in Rhode Island. URI Sea Grant reports an approximation of 300,000 saltwater anglers, most from out-of-state, that made one million fishing trips in 2000. "This indicates that the recreational component is significant both in terms of the associated revenues generated (support industries) and harvesting capacity. Newport is also home to a number of fishing charter vessels targeting striped bass, bluefish, blue sharks, black sea bass, and other species."

Future

From interviews collected for the "New England Fishing Communities" report, Hall-Arber and others found that fishermen fear that increasing tourism and cruise ships will cause the State Pier 9 to be used more for tourism rather than a harbor for commercial fishing, as the fishing industry is far from being a major economic input to Newport. Until 1973, Newport was Rhode Island's fishing and shipping center. For example, in 1971 over half of the state's total commercial fisheries landings were in Newport. In 1973, Point Judith became and presides as the most important commercial port in the state.

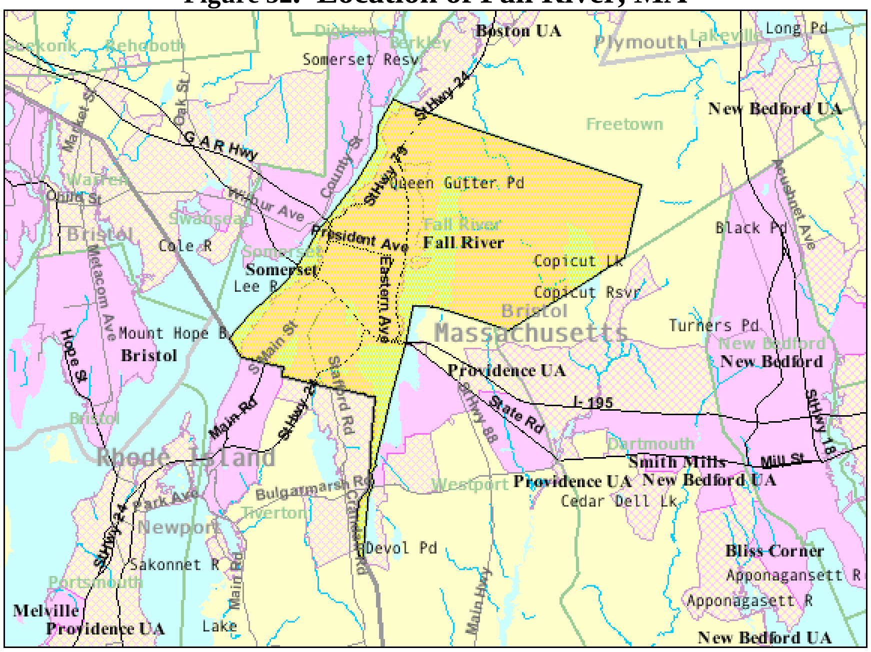
9. FALL RIVER

2004-2006 Average Landings Value per Year = $ 6.4 mil
2004-2006 Average SMB Landings Value Per Year = $ 1.1 mil
Percent of Total Landings Value from SMB = 17%

Regional orientation

The city of Fall River (41.70º N, 71.56º W) is located in Southeastern Massachusetts in Bristol County, along the Rhode Island border. It borders Westport, RI and is about 15 miles from New Bedford, MA. Fall River is 34 square miles in area and sits on Mount Hope Bay at the mouth of the Taunton River. Mount Hope Bay is a component of the larger Narragansett Bay.

Figure 52. Location of Fall River, MA



Historical/Background

Fall River was home to the Wampanoag tribe until they were pushed out during King Phillip's War in 1675. The name comes from a translation of Quequechan, meaning "falling waters", the Wampanoag name for the area. The original settlers to the area were farmers and ships' carpenters from Rhode Island. It was founded in 1803, and incorporated as a city in 1854. Fall River has a long industrial history; the first cotton mill was built here in 1811. This started a trend in textiles manufacturing that would eventually make Fall River one of the textile capitals of the nation. By the early 20th century it was known as Spindle City and had over 100 mills employing over 30,000 people. During the Depression, there was a significant economic downturn as jobs moved to the south and many mills closed; this economic decline continued through much of the 20th century and is only recently reversing itself. Today Fall River continues to have a highly ethnically diverse population.

Involvement in Northeast Fisheries

Commercial

Atlantic Frost Seafoods is a shore-side processing facility based on a vessel docked in Fall

River. They process mackerel and herring, and have a capacity of 150 tons per day. Atlantic Frost is owned by Global Fish, a Norwegian corporation which is one of the world's largest suppliers of pelagic fish. In 2004, Blount Seafood, established in 1880, relocated its headquarters and much of its value-added seafood processing operations to Fall River.

There are presently four red crab vessels based in Fall River which are members of the New England Red Crab Harvesters Association. Crabs landed here are shipped to a facility in Nova Scotia for processing.

SMB species were the 3rd most important segment of Fall River's landings by value. The landings data for Fall River show that red crab is by far the most valuable species landed here for the years 1997-2006 (Table 42). This information paints a picture of a highly variable fishery. Landings fluctuated considerably between the years 1997-2006, from a low in 1998 to a high the following year. Landings then declined again for the next few years, but were up again. Exact numbers can not be provided for confidentiality reasons.

The trend in home port fishing seems to follow the landings somewhat, with landings being more than two orders of magnitude higher than home port fishing in some years, but in later years the level of home port fishing increases and is closer to, but still lower than, the level of landings (Table 43). It seems many of the boats landing their catch here are ported elsewhere. Interestingly, the number of home port vessels is relatively consistent in all years, as is the number of city owner vessels.

Landings by Species

Table 42. Rank Value of Landings for Federally Managed Groups*
*Due to dealer confidentiality, exact dollar values cannot be supplied. Thus, only rankings are given.

	Average from 1997-2006
Red Crab	1
Lobster	2
Squid, Mackerel, Butterfish	3
Monkfish	4
Summer Flounder, Scup, Black Sea Bass	5
Other	6
Herring	7
Skate	8
Largemesh Groundfish	9
Dogfish	10
Smallmesh Groundfish	11
Surf Clams, Ocean Quahog	12
Bluefish	13
Tilefish	14

Vessels by Year

Table 43. Federal Vessel Permits Between 1997-2006

Year	# Vessels (home ported)	# Vessels (owner's city)
1997	7	7
1998	5	6
1999	7	7
2000	6	8
2001	6	7
2002	6	8
2003	6	5
2004	6	5
2005	6	5
2006	6	8

 # Vessels home ported = No. of permitted vessels with location as homeport
 # Vessels (owner's city) = No. of permitted vessels with location as owner residence
Level of fishing home port ($) = Landed value of fisheries associated with home ported vessels
Level of fishing landed port ($) = Landed value of fisheries landed in location

Recreational

One of the Massachusetts Saltwater Fishing Derby Official Weigh Stations is located at Main Bait & Tackle in Fall River. This is one of four bait and tackle shops in Fall River. Fall River also has a jetty and a ramp with paved access, which are usable at all tides. There is also a Fall River Junior Bassmasters club, though it operates out of Cambridge, MA (60 miles away).

Subsistence

Hall-Arber et al. (2001) notes that “lots of the people who participate in recreational fishing in Tiverton are Cambodian or have other ethnic backgrounds.” Some of this "recreational" activity may actually support a fisheries- based subsistence life style.” Tiverton, RI is only 8 miles from Fall River and many of these Cambodian fishermen probably reside in Fall River, given Fall River’s Cambodian population and the fact that that Tiverton’s 2000 population was 98% white and the “Other Asian” category (where Cambodians would be found) was composed fewer than 5 people.

Future

As of February 2007, “Fall River [was] in the final phase of its comprehensive Harbor Plan. With funding provided by the state, the city commissioned consultants to formulate a definitive marketing and development blueprint for the waterfront and downtown districts. Implementation has already begun. An extended boardwalk has been completed and the state has committed funding for the overhaul of the State Pier as a marine-related mixed use development.” The Commerce Park in Fall River will soon hold large facilities for Main Street Textiles and the TJX Corporation, creating 1,600 new jobs for the city.

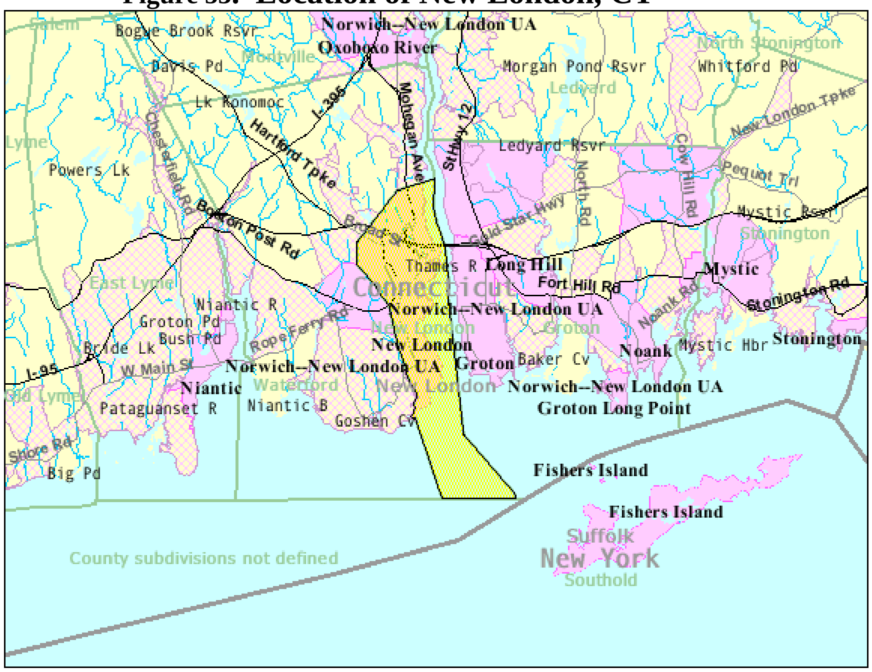
10. NEW LONDON

2004-2006 Average Landings Value per Year = $ 5.4 mil
2004-2006 Average SMB Landings Value Per Year = $ 0.9 mil
Percent of Total Landings Value from SMB = 16%

Regional orientation

The city of New London, Connecticut (41.35°N, 72.11W°) is a part of New London County. It is bordered by Waterford on the north and west, by the Thames River to the east and Long Island Sound to the south. It covers 5.5 square miles and is located adjacent to I-95.

Figure 53. Location of New London, CT



Historical/Background

New London was first settled in 1646 by John Winthrop, the younger. His father, John Winthrop, led a Puritan immigration from England. The town was named in 1658 and was finally incorporated in 1784. It was an important area in terms of ship building and remains a fishing community even today. Over the years, many sections of New London broke off and became different towns. Today the City of New London is much smaller than it was originally. New London has been an important town since the beginning of our country and was attractive to the early colonists because of its waterways. It has a deep harbor and provides direct access to the Atlantic Ocean. The whaling industry began here and many other industries like ship building and fishing were essential to the area's economic growth and development.

Involvement in Northeast Fisheries

Commercial

SMB species were the 3rd most important segment of New London's landings by value. Commercial fishermen in New London seem to be mostly fishing for lobster. All lobstering is done near the shore with the maximum distance away from shore being 8 miles. Lobster fishermen have complained that overfishing has caused the lobster population to decline, making it more difficult to catch sufficient amounts to run their businesses. They have to put out more traps to keep their catch stable. Competition is fierce and the fishermen tend to be very territorial. People that have been fishing the area for a long time (up to three generations) have the best spots and if a newcomer oversteps his bounds, often he will find his lines have been cut.

There are also three whiting boats in the area which fish on Georges Bank. They are all owned by the same company and go out for 3-5 day trips. They box their catch immediately on board and ship directly to a dealer at Hunt's Point Fish Market (New York).

The fishermen in the area are generally dispersed among the small marinas that are on the mouth of the Thames River. They are mixed in among the recreational fishermen. These marinas are located amongst many places for repair and supplies.

The most valuable species grouping landed in New London averaged for 1997-2006 is smallmesh groundfish (Table 44). In 2006, however, the value of scallop landings were $1.5 million, higher the smallmesh groundfish landings in that year, worth $1.45 million. The total landings in New London increased in most years from 1997-2005, to just over $6 million in 2005, and then declined to $4.5 million in 2006 (Table 44).

Table 44. New London Landings by species 1997-2006.

	Average from 1997-2006	**2006 only**
Smallmesh Groundfish	1,602,275	1,454,062
Scallop	888,008	1,517,005
Squid, Mackerel, Butterfish	628,133	748,686
Lobster	363,121	318,757
Monkfish	319,131	238,333
Other	97,624	122,575
Surf Clams, Ocean Quahog	83,600	0
Summer Flounder, Scup, Black Sea Bass	55,611	147,861
Herring	17,997	281
Largemesh Groundfish	11,531	5,398
Skate	6,358	14,417
Tilefish	3,708	1,921
Bluefish	1,316	818
Red crab	755	0
Dogfish	18	9

The number of home ported vessels increased in this same time period, from 14 in 1997 up to 25 in 2006. The level of fishing for home ported vessels saw a tremendous increase in this time period. Values were low in most years, from $56,000 in 1997 and under $1 million in every other year, then jumping up to $4.3 million in 2006. There were very few vessel owners living in New London.

This indicates that many people come to unload their catches in New London or keep their vessels here, but do not actually make their home in New London.

Landings by Species

Table 45. Dollar value by Federally Managed Groups of landings in New London

	Average from 1997-2006	2006 only
Smallmesh Groundfish	1,602,275	1,454,062
Scallop	888,008	1,517,005
Squid, Mackerel, Butterfish	628,133	748,686
Lobster	363,121	318,757
Monkfish	319,131	238,333
Other	97,624	122,575
Surf Clams, Ocean Quahog	83,600	0
Summer Flounder, Scup, Black Sea Bass	55,611	147,861
Herring	17,997	281
Largemesh Groundfish	11,531	5,398
Skate	6,358	14,417
Tilefish	3,708	1,921
Bluefish	1,316	818
Red crab	755	0
Dogfish	18	9

Table 46. All columns represent vessel permits or landings value combined between 1997-2006

Year	# Vessels (home ported)	# Vessels (owner's city)	Level of fishing home port ($)	Level of fishing landed port ($)
1997	14	2	56,204	2,980,500
1998	15	3	146,100	2,639,813
1999	15	4	353,680	3,854,100
2000	15	4	455,254	2,835,704
2001	21	5	507,482	3,521,294
2002	20	4	127,221	4,036,575
2003	19	2	810,561	4,691,922
2004	20	3	295,831	5,589,424
2005	19	4	164,020	6,072,398
2006	25	3	4,355,277	4,570,123

(Note: # Vessels home ported = No. of permitted vessels with location as homeport
 # Vessels (owner's city) = No. of permitted vessels with location as owner residence
Level of fishing home port ($) = Landed value of fisheries associated with home ported vessels
Level of fishing landed port ($) = Landed value of fisheries landed in location)

Recreational

There are many places in New London to fish recreationally. Fort Trumbull State Park has over 500 feet of shorefront access to the water for game fishing. The park is open 24 hours a day, 365 days a year so recreational fishermen can go there any time. The pier also has bright lighting and pole holders. Sport fish usually caught there include striped bass, bluefish, weakfish and tautog.

One website lists eleven different charter sportfishing businesses for New London. The Connecticut Charter and Party Boat Association represents eighteen boats in the Groton/New London area. Charter boats generally offer full or half-day charters. Most boats fish inshore for striped bass, bluefish, fluke, sea bass, scup, and blackfish, while some venture offshore for tuna and shark. In addition, there are many marine supply shops and bait shops in the area. Between 2001-2005, there were a total of 14 charter and party boats which logged trips in New London, carrying a total of 10,398 anglers on 1,885 different trips.

Future

There are currently many plans for development in New London. Pfizer, the pharmaceutical company, was working in 2006 on construction of their new Global Development facility in New London which will likely bring many new jobs for the people living in and around New London.

The New London Development Corporation (NLCD) is specifically centered around bringing new economic development into the city and is dedicated to making it bigger with more jobs and more recreational activities. They are a non-profit group comprised of citizens, business owners, and community leaders in the city.

One of the current projects of the NLDC is the expansion of Fort Trumbull State Park. Fort Trumbull is a 90 acre peninsula located near Pfizer's new building. The corporation is working on expanding the park to include a Coast Guard Museum, a Riverwalk stretching along the whole waterfront with pedestrian and bicycle pathways, and new streets. They are also working on maritime development. New London has one of the longest coastlines of any town in the state and the NLDC is working to create more recreational boating, improved marinas, upgraded facilities, more amenities, and more docking.

6.5.2 Economic Environment

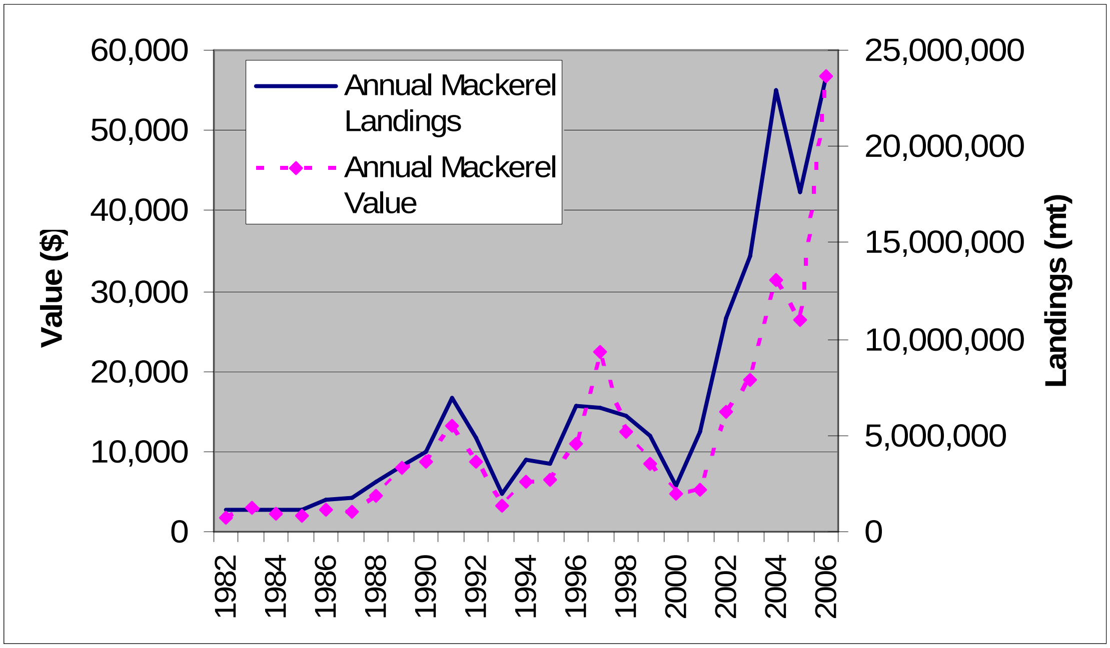
The focus in this section is on participation, fleet characteristics, and economic trends in the SMB and NE small mesh multispecies fisheries.

6.5.2.1 Atlantic Mackerel Fishery

Commercial Atlantic Mackerel Fishery

The commercial Atlantic Mackerel Fishery's economic environment was detailed in section 6.5.2.1 of Amendment 9. While management actions are not expected to impact the Atlantic mackerel fishery, Amendment 9 can be consulted for details on the Atlantic mackerel fishery. Figure 54 provides an update of annual Atlantic mackerel landings and value based on NE dealer weigh-out data.

Figure 54. Atlantic mackerel landings and value, 1982-2006.
Data source: Unpublished NMFS dealer weighout data



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 in Amendment 9.

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% on average from the 2002-2006 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 by value per individual moratorium-permitted vessel have fluctuated from 2002 to 2006, the vast majority of *Illex* landings (96%) during this timeframe has come from only 22 distinct vessels. Within this group, greater than 73% of the combined 2002-2006 landings by value came from four vessels.

Market for *Illex*

From 2002-2006, the disposition of the U.S. commercial harvest of *Illex* was divided 80% to the food/unknown category and 20% to the bait category. Unlike other SMB species, export data for *Illex* is lacking.

Fleet Characteristics

Fleet characteristic analysis was limited to those vessels that landed at least one half of one percent (0.5 %) of the total *Illex* catch by value over 2002-2006 (i.e. the most recent 5 years with complete data). These criteria resulted in a list of 22 vessels that accounted for 96% of *Illex* revenues. These vessels will be termed "major" vessels hereafter. Of the major vessels, the vessel with the most *Illex* revenue 2002-2006 was at $11,347,863 and the vessel with the least was at $180,512. Principal landing ports (as indicated in the NMFS permit data) with more than one major vessel include Cape May, NJ, Point Judith, RI , Davisville, RI, and Wanchese, NC (Table 47). These vessels range in size from 114 to 246 gross tons, and are between 72 and 138 feet in length. Crew size for these vessels ranges between 3 and 14.

New Jersey, Rhode Island, North Carolina and Virginia are the primary states where *Illex* are landed commercially (Table 48 and Table 49). With regard to specific ports, the majority of *Illex* revenues in recent years (2004-2006) came from landings in North Kingston, RI and Cape May, NJ (Table 50). 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 averaged 43% of the port’s gross revenues.

Table 47. Distribution of principle ports for the 2002-2006 major *Illex* vessels.
Data source: Unpublished NMFS Permit Data

Principal Port	State	Major Vessels (N)
CAPE MAY	NJ	8
POINT JUDITH	RI	7
DAVISVILLE/ N KINGSTOWN	RI	CI[1]
WANCHESE	NC	CI
GLOUCESTER	MA	CI
HAMPTON	VA	CI
NEWPORT	RI	CI
total		22

[1] CI = Confidential information (i.e., less than 3 vessels)

Table 48. *Illex* commercial landings (mt) by state.
Data source: Unpublished NMFS dealer weighout data.

	NJ	RI	VA	NC	All others	Total
2002	222	2,388	94	42	4	2,750
2003	1,502	4,609	35	242	3	6,391
2004	14,050	10,285	579	1,124	60	26,098
2005	3,217	7,418	322	654	422	12,032
2006	4,840	8,310	369	402	23	13,944

Table 49. *Illex* commercial landings (pct) by state.
Data source: Unpublished NMFS dealer weighout data.

	NJ	RI	VA	NC	All others	Total
2002	8%	87%	3%	2%	0%	100%
2003	23%	72%	1%	4%	0%	100%
2004	54%	39%	2%	4%	0%	100%
2005	27%	62%	3%	5%	4%	100%
2006	35%	60%	3%	3%	0%	100%

Table 50. 2004-2006 average annual *Illex* revenue for ports averaging at least $100,000 per year from *Illex*.
Data source: Unpublished NMFS Dealer Weighout Data

Port	State	Total Landings Value Per Year ($)	Illex Landings Value Per Year ($)	Percent of Total Value of Landings from Illex	Rank: Illex Value/year	Rank: Percent of Total Landings from Illex
NORTH KINGSTOWN	RI	14,341,172	CI	CI	1	1
CAPE MAY	NJ	55,730,322	3,400,054	6%	2	2
POINT JUDITH	RI	40,422,523	664,846	2%	3	3
WANCHESE	NC	13,288,201	CI	CI	4	CI
HAMPTON	VA	19,331,867	221,136	1%	5	4

For the 22 major vessels, in terms of their dependence on *Illex,* one had less than 5% of its revenue from mackerel, four were between 5%-10%, eleven were between 10%-25%, and six were between 25%-50% (Table 51).

Table 51. Relative importance of *Illex* revenue for the major *Illex* vessels totaled across years and averaged across vessels from 2002 – 2006 (N=22).
Data source: Unpublished NMFS Dealer Weighout Data

Pct of annual revenue from Illex	Vessels (N)	Mean Illex revenue ($)	Mean revenue (all species) ($)
<5%	1	180,512	3,663,105
5%-10%	4	343,790	4,645,942
10%-25%	11	698,182	3,920,370
25%-	6	4,645,557	10,176,817

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 before falling to around 8 million in 2005 and 2006. Revenues have tracked landings fairly consistently over the entire time period (Figure 55). The number of trips that landed over 100 lbs *Illex* has varied considerably over 1998-2006, with a high around 600 in 1998 to a low of under 100 in 2002 (Figure 56).

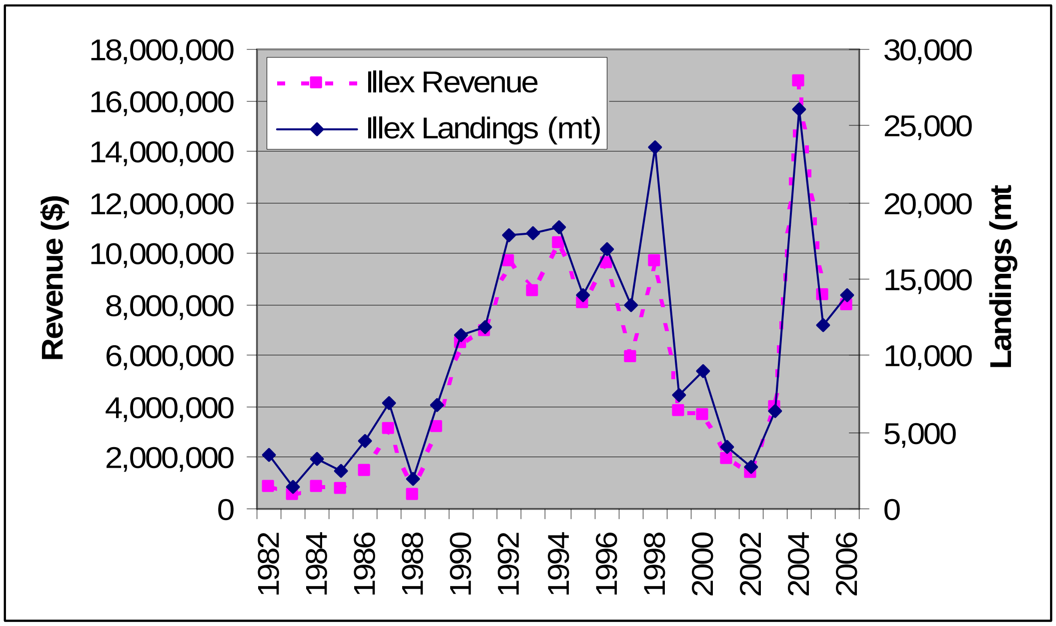


Figure 55. U.S. Commercial *Illex* landings (mt) and value from 1982 – 2006.
Data source: Unpublished NMFS dealer weighout data.

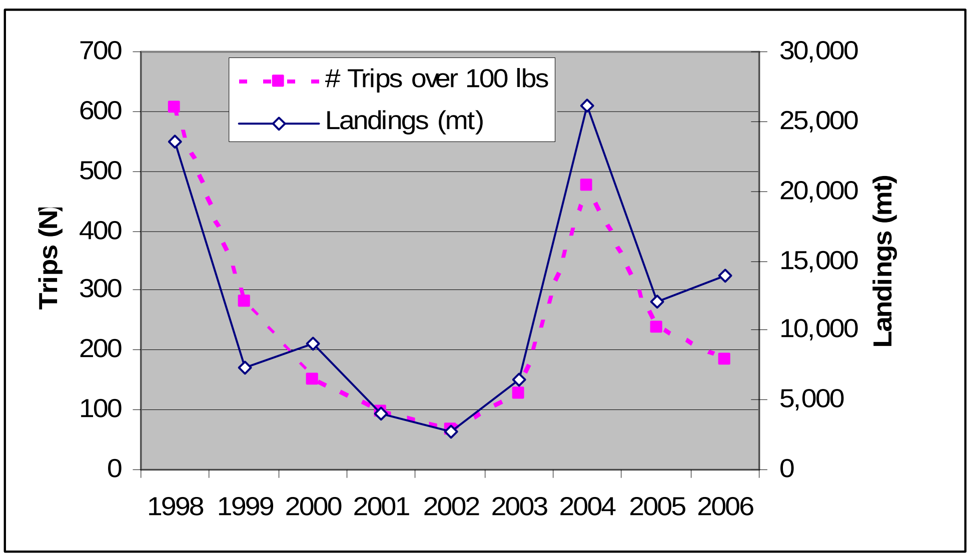


Figure 56 U.S. commercial *Illex* trips (N) and landings (mt) from 1998 - 2006.
Data source: Unpublished NMFS dealer weighout data

Within years, the *Illex* fishery has historically been dominated by landings in May through October. Figure 57 provides an illustration of the average 2002-2006 gross revenues by month. Over the past three years (2004-2006), the price of *Illex* during the height of the fishery has ranged from about

$530/mt to $780/mt. The price of *Illex* in 2006 was less than in the previous two years (Figure 58). No price is indicated for October 2004 because the fishery was closed Sept 21, 2004 when 95% of the quota was reached.

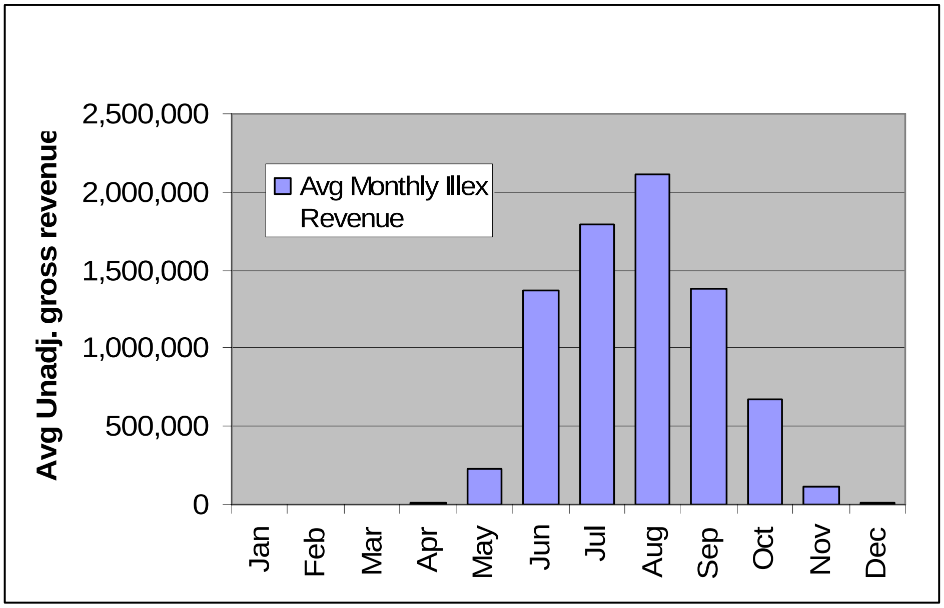


Figure 57. Average *Illex* value (unadjusted $) by month from 2002 – 2006.
Data source: Unpublished NMFS dealer weighout data

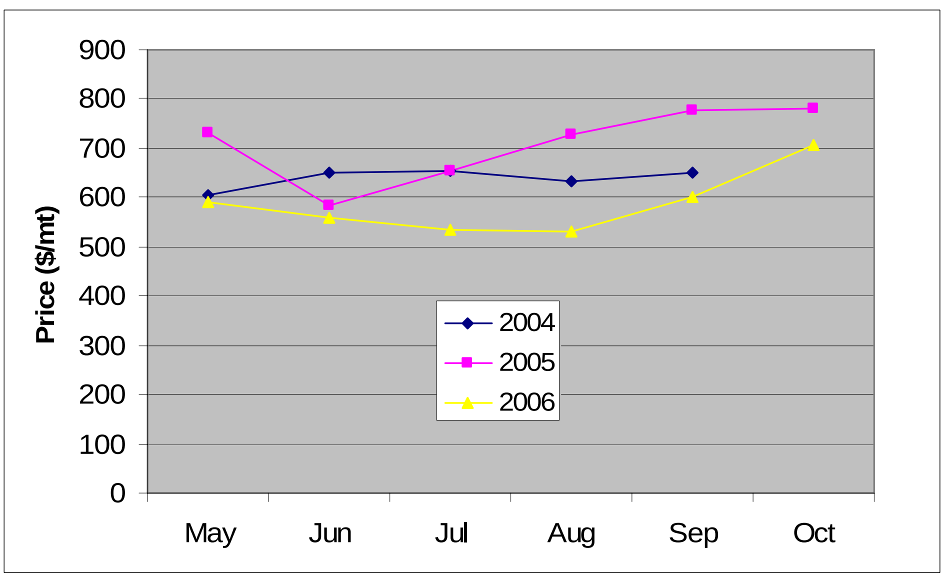


Figure 58. *Illex* price ($/mt) by month in 2004 – 2006.
Data source: Unpublished NMFS dealer weighout data

Commercial Gear

Table 52 and Table 53 provide revenue data by gear for *Illex* landings in 2004-2006. According to the 2004-2006 dealer weighout data, bottom otter trawls are the primary gear used in the commercial harvest of *Illex* (Table 52). In 2004, the record high year for *Illex* landings, 99.9% of the *Illex* revenue landings came from bottom otter trawls (discounting the "unknown" gear category). Additionally, the distribution of commercial gear by state (Table 53) reflects the predominance of bottom otter trawls in the harvest of *Illex*.

Table 52. Average *Illex* revenue (unadj. $s) by gear according to 2004-2006 dealer weighout data.

GEAR_NAME	2004-2006 Avg Revenue
TRAWL,OTTER,BOTTOM,FISH	$10,039,567
TRAWL,OTTER,MIDWATER	$440,880
TRAWL,OTTER,BOTTOM,OTHER	$307,915
UNKNOWN	$120,650
DREDGE, OTHER	$63,232
All others	$75,936

Table 53. Commercial *Illex* revenue (unadj. $s) by gear and state (avg 2004-2006; minimum cutoff of $50,000/state).
Data source: Unpublished NMFS dealer weighout data

GEAR_NAME	NJ	CT	NC	RI	VA
HAND LINE, OTHER	$35,685	.	.	.	.
TRAWL,OTTER,BOTTOM,FISH	**$2,901,561**	**$94,626**	**$410**	**$6,836,726**	**$190,198**
TRAWL,OTTER,BOTTOM,OTHER	**.**	**.**	**$307,818**	**.**	**$98**
TROLL LINE, OTHER	.	.	.	.	.
GILL NET,SINK, OTHER	.	.	.	$2,284	.
DREDGE, SCALLOP,SEA	.	.	.	.	$21
POTS + TRAPS,OTHER	$12,493	.	.	$7	.
POTS + TRAPS,FISH	.	.	$10	.	.
RAKES, OTHER	.	.	.	$75	.
WEIR	.	.	.	.	.
DIVING GEAR	$18,826	.	.	$5,329	.
TRAWL,OTTER,MIDWATER	**$411,669**	**.**	**.**	**.**	**$29,047**
DREDGE, OTHER	$856	.	$3	$60,590	$1,783
TONGS AND GRABS, OTHER	.	.	$104	.	.
UNKNOWN	$18,967	$21	.	$60,171	.

6.5.2.3 Commercial *Loligo* Fishery

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

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 in Amendment 9.

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 2006, vessels in possession of the *Loligo/*butterfish moratorium permit accounted for between 96%- 89% of annual commercial *Loligo* landings. The proportion of landings from unknown vessels or vessels with no *Loligo* Permit has been increasing (likely state vessels) (Table 54). The contribution to annual landings by incidental catch permit holders has ranged from 0%-2%.

Table 54. The landings (mt) of *Loligo* by permit category from 1998 – 2006.
Source: Unpublished NMFS dealer weighout and permit data

	Loligo Butterfish Moratorium		Party Charter		Incidental		No Loligo Permit or Unknown		Total	
Year	mt	%	mt	%	mt	%	mt	%	mt	%
1998	18,263	96%	0	0%	126	1%	734	4%	19,123	100%
1999	18,214	95%	0	0%	215	1%	680	4%	19,109	100%
2000	16,280	93%	0	0%	393	2%	802	5%	17,475	100%
2001	13,423	94%	6	0%	170	1%	640	4%	14,238	100%
2002	15,279	91%	4	0%	408	2%	1,016	6%	16,707	100%
2003	10,988	92%	0	0%	98	1%	850	7%	11,935	100%
2004	13,933	90%	1	0%	158	1%	1,355	9%	15,447	100%
2005	15,259	90%	11	0%	72	0%	1,639	10%	16,981	100%
2006	14,117	89%	0	0%	256	2%	1,507	9%	15,880	100%

The bulk (87%) of *Loligo* landings by value from 2002-2006 was harvested by 138 vessels that each accounted for at least one tenth of one percent (0.1 %) of the total *Loligo* catch by value.

Market for *Loligo*

The disposition of the vast majority of the U.S. commercial harvest of *Loligo* is in the food/unknown category (average = 99.9% from 2002-2006), while a small amount is reported to be sold as bait 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

Fleet characteristic analysis was limited to those vessels that landed at least one tenth of one percent (0.1 %) of the total *Loligo* landings value during the period 2002-2006 (i.e., the most recent 5 years with complete data). These criteria resulted in a list of 138 vessels that accounted for 87% of *Loligo* revenues. These vessels will be termed "major" vessels hereafter. Of the major vessels, the vessel with the most *Loligo* revenue 2002-2006 was at $4,227,568 and the vessel with the least was at $119,784. Principal landing ports (as indicated in the NMFS permit data) with more than one major vessel include Point Judith, RI, New Bedford, MA, Cape May, NJ, Shinnecock, NY, Montauk, NY, Boston, MA, Newport, RI, Hampton Bays, NY, Point Pleasant, NJ, Narragansett, RI, Point Pleasant, NJ, Gloucester MA, Davisville, RI, and Point Lookout, NY (Table 55). These vessels range in size from 15 to 246 gross tons, and are between 32 and 138 feet in length. Crew size for these vessels ranges between 1 and 14.

Rhode Island, New York, New Jersey and Massachusetts are the primary states where *Loligo* are landed commercially (1 CD=Confidential data (less than 3 vessels) Table 56 and Table 57). With regard to specific ports, the majority of *Loligo* revenues in recent years (2004-2006) came from landings in Point Judith, RI, Montauk, NY, North Kingstown, RI, Hampton Bays, NY, Cape May, NJ, Newport, RI, and New Bedford, MA (Table 58).

Table 55. Distribution of principle ports for the 2002-2006 "major" *Loligo* vessels.

Principal Port	State	Major Vessels (N)
POINT JUDITH	RI	43
NEW BEDFORD	MA	15
CAPE MAY	NJ	12
SHINNECOCK	NY	12
MONTAUK	NY	11
BOSTON	MA	7
NEWPORT	RI	7
HAMPTON BAYS	NY	5
POINT PLEASANT	NJ	5
GLOUCESTER	MA	3
DAVISVILLE/ N KINGSTOWN	RI	CD[1]
POINT LOOKOUT	NY	CD
BARNEGAT LIGHT	NJ	CD
BELFORD	NJ	CD
CHILMARK	MA	CD
ELIZABETH	NJ	CD
GREENPORT	NY	CD
LITTLE COMPTON	RI	CD
MYSTIC	CT	CD
NARRAGANSETT	RI	CD
NEW LONDON	CT	CD
NEW YORK	NY	CD
PORTLAND	ME	CD
PROVINCETOWN	MA	CD
SEAFORD	VA	CD
WILDWOOD	NJ	CD
Total		138

[1] CD=Confidential data (less than 3 vessels)

Table 56. *Loligo* commercial landings (mt) by state.
Data source: Unpublished NMFS dealer weighout data.

	RI	NY	NJ	MA	All others	Total
2002	8,227	4,361	2,093	1,068	959	16,707
2003	7,121	2,088	1,077	849	800	11,935
2004	9,345	2,886	1,309	1,073	834	15,447
2005	10,041	3,039	2,143	981	780	16,984
2006	9,660	2,909	1,446	1,303	561	15,880

Table 57. *Loligo* commercial landings (pct) by state.
Data source: Unpublished NMFS dealer weighout data.

	RI	NY	NJ	MA	All others	Total
2002	49%	26%	13%	6%	6%	100%
2003	60%	17%	9%	7%	7%	100%
2004	60%	19%	8%	7%	5%	100%
2005	59%	18%	13%	6%	5%	100%
2006	61%	18%	9%	8%	4%	100%

Table 58. 2004-2006 average annual *Loligo* revenue for ports averaging at least $250,000 per year from *Loligo*.
Data source: Unpublished NMFS Dealer Weighout Data

Port	State	Total Landings Value Per Year ($)	Loligo Landings Value Per Year ($)	Percent of Total Value of Landings from Loligo	Rank: Loligo Value/year	Rank: Percent of Total Landings from Loligo
POINT JUDITH	RI	40,422,523	11,696,638	29%	1	2
MONTAUK	NY	15,443,799	3,406,219	22%	2	4
HAMPTON BAYS	NY	7,045,714	1,791,169	25%	3	3
CAPE MAY	NJ	55,730,322	1,596,670	3%	4	7
NEWPORT	RI	14,573,477	1,229,008	8%	5	6
NEW BEDFORD	MA	256,667,961	1,043,569	0%	6	9
NEW LONDON	CT	5,410,648	CI	CI	7	5
PT. PLEASANT	NJ	21,169,837	387,323	2%	8	8
POINT LOOKOUT	NY	778,749	308,852	40%	9	1
NORTH KINGSTOWN	RI	14,341,172	CI	CI	CI	CI

(North Kingstown is in the top ten but details can not be disclosed.)

For the 138 major vessels, in terms of their dependence on *Loligo*, ten had less than 5% of revenue from *Loligo*, eleven were between 5%-10%, forty were between 10%-25%, sixty were between 25%-50%, fourteen were between 50%-75%, one was between 75%-90%, and two had over 90% of revenue from *Loligo*(Table 59).

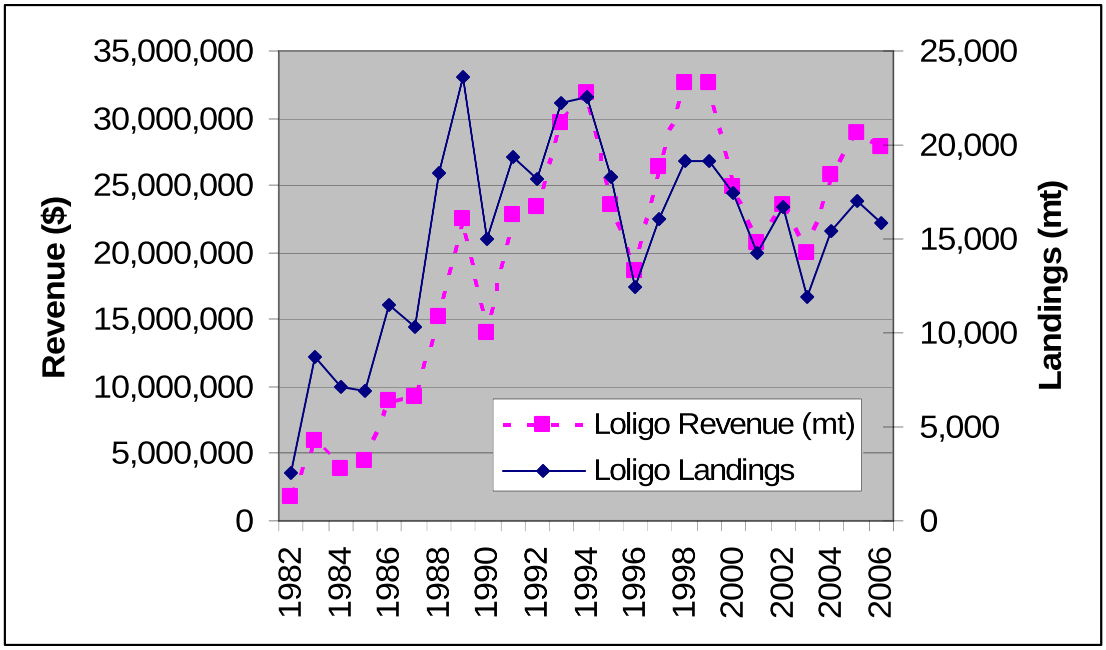
Table 59. Relative importance of *Loligo* revenue for the major *Loligo* vessels totaled across years and averaged across vessels from 2002 – 2006 (N = 138).
Data source: Unpublished NMFS Dealer Weighout Data

Pct of annual revenue from Loligo	Vessels (N)	Mean Loligo revenue	Mean revenue (all species)
<5%	10	153,344	5,444,136
5%-10%	11	256,573	3,482,368
10%-25%	40	559,542	3,241,939
25%-50%	60	938,926	2,501,607
50%-75%	14	1,719,946	2,844,137
75%-90%	1	886,210	1,047,603
90%+	2	647,770	690,407

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 $33 million in 1999. Annual revenues have tracked landings fairly consistently over the entire time period
Figure 59). The number of trips that landed over 100 lbs of *Loligo* declined fairly steadily from 1998 (~8,600) to 2005 (~3,600), though they rose in 2006 (to ~4,800) (Figure 60).

Figure 59. U.S. Commercial *Loligo* landings (mt) and revenue from 1982 – 2006.
Data source: Unpublished NMFS dealer weighout data.



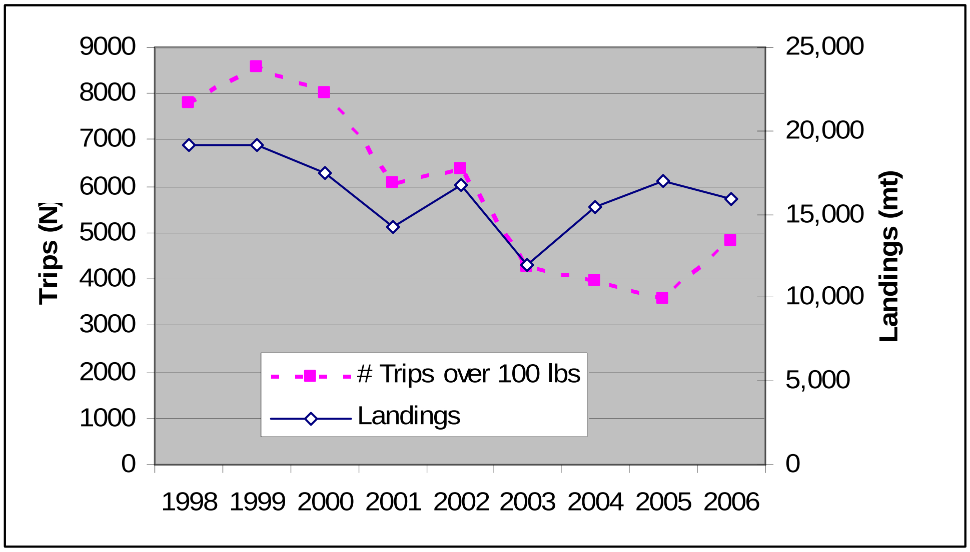


Figure 60. U.S. commercial *Loligo* trips (N) and landings (mt) from 1998 - 2006.
Data source: Unpublished NMFS dealer weighout data

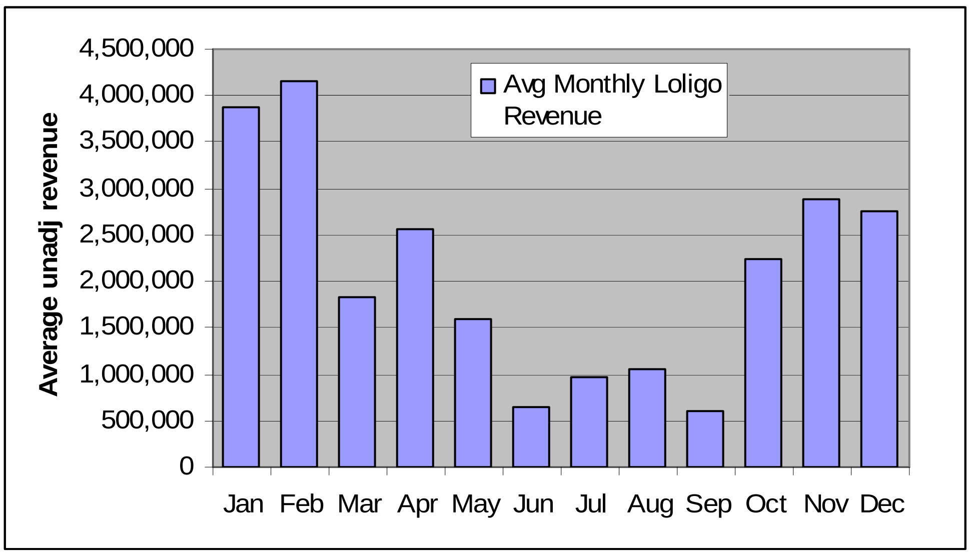


Figure 61. Average *Loligo* value (unadjusted $) by month from 2002 – 2006.
Data source: Unpublished NMFS dealer weighout data

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 61**). Over the past three years (2004-2006), the price of *Loligo* has ranged from ~$1,500/mt to ~$2,600/mt. The average monthly price of *Loligo* has tended to have a small increase in March, lower early summer prices, and high prices in late summer/early fall (Figure 62).

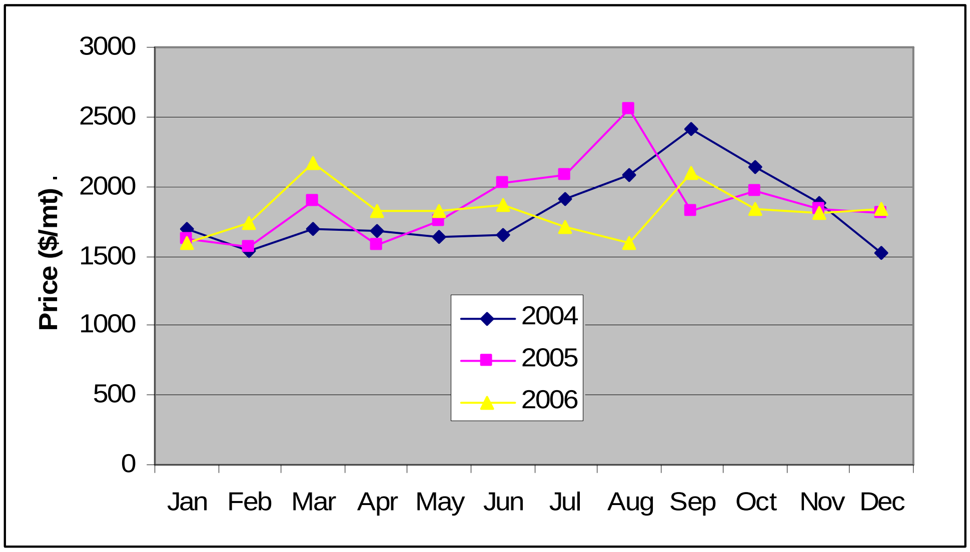


Figure 62. *Loligo* price ($/mt) by month in 2004 – 2006.
Data source: Unpublished NMFS dealer weighout data

<u>Commercial Gear</u>

According to the 2004-2006 dealer reports, bottom otter trawls are the primary gear used in the commercial harvest of *Loligo*, and this is consistent across states (Table 60 and Table 61).

Table 60. Average *Loligo* revenue (unadj. $s) by gear according to 2004-2006 dealer weighout data.

GEAR_NAME	2004-2006 Avg. Revenue
TRAWL,OTTER,BOTTOM,FISH	$21,223,722
UNKNOWN	$2,167,728
DREDGE, OTHER	$1,189,676
TRAWL,OTTER,MIDWATER	$918,460
HAND LINE, OTHER	$384,553
WEIR	$222,286
GILL NET,SINK, OTHER	$213,480
All others	$1,157,591

Table 61. Commercial *Loligo* revenue (unadj. $s) by gear and state (avg 2004-2006). Minimum $50,000/State.
Data source: Unpublished NMFS dealer weighout data

GEAR_NAME	MA	NJ	NY	RI	CT
LONGLINE, BOTTOM	$9,040	$46,288	$86,721	$9,635	.
HAND LINE, OTHER	$5,904	$231,532	$85,068	$62,042	.
HARPOON,OTHER	.	.	$116	.	.
TRAWL,OTTER,BOTTOM,FISH	**$1,266,378**	**$1,170,899**	**$3,740,753**	**$13,923,191**	**$1,069,125**
TRAWL,OTTER,BOTTOM,SCALLOP	.	.	.	.	.
TRAWL,OTTER,BOTTOM,SHRIMP	.	.	.	.	.
TRAWL,OTTER,BOTTOM,OTHER	.	.	$2,070	$4,520	.
TROLL LINE, OTHER	$516	.	$132,120	$562	.
LONG SEINE	$6,971	.	.	.	.
FLOATING TRAP	.	.	.	$23,471	.
DIP NET, COMMON	.	.	$28	.	.
GILL NET,SINK, OTHER	**$2,040**	**$59,425**	**$39,834**	**$107,797**	.
GILL NET,SET /STAKE, SEA BASS	.	.	.	.	.
PURSE SEINE, OTHER	.	.	.	$11	.
DREDGE, SCALLOP,SEA	$7,520	$35,519	$14,992	$15	.
POUND NET, OTHER	$33,996	$25,540	$4,158	$43,272	.
POUND NET, FISH	.	.	$4,389	.	$2,862
TRAWL,OTTER,MIDWATER PAIRED	.	.	$3,638	.	.
POTS + TRAPS,OTHER	$2,850	$18,997	$35,749	$82,499	.
POTS + TRAPS,FISH	.	.	$6	.	.
POT/TRAP, LOBSTER OFFSH NK	.	.	$13,384	$9,738	.
POT/TRAP, LOBSTER INSH NK	.	.	.	$117,486	.
BY HAND, OTHER	$2,306	.	$2,777	$16	.
RAKES, OTHER	$44	.	.	$168,756	.
WEIR	$222,026	.	$224	.	.
FYKE NET, OTHER	.	.	$1,243	.	.
DIVING GEAR	.	$1,408	$195,069	$1,243	.
SCOTTISH SEINE	.	.	$540	.	.
TRAWL,OTTER,MIDWATER	**$2,613**	**$332,935**	**$572,401**	**$1,207**	**.**
DREDGE, OTHER	**$71,926**	**$90,509**	**$146,062**	**$879,866**	.
GILL NET,OTHER	$38	.	.	.	.
UNKNOWN	**$225,680**	**$141,781**	**$694,041**	**$1,017,169**	**$86,514**

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 2006, 91%-61% of annual commercial butterfish landings came from vessels in possession of the *Loligo* / butterfish moratorium permit (Table 62). The contribution to annual landings by incidental catch permit holders has ranged from 1%-6%. The remainder of the landings as reported in the dealer data comes from vessels with no Federal butterfish permit or from unknown vessels, and has ranged from 8%-36% (federal dealers must report all landings and states provide NMFS with catch numbers for their state dealers so this catch category is currently accounted for by the dealer weighout database and is available to determine total landings). The higher recent percentage from this category is primarily due to less directed fishing by permit holders rather than more landings by no permit/unknown vessels (actual landings have been decreasing). The bulk (67%) of butterfish landings by value from 2002 to 2006 was harvested by 136 vessels that each accounted for at least one tenth of one percent (0.1 %) of the total *Loligo* catch by value.

Table 62. The landings (mt) of butterfish by permit category from 1998 – 2006.
Source: Unpublished NMFS dealer weighout and permit data

	Loligo Butterfish Moratorium		Party Charter		Incidental		No Loligo Butterfish Permit or Unknown		Total	
Year	mt	%	mt	%	mt	%	mt	%	mt	%
1998	1,711	87%	0	0%	34	2%	221	11%	1,966	100%
1999	1,868	89%	0	0%	33	2%	209	10%	2,110	100%
2000	1,175	81%	0	0%	60	4%	214	15%	1,449	100%
2001	3,991	91%	1	0%	52	1%	360	8%	4,404	100%
2002	653	75%	0	0%	39	4%	180	21%	872	100%
2003	367	69%	0	0%	17	3%	151	28%	536	100%
2004	325	61%	0	0%	22	4%	190	35%	537	100%
2005	269	62%	0	0%	11	3%	156	36%	437	100%
2006	375	68%	0	0%	35	6%	143	26%	554	100%

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 unpublished 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 to mid-1990's and, in particular, the number of large butterfish in the population has declined substantially relative to historic levels.

Fleet Characteristics

Fleet characteristic analysis was limited to those vessels that landed at least one tenth of one percent (0.1 %) of the total butterfish catch by value over 2002-2006 (i.e. the most recent 5 years with complete data). These criteria resulted in a list of 136 vessels that accounted for 67% of butterfish revenues. These vessels will be termed "major" vessels hereafter. Of the major vessels, the vessel with the most butterfish revenue 2002-2006 was at $103,123 and the vessel with the least was at $3,800. Principal landing ports (as indicated in the NMFS permit data) with more than one major vessel include Point Judith, RI, New Bedford, MA, Cape May, NJ, Shinnecock, NY, Montauk, NY, Boston, MA, Newport, RI, Hampton Bays, NY, Point Pleasant, NJ, Narragansett, RI, Point Pleasant, NJ, Gloucester MA, Davisville, RI, and Point Lookout, NY (Table 63). These vessels range in size from 2 to 199 gross tons, and are between 28 and 138 feet in length. Crew size for these vessels ranges between 1 and 15.

Rhode Island and New York are the primary states where butterfish are landed commercially (Table 64 and Table 65).

With regard to specific ports, the majority of butterfish revenues in recent years (2004-2006) came from landings in Point Judith, RI, and Montauk, NY. 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 Greenport, NY (Table 66).

Table 63. Distribution of principle ports for the 2002-2006 major butterfish vessels.

Principal Port	State	Major Vessels (N)
POINT JUDITH	RI	44
MONTAUK	NY	14
SHINNECOCK	NY	9
CAPE MAY	NJ	8
NEWPORT	RI	8
BOSTON	MA	5
NEW BEDFORD	MA	5
BELFORD	NJ	4
HAMPTON BAYS	NY	4
POINT PLEASANT	NJ	4
FREEPORT	NY	3
GLOUCESTER	MA	3
NEW YORK	NY	3
BARNEGAT LIGHT	NJ	CI[1]
DAVISVILLE/ N KINGSTOWN	RI	CI
EAST HAMPTON	NY	CI
GREENPORT	NY	CI
NARRAGANSETT	RI	CI
POINT LOOKOUT	NY	CI
WANCHESE	NC	CI
BEAUFORT	NC	CI
CHATHAM	MA	CI
MATTITUCK	NY	CI
MYSTIC	CT	CI
OCEAN CITY	MD	CI
PROVINCETOWN	MA	CI
SACO	ME	CI
SEAFORD	VA	CI
Total		136

[1] CI= confidential information (less than 3 vessels)

Table 64. Butterfish commercial landings (mt) by state.
Data source: Unpublished NMFS dealer weighout data.

	CT	MA	NJ	NY	NC	RI	All others	Total
2002	75	24	59	**238**	26	**414**	36	872
2003	89	27	31	**121**	18	**233**	16	536
2004	53	28	36	**154**	6	**205**	55	537
2005	37	8	37	**199**	0	**122**	34	437
2006	43	21	22	**213**	0	**239**	16	554

Table 65. Butterfish commercial landings (pct) by state.
Data source: Unpublished NMFS dealer weighout data.

	CT	MA	NJ	NY	NC	RI	All others	Total
2002	9%	3%	7%	27%	3%	47%	4%	100%
2003	17%	5%	6%	23%	3%	44%	3%	100%
2004	10%	5%	7%	29%	1%	38%	10%	100%
2005	8%	2%	8%	46%	0%	28%	8%	100%
2006	8%	4%	4%	39%	0%	43%	3%	100%

Table 66. 2004-2006 average annual butterfish revenue for ports averaging at least $25,000 per year from butterfish.
Data source: Unpublished NMFS Dealer Weighout Data

Port	**State**	**Total Landings Value Per Year**	**Butterfish Landings Value Per Year**	**Percent of Total Landings from Butterfish**	**Rank: Butterfish Value/year**	**Rank: Percent of Total Landings from Butterfish**
POINT JUDITH	RI	40,422,523	211,059	1%	1	5
MONTAUK	NY	15,443,799	168,752	1%	2	3
NEW LONDON	CT	5,410,648	CI	CI	3	CI
AMMAGANSETT	NY	485,115	40,823	8%	4	1
GREENPORT	NY	763,444	38,979	5%	5	2
HAMPTON BAYS	NY	7,045,714	35,822	1%	6	6
NEWPORT	RI	14,573,477	25,795	0%	7	7

For the 136 major vessels, in terms of their dependence on Butterfish, 124 had less than 5% of revenue from *Loligo*, two were between 5%-10%, and ten were between 10%-25% (**Table 67**).

Table 67. Relative importance of butterfish revenue for major butterfish vessels totaled across years and averaged across vessels from 2002 – 2006 (N = 136).
Data source: Unpublished NMFS Dealer Weighout Data

Pct of annual revenue from butterfish	Vessels (N)	Mean butterfish revenue	Mean revenue (all species)
<5%	124	17,663	2,719,435
5%-10%	2	55,066	666,555
10%-25%	10	37,987	216,903

Trends in Butterfish Revenues

Annual gross revenues from U.S. commercial butterfish landings have declined considerably in recent years. 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 – 2006. Revenue has fluctuated more widely over the same time period. Since butterfish are rarely the target species for a given fishing trip, a perfect relationship between fishing effort and revenue is not expected (Figure 63).

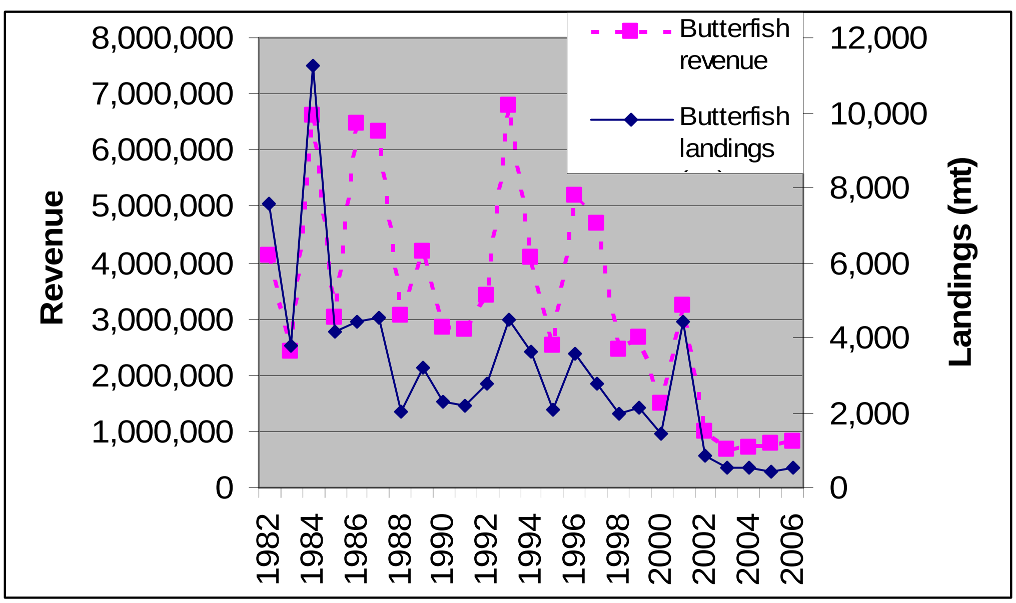


Figure 63. U.S. Commercial butterfish landings (mt) and revenue (unadjusted $1,000s) from 1982 – 2004.
Data source: Unpublished NMFS dealer weighout data.

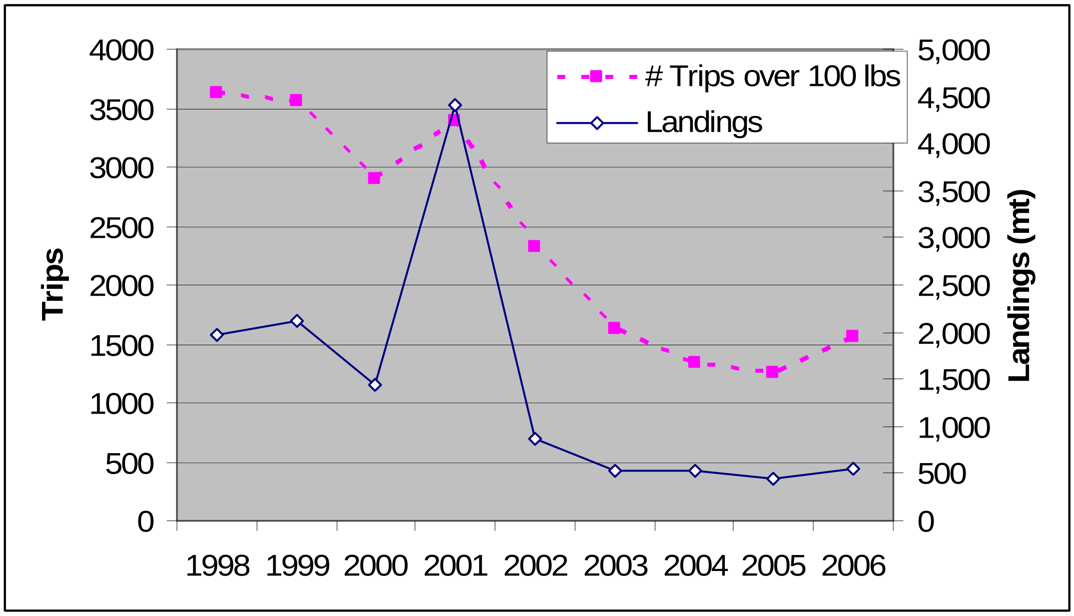


Figure 64. U.S. commercial butterfish trips (N) and landings (mt) from 1998 - 2006.
Data source: Unpublished NMFS dealer weighout data

The number of trips that landed over 100 lbs butterfish declined from ~3,600 in 1998-1999 to ~1500 in 2006 (Figure 64). Revenue has recently been relatively evenly distributed throughout the year with a peak in May and a low-point in August (Figure 65).

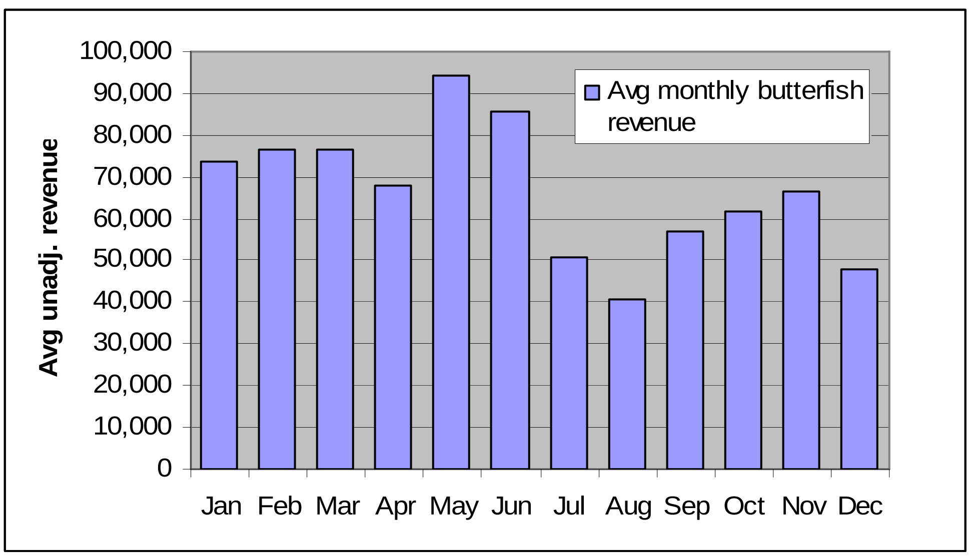


Figure 65. Average Butterfish value (unadjusted $) by month from 2002 – 2006.
Data source: Unpublished NMFS dealer weighout data

Over the past three years (2004-2006), the price of butterfish has varied from ~$1,000/mt to ~$2,300/mt (Figure 66).

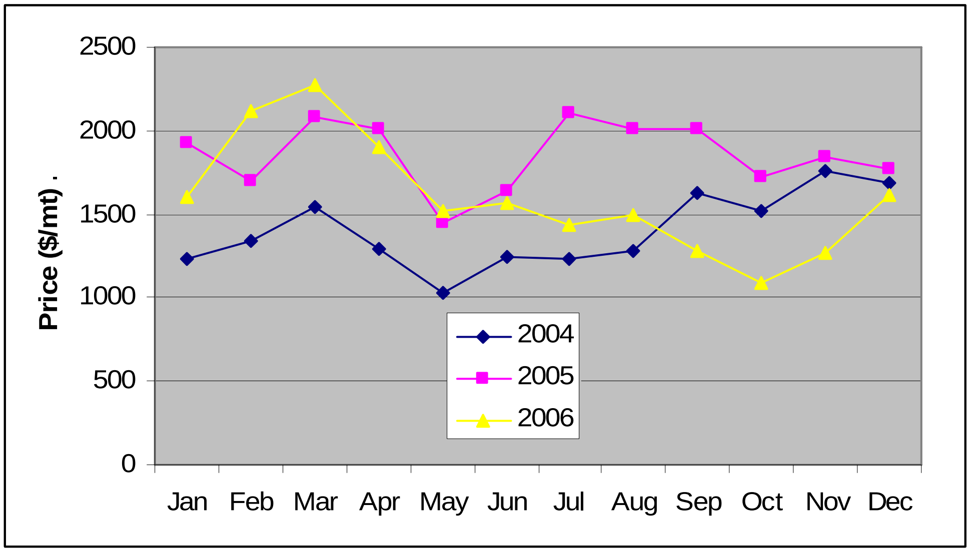


Figure 66. Butterfish price ($/mt) by month in 2004 – 2006.
Data source: Unpublished NMFS dealer weighout data

Commercial Gear

According to the 2004-2006 dealer reports, bottom otter trawls are the primary gear used in the commercial harvest of butterfish, and this is consistent across states (Table 68 and Table 69).

Table 68. Average butterfish revenue (unadj. $s) by gear according to 2004-2006 dealer weighout data.

GEAR_NAME	2004-2006 Avg Revenue
TRAWL,OTTER,BOTTOM,FISH	$509,202
UNKNOWN	$129,624
POUND NET, FISH	$31,837
All others	$104,899

Table 69. Commercial butterfish revenue (unadj. $s) by gear and state (avg 2004-2006). Minimum $25,000/State.
Data source: Unpublished NMFS dealer weighout data

GEAR_NAME	NJ	NY	RI	VA	CT
LONGLINE, BOTTOM	$3,156	$3,564	$412	.	.
HAND LINE, OTHER	$1,052	$12,367	$1,010	$1	.
TRAWL,OTTER,BOTTOM,FISH	**$27,807**	**$198,503**	**$196,704**	**$1,753**	**$58,094**
TRAWL,OTTER,BOTTOM,CRAB	.	.	.	$15	.
TRAWL,OTTER,BOTTOM,SCALLOP	.	.	.	$3	.
TRAWL,OTTER,BOTTOM,OTHER	.	$51	$667	.	.
TROLL LINE, OTHER	$6	$1,072	$76	.	.
TROLL & HANDLINE, COMBINED	.	.	.	.	.
COMMON SEINE, HAUL SEINE	.	.	.	$30	.
LONG SEINE	.	.	.	$5	.
FLOATING TRAP	.	.	$1,075	.	.
GILL NET,SINK, OTHER	$5,697	$4,334	$1,615	$7,999	.
GILL NET,STAKE,OTHER	.	.	.	$3	$8
GILL NET,DRIFT, OTHER	$20	.	.	$3,085	.
DREDGE, SCALLOP,SEA	$187	$865	$3	.	.
POUND NET, OTHER	$6,254	$238	$1,657	$1,052	.
POUND NET, FISH	.	$69	.	$31,398	.
TRAWL,OTTER,MIDWATER PAIRED	.	$267	.	.	.
POTS + TRAPS,OTHER	$472	$2,784	$986	.	.
POTS + TRAPS,FISH	.	.	.	.	.
POT/TRAP, LOBSTER OFFSH NK	.	$27	$91	.	.
POT/TRAP, LOBSTER INSH NK	.	.	$2,564	.	.
BY HAND, OTHER	.	$94	$2	$1	.
WEIR	.	.	.	.	.
FYKE NET, OTHER	.	$47	.	.	.
FYKE NET, FISH	.	.	.	.	.
DIVING GEAR	.	$5,395	.	.	.
SCOTTISH SEINE	.	$4	.	.	.
TRAWL,OTTER,MIDWATER	$5,228	.	$44	$46	.
DREDGE, OTHER	$899	$1,778	$19,769	$58	.
DREDGE, CLAM	.	.	.	$29	.
UNKNOWN	$3,505	$97,326	$26,724	$645	.

6.5.2.5 Commercial Small Mesh Multispecies Fishery

Access to the Commercial Fishery

The small mesh multispecies fishery remains one of the few open access fisheries in New England, although plans to institute limited access are underway. “Small-mesh multispecies” includes three species commercially harvested in gear less than the regulated mesh size required for other multispecies groundfish. They are silver hake, Merluccius bilinearis (commonly known as whiting), red hake, Urophycis chuss (commonly known as ling) and offshore hake, Merluccius albidus (also known as whiting but sometimes known as black-eye whiting). The Council currently manages these species under the Multispecies FMP but because they are harvested differently and subject to different regulations than other multispecies groundfish species, the Council may, after consultation with NOAA, manage these species in a separate FMP.

Fleet Characteristics

Fleet characteristic analysis was limited to those vessels that landed at least one tenth of one percent (0.1 %) of the total small mesh multispecies catch by value over 2002-2006 (i.e. the most recent 5 years with complete data). These criteria resulted in a list of 102 vessels that accounted for 71% of small mesh multispecies revenues (Table 70). These vessels will be termed "major" vessels hereafter. Of the major vessels, the vessel with the most small mesh multispecies revenue 2002-2006 was at $3,015,226 and the vessel with the least was at $43,106. Principal landing ports (as indicated in the NMFS permit data) with more than one major vessel include Point Judith, RI, Montauk, NY, New Bedford, MA, Gloucester MA, Boston, MA, Point Pleasant, NJ, Shinnecock, NY, Belford, NJ, Hampton Bays, NY, Newport, RI, and Provincetown, MA. These vessels range in size from 11 to 199 gross tons, and are between 35 and 93 feet in length. Crew size for these vessels ranges between 1 and 7.

Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, and Rhode Island are the primary states where small mesh multispecies are landed commercially (Table 71 and Table 72).

With regard to specific ports, the majority of small mesh multispecies revenues in recent years (2004-2006) came from landings in New London, CT, Point Judith, RI, Montauk, NY, and New Bedford, MA (Table 73). Small mesh multispecies fishing has been most important in New York, NY, New London, CT, and Montauk, NY.

Table 70. Distribution of principle ports for the 2002-2006 major small mesh multispecies vessels.

Principal Port	State	Major Vessels (N)
POINT JUDITH	RI	37
MONTAUK	NY	12
NEW BEDFORD	MA	11
GLOUCESTER	MA	7
BOSTON	MA	5
POINT PLEASANT	NJ	5
SHINNECOCK	NY	5
BELFORD	NJ	3
HAMPTON BAYS	NY	CI[1]
NEWPORT	RI	CI
PROVINCETOWN	MA	CI
BARNEGAT LIGHT	NJ	CI
BRANT ROCK	MA	CI
CHATHAM	MA	CI
HAMPTON	NH	CI
NARRAGANSETT	RI	CI
NEW LONDON	CT	CI
NEW YORK	NY	CI
PERTH AMBOY	NJ	CI
POINT LOOKOUT	NY	CI
SAUNDERSTOWN	RI	CI
SEABROOK	NH	CI
	Total:	102

[1] CI=confidential information (less than 3 vessels).

Table 71. Small mesh multispecies commercial landings (mt) by state.
Data source: Unpublished NMFS dealer weighout data.

YEAR	CT	MA	NH	NJ	NY	RI	All others	Total
2002	1,300	2,371	79	482	1,991	2,602	26	8,851
2003	1,304	2,925	83	79	2,158	2,905	7	9,461
2004	1,525	2,745	57	125	2,430	2,397	3	9,281
2005	1,673	2,578	46	169	1,476	1,998	2	7,942
2006	1,185	1,772	41	104	1,187	1,728	6	6,023

Table 72. Small mesh multispecies commercial landings (pct) by state.
Data source: Unpublished NMFS dealer weighout data.

YEAR	CT	MA	NH	NJ	NY	RI	All others	Total
2002	15%	27%	1%	5%	22%	29%	0%	100%
2003	14%	31%	1%	1%	23%	31%	0%	100%
2004	16%	30%	1%	1%	26%	26%	0%	100%
2005	21%	32%	1%	2%	19%	25%	0%	100%
2006	20%	29%	1%	2%	20%	29%	0%	100%

Table 73. 2004-2006 average annual small mesh multispecies revenue for ports averaging at least $50,000 per year from small mesh multispecies.
Data source: Unpublished NMFS Dealer Weighout Data

Port	State	Total Landings Value Per Year	Small mesh multispecies Landings Value Per Year	Percent of Total Landings from Small mesh multispecies	Rank: Small mesh multispecies Value/year	Rank: Percent of Total Landings from Small mesh multispecies
NEW LONDON	CT	5,410,648	CI	CI	1	2
POINT JUDITH	RI	40,422,523	CI	CI	2	6
MONTAUK	NY	15,443,799	CI	CI	3	3
NEW BEDFORD	MA	256,667,961	CI	CI	4	11
HAMPTON BAYS	NY	7,045,714	CI	CI	5	5
GLOUCESTER	MA	45,371,919	CI	CI	6	10
NEW YORK CITY	NY	CI	CI	CI	7	1
STONINGTON	CT	10,443,873	CI	CI	8	9
POINT LOOKOUT	NY	778,749	CI	CI	9	4
BELFORD	NJ	3,508,115	CI	CI	10	7
PT. PLEASANT	NJ	21,169,837	CI	CI	11	13
NEWPORT	RI	14,573,477	CI	CI	12	12
SEABROOK	NH	2,896,271	CI	CI	13	8

For the 102 major vessels, in terms of their dependence on small mesh multispecies, thirty-six had less than 5% of revenue from *Loligo*, twenty-six were between 5%-10%, twenty-four were between 10%-25%, eleven were between 25%-50%, four were between 50%-75%, and one was between 75%-90% (Table 74)).

Table 74. Relative importance of small mesh multispecies revenue for major small mesh multispecies vessels totaled across years and averaged across vessels from 2002 – 2006 (N = 102).
Data source: Unpublished NMFS Dealer Weighout Data

Pct of annual revenue from small mesh multispecies	Vessels (N)	Mean Small mesh multispecies revenue	Mean revenue (all species)
<5%	36	74144.69	2490144
5%-10%	26	119861.65	1749658.85
10%-25%	24	334323	2205743.54
25%-50%	11	879098.73	2840690.91
50%-75%	4	2012822.25	3690990.75
75%-90%	1	56535	65805

Trends in Small mesh multispecies Revenues

Annual gross revenues from U.S. commercial small mesh multispecies landings have declined considerably in recent years after reaching a peak in the late 1990s. In the 1990s, revenue peaked at about $16,000,000 annually before falling to about $7,000,000 in 2006 (Figure 67).

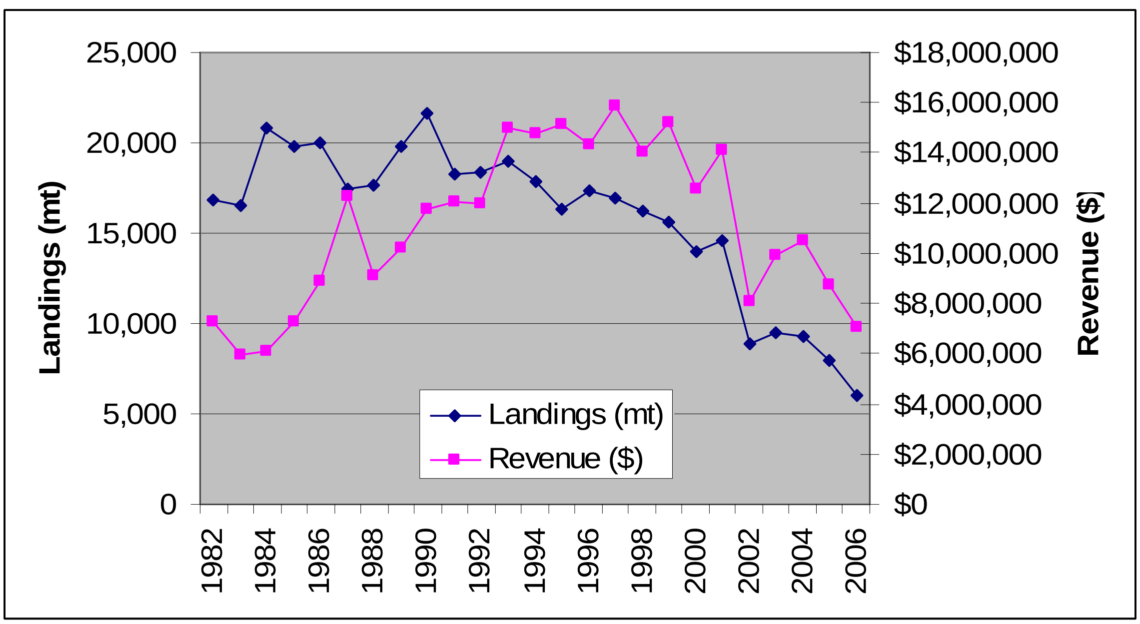


Figure 67. U.S. Commercial small mesh multispecies landings (mt) and revenue (unadjusted $1,000s) from 1982 – 2004.
Data source: Unpublished NMFS dealer weighout data.

Revenue has recently been relatively evenly distributed throughout the year with a late summer peak (Figure 68). Over the past three years (2004-2006), the price of small mesh multispecies has varied from ~$800/mt to ~$1,600/mt (Figure 69).

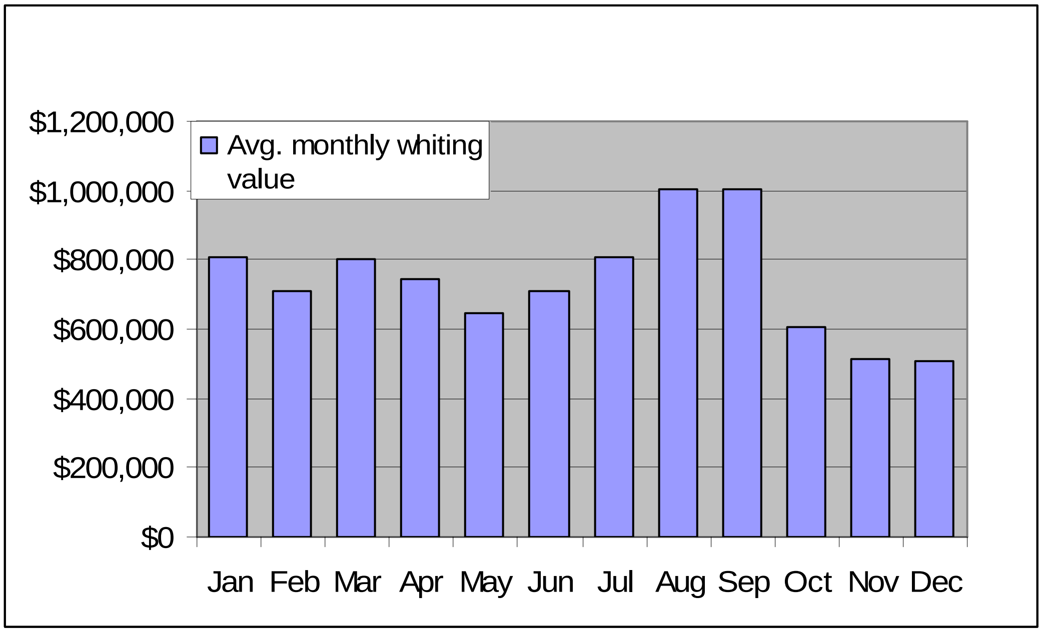


Figure 68. Average Small mesh multispecies value (unadjusted $) by month from 2002 – 2006.
Data source: Unpublished NMFS dealer weighout data

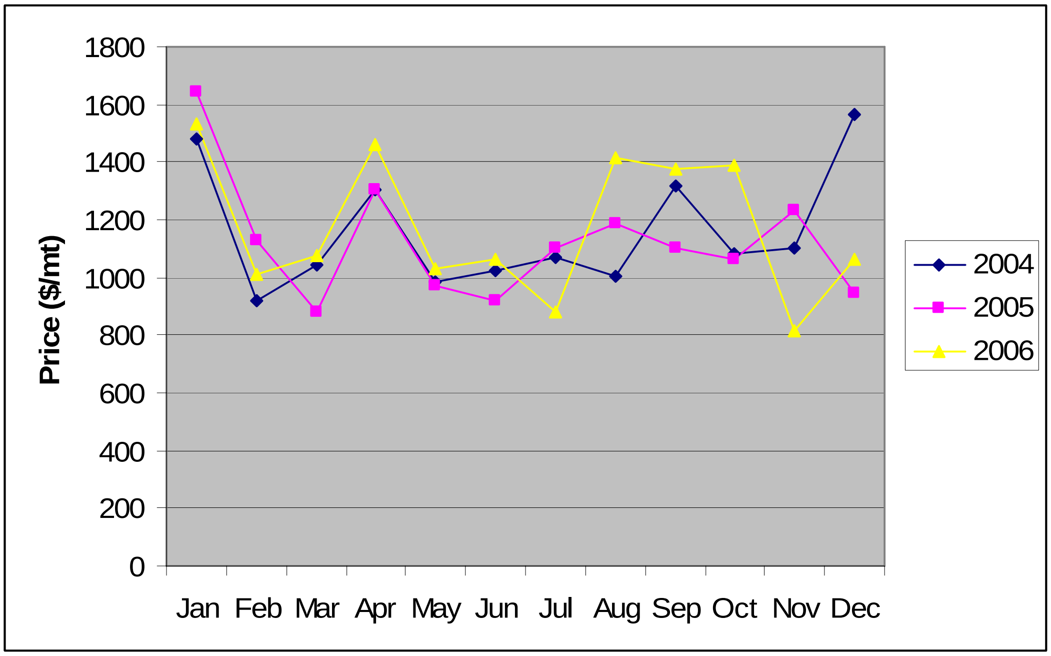


Figure 69. Small mesh multispecies price ($/mt) by month in 2004 – 2006.
Data source: Unpublished NMFS dealer weighout data

Commercial Gear

According to the 2004-2006 dealer reports, bottom otter trawls are the primary gear used in the commercial harvest of small mesh multispecies (Table 75).

Table 75. Average small mesh multispecies revenue (unadj. $s) by gear according to 2004-2006 dealer weighout data.

GEAR_NAME	2004-2006 Average Revenue
TRAWL,OTTER,BOTTOM,FISH	$6,605,923
UNKNOWN	$896,912
DREDGE, OTHER	$848,882
LONGLINE, BOTTOM	$174,523
GILL NET,SINK, OTHER	$61,667
HAND LINE, OTHER	$34,132
All others	$148,695

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 10. The impact analysis focuses on the valued ecosystem components (VECs) that were identified for Amendment 10 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 76 is provided as a summary of the likely impacts of the various management alternatives considered in the development of Amendment 10.

Table 76. Management alternatives under consideration in Amendment 10 and expected impacts on the "valued ecosystem components" (VECs).

Management Measure		VECs				
		Managed resource	**Non-target species**	**Habitat including EFH**	**Protected Resources**	**Human Communities**
BUTTERFISH STOCK REBUILDING PROGRAM	Alternative 1A: No action	Butterfish - No impact (relative to status quo) *Loligo*- No impact	No impact (relative to status quo)	No Impact	No Impact	No impact
	Alternative 1B: Butterfish rebuilding program with butterfish mortality cap for *Loligo* fishery distributed by trimester based on current *Loligo* quota allocation	Butterfish:Positive *Loligo*: neutral to positive if butterfish cap constrains *Loligo* fishery	Neutral to positive if effort in *Loligo* fishery is reduced	Neutral to positive if effort in *Loligo* fishery is reduced	Neutral to positive if effort in *Loligo* fishery is reduced	Neutral to negative in short term; Potentially positive in long term if directed butterfish fishery is re-established
	Alternative 1C: Butterfish rebuilding program with butterfish mortality cap for *Loligo* distributed by trimester based on recent *Loligo* landings	Butterfish:Positive *Loligo*: neutral to positive if butterfish cap constrains *Loligo* fishery	Neutral to positive if effort in *Loligo* fishery is reduced	Neutral to positive if effort in *Loligo* fishery is reduced	Neutral to positive if effort in *Loligo* fishery is reduced	Neutral to negative in short term; Potentially positive in long term if directed butterfish fishery is re-established
	Alternative 1D: Butterfish rebuilding program with butterfish mortality cap for *Loligo* distributed by trimester based on bycatch rate method	Butterfish:Positive *Loligo*: neutral to positive if butterfish cap constrains *Loligo* fishery	Neutral to positive if effort in *Loligo* fishery is reduced	Neutral to positive if effort in *Loligo* fishery is reduced	Neutral to positive if effort in *Loligo* fishery is reduced	Neutral to negative in short term; Potentially positive in long term if directed butterfish fishery is re-established
	Alternative 1E: Implement a 3.0 inch minimum mesh size in the directed *Loligo* fishery	Butterfish:positive *Loligo*: neutral to positive	positive	Potentially negative if bottom trawl effort in *Loligo* fishery increases	Potentially negative if effort in *Loligo* fishery increases	Negative short term ; Potentially positive in long term if directed butterfish fishery is re-established

Table 76 (continued)

Management Measure		VECs				
		Managed resource	Non-target species	Habitat including EFH	Protected Resources	Human Communities
***LOLIGO* MINIMUM MESH SIZE REQUIREMENTS-**	Alternative 2A: No Action	Butterfish – negative would contribute to continued discarding and stock deterioration *Loligo* - 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 habitat disturbances	No impact- changes to intensity or distribution of fishing effort are not expected resulting in no additional interactions with protected species	No impact- changes to intensity or distribution of fishing effort are not expected , thus socio-economic impacts are not expected
	Alternative 2B: Increase minimum codend mesh size to $2^{1/8}$ inches (50 mm)	Butterfish - low positive, minimal impact due to low predicted escapement *Loligo* – low negative to low positive depending on survival of escapees	Low positive- a slight decrease in discard morality would be expected relative to 2A	Neutral to low negative- reduced *Loligo* retention could result in increased effort depending on responses to regulation; increased effort could result in additional habitat disturbances	Neutral to low negative- reduced *Loligo* retention could result in increased effort depending on responses to regulation; increased effort could result in additional interactions with protected species	Neutral to low negative- loss due to codend replacement should not be significant, however revenue loss due to increased escapement of *Loligo* is likely to occur compared to status quo (2A)

	Alternative 2C: Increase minimum codend mesh size to $2^{3/8}$ inches (60 mm)	Butterfish – literature selectivity parameters for butterfish escapement predict low positive; observer data suggest positive	Low positive- a slight decrease in discard morality would be expected relative to 2A-2B	Neutral to low negative- reduced *Loligo* retention could result in increased effort depending on responses to regulation; increased effort could result in additional habitat disturbances	Neutral to low negative- reduced *Loligo* retention could result in increased effort depending on responses to regulation; increased effort could result in additional interactions with protected species	Neutral to low negative- loss due to codend replacement should not be significant, however revenue loss due to increased escapement of *Loligo* is likely to occur to a greater extent than under 2A-2B
		Loligo – low negative to low positive depending on survival of escapees				
	Alternative 2D: Increase minimum codend mesh size to $2^{1/2}$ inches	Butterfish – low positive, expected to provide benefit to stock through increased escapement	Low positive- a slight decrease in discard morality would be expected relative to 2A-2C	Neutral to low negative- reduced *Loligo* retention could result in increased effort depending on responses to regulation; increased effort could result in additional habitat disturbances	Neutral to low negative- reduced *Loligo* retention could result in increased effort depending on responses to regulation; increased effort could result in additional interactions with protected species	Neutral to low negative- loss due to codend replacement should not be significant, however revenue loss due to increased escapement of *Loligo* is likely to occur to a greater extent than under 2A-C
		Loligo – low negative to low positive depending on survival of escapees				

	Alternative 2E: Increase minimum codend mesh size to 3 inches	Butterfish - High Positive *Loligo* – low negative to low positive depending on survival of escapees	Positive- a greater decrease in discard mortality would be expected relative to 2A-2D	Neutral to low negative- reduced *Loligo* retention could result in increased effort depending on responses to regulation; increased effort could result in additional habitat disturbances	Neutral to low negative- reduced *Loligo* retention could result in increased effort depending on responses to regulation; increased effort could result in additional interactions with protected species	Neutral to low negative- loss due to codend replacement should not be significant, however revenue loss due to increased escapement of *Loligo* is likely to occur to a greater extent than under 2d
EXEMPTIONS FROM *LOLIGO* MINIMUM MESH REQUIREMENTS FOR *ILLEX* VESSELS -	**Alternative 3A: No Action**	Butterfish - Low Negative – would not allow for increased escapement of butterfish *Loligo* - 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 protected species interactions	No Impact- changes to intensity or distribution of fishing effort are not expected, thus socio-economic impacts are not expected
	Alternative 3B: Exclude month of September from current mesh exemption for *Illex* fishery	Butterfish - Low-positive, may increase escapement of butterfish, thus reducing mortality Other SMB - No Impact- not expected to increase *Illex* or *Loligo* mortality	Low Positive- when the *Illex* fishery is not exempt from the *Loligo* minimum mesh size it would reduce mortality on non-target species	No impact- changes to intensity or distribution of fishing effort expected to be minor, thus no additional or fewer habitat disturbances	No Impact- minor changes to intensity or distribution of fishing effort, thus no additional or fewer protected species interactions	Potentially Low Negative – any changes to harvest effort are expected to be minor, thus this measure would not generate measurable socio-economic impacts

	Alternative 3C: Exclude months of August and September from current mesh exemption for *Illex* fishery	Butterfish - Low Positive- may increase escapement of butterfish, thus reducing mortality *Illex* - Potentially Low Negative - mortality may increase, but the extent is unclear Other SMB - No Impact – not expected to increase or reduce mortality	Low Positive-–when the *Illex* fishery is not exempt from the *Loligo* minimum mesh size, it would reduce 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 protected species interactions, particularly with pilot whales	Potentially Negative - likely to require additional harvest effort in order to meet harvest targets, thus expected to generate negative socio-economic impacts
	Alternative 3D: Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels	Butterfish - Low Positive - Low Positive – would have greatest positive impact on butterfish because it would maximize the use of larger mesh, allowing greater escapement *Illex* - 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

Table 76 (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 4A: No Action	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 4B: Butterfish GRA1 (minimum of 3 inch codend mesh size in effective area)	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 76 (continued)

Management Measure		VECs: Managed resource	VECs: Non-target species	VECs: Habitat including EFH	VECs: Protected Resources	VECs: Human Communities
IMPLEMENTATION OF SEASONAL GEAR RESTRICTED AREAS (GRAS) TO REDUCE BUTTERFISH DISCARDS (continued)	Alternative 4C: Butterfish GRA2 (minimum of 3 inch codend mesh size in effective area)	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 4D: Butterfish GRA3 (minimum of 3[3/4] inch codend mesh size in effective area)	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 76 (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 4E: Butterfish GRA4 (minimum of $3^{3/4}$ inch codend mesh size in effective area)	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

For Table 76, please refer to the following underlined impact definitions:

Managed Species, Non-Target Species, Protected Species:
Positive: actions that increase stock/population size
Negative: actions that decrease stock/population size

Habitat:
Positive: actions that improve the quality or reduce disturbance of habitat
Negative: actions that degrade the quality 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

Impact Qualifiers:
Low (as in *low* positive or *low* negative): to a lesser degree
High (as in *high* positive or *high* negative) to a greater degree
Potentially: a relatively higher degree of uncertainty is associated with the impact

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.

When the Council selects preferred alternatives, the direct and indirect effects of the combined suite of alternatives will be analyzed. Additionally, the combination of these measures will be assessed in the cumulative effects section.

Before describing impacts, butterfish stock status and the butterfish rebuilding plan are briefly reviewed. For stock status details see 6.1.4. For rebuilding plan details see 5.2.

Butterfish Status

SAW/SARC 38 (NEFSC 2004) determined butterfish was overfished based on data through 2002. The 2004 SAW/SARC report is the authoritative reference for stock status and current federal law obligates the Council to develop and implement a stock rebuilding plan until the stock is determined to be rebuilt to the Bmsy level through a peer reviewed butterfish stock assessment (scheduled for 2010). Discards account for approximately 66% of butterfish mortality (NEFSC 2004). The directed *Loligo* fishery accounts for approximately 68% of discards and 75% of total catch (discards + kept) of butterfish recorded in the observer database (unpublished NMFS observer data).

Adaptive Approach

As butterfish rebuilds and the ABC increases, the Council, through the annual specifications process may keep this same ratio, or may keep landings low and allocate more of the ABC to discards (so as to allow the *Loligo* fishery to operate). In the annual specifications, analysis will describe the pros and cons of different allocation models and the Council will make a decision on this fundamentally allocative matter. The general goal would be to rationally maximize benefits from the combined use of sustainable *Loligo* and butterfish resources, simply acknowledging the tradeoff that may occur between butterfish DAH and *Loligo* DAH because of the butterfish bycatch in the *Loligo* fishery (i.e. use a mixed-species management approach). Strict limits on directed harvest currently available through the specifications would control harvest and the measures proposed in Amendment 10 would control bycatch/discards.

ABC Specification

The ABC for butterfish during rebuilding will be specified through the annual specification process based on the most recent estimates of stock biomass and the following control rule: ABC will equal **the yield associated with applying a fishing mortality rate of F=0.1 to the most current estimate of stock biomass**. An F of 0.1 facilitates rebuilding according to an auto-regressive (AR1) time-series model developed by the SMB FMAT and reviewed by the MAFMC SSC (see appendix ii). IOY, DAH, and DAP will be established through the same annual specification process as currently occurs. The Science and Statistical Committee (SSC) will review the stock biomass estimate and annual quota. It is anticipated that applying F=0.1 to the estimated biomass will result in ABC specifications in the range of the table below, but if stock was estimated to be lower than anticipated, applying F=0.1 could result in a lower ABC specification. Likewise, if stock was estimated to be higher than anticipated, applying F=0.1 could result in a higher ABC specification than is illustrated in the following table.

Year	ABC Specification (mt)
2009	1500-2000
2010	1500-2000
2011	1500-5000
2012	1500-7200
2013	1500-9000

The process for closing directed butterfish fishing will generally remain the same as in the 2008 specifications. If the directed butterfish fishery is closed, *Loligo* moratorium vessels and all other vessels would be subject to the closure-related incidental trip limits for butterfish set in the annual specifications.

Proposed Rebuilding Timeframe

The Council proposes a five-year butterfish rebuilding program. A five year time frame balances the Magnuson Stevens Act requirements of rebuilding in a time frame as short as possible, taking into account the status and biology of butterfish, and taking into account the needs of fishing communities. While the rebuilding plan is described over 5 years because it is likely butterfish can be rebuilt in 5 years, some measures to control butterfish discarding will need to be permanent to ensure long term sustainability of the butterfish stock.

Year 1 (2009) of the rebuilding plan will maintain the 2008 annual ABC specification for butterfish at 1,500 mt (landings limited to 500 mt) and could include an increase in the minimum mesh size requirement in the *Loligo* fishery up to $2^{3/8}$ inches (60 mm). In year 1, keeping landings low aids in butterfish rebuilding by restricting directed fishing, and as described below in section 7.1.2, a mesh increase up to 60mm could help to increase the butterfish stock size by increasing escapement of juveniles. However, the key provisions of this rebuilding plan occur in years 2-5.

Years 2-5 (2010-2013) of the rebuilding plan under measure 1 (see below) would institute and maintain a mixed species management system with a butterfish mortality cap for the *Loligo* fishery that would track *Loligo* landings and butterfish mortality (landings and discards) simultaneously, or a 3 inch minimum mesh requirement. Under the mixed species management program, the directed *Loligo* fishery would be closed when either the *Loligo* quota or the butterfish mortality cap quota (landings + discards) for the *Loligo* fishery is reached, whichever comes first. In this document, anytime the language "mortality cap" is used, it is meant to reference a butterfish mortality cap program for the *Loligo* fishery. The butterfish mortality cap program for the *Loligo* fishery would control the sum of butterfish landings and discards in the *Loligo* fishery so as to facilitate rebuilding and protection of the butterfish stock after it rebuilds.

Also in years 2-5, but as an alternative, or in addition, to the mixed species approach, the Council could choose alternatives from measures 2-4 (mesh size increases, changes to the current *Loligo* mesh exemption program, and/or gear restricted areas as summarized below and detailed later). The analysis contained in the DSEIS will show however that as stand alone management actions, only measure 1 alternatives (mortality cap or the 3 inch minimum codend mesh requirement) are likely to be successful in the long run.

The reader will note that a 3 inch minimum codend mesh requirement for *Loligo* vessels appears twice, as Alternative 1E and Alternative 2E (codend mesh requirements). This is partly an artifact of how the Alternatives were developed though the Council process, and partly because the 3 inch minimum codend mesh requirement and the butterfish mortality cap for the *Loligo* fishery are most likely to be effective as stand-alone actions in terms of rebuilding. As such, it is useful to have the 3 inch minimum codend mesh requirement in both the Measure 1 group as well as the Measure 2 group to facilitate comparison with other related Alternatives in each Measure.

7.1.1 Alternatives Considered for Implementing the Butterfish Rebuilding Plan

- Alternative 1A: No Action (Maintain 2008 annual specifications for butterfish)
- Alternative 1B: Butterfish rebuilding program with butterfish mortality cap implemented to control total annual fishing mortality on butterfish with the seasonal allocation of the butterfish mortality cap based on the current allocation of *Loligo* quota distribution by trimester as follows: trimester 1= 43%; trimester 2=17% and trimester 3=40% (based on the current *Loligo* quota allocation by trimester)
- Alternative 1C: Butterfish rebuilding program with butterfish mortality cap implemented to control total annual fishing mortality on butterfish with the seasonal allocation of the butterfish mortality cap based on recent *Loligo* landings

(2002-2006) by trimester as follows: trimester 1= 50%; trimester2=17% and trimester 3=33%

- Alternative 1D: Butterfish rebuilding program with butterfish mortality cap implemented to control total annual fishing mortality on butterfish with the seasonal allocation of the butterfish mortality based on the bycatch rate approach as follows: trimester 1= 65.0%; trimester2=3.3% and trimester 3=31.7%
- Alternative 1E: Implement a 3.0 inch minimum mesh requirement in the directed *Loligo* fishery **(no mortality cap)**

Mixed Species Management Model Description

Under Alternatives 1B-D, the directed fishery for butterfish would be limited per the fishing mortality rates specified, and a butterfish mortality cap program for the *Loligo* fishery would be implemented. Since NMFS Observer data show that the majority of butterfish bycatch occurs in the *Loligo* fishery, the Council is only proposing a mortality cap program for the *Loligo* fishery and the cap amount would be 75% of the ABC (allocated by *Loligo* trimesters- see appendix v for details). The remaining 25% of the ABC would cover harvest and discard mortality in other fisheries. The process for closing the directed butterfish fishing will generally remain the same as in the 2008 specifications. If the directed butterfish fishery is closed, *Loligo* moratorium vessels and all other vessels would be subject to the closure-related incidental trip limits set in the annual specifications. Council staff, in coordination with the SMB Monitoring Committee will analyze NMFS dealer weighout data and observer program data on an ongoing basis during the annual specification process to determine if the rebuilding program constrains overall mortality, and the Council will consider changes to the rebuilding program as necessary. If problems are detected, the SMB Committee will request further analysis and management recommendations through the annual specification process or an amendment or framework as necessary and appropriate.

Since *Loligo* is allocated by trimester, the butterfish mortality cap would also be allocated by trimester. The butterfish mortality cap for the *Loligo* fishery could be allocated based on: the current seasonal allocation of the *Loligo* quota (1B), recent *Loligo* landings (1C), or an alternative butterfish bycatch allocation which takes into account the seasonal allocation of the *Loligo* quota and expected butterfish discard rates by trimester (1D). The directed *Loligo* fishery would close when the pre-specified closure trigger (80%-90% set during the annual specifications process- see **5.3.1**) of the butterfish mortality cap for the *Loligo* fishery for each trimester is harvested. The three mortality cap alternatives would have the same annual quota, so the differences between them are primarily economic- they would primarily affect *when* the directed *Loligo* fishery would close, not overall butterfish mortality.

Tracking of the butterfish mortality cap would parallel tracking of DAH, however butterfish landed **or discarded** by vessels landing more than 2,500 pounds of *Loligo* would count against the butterfish mortality cap for the *Loligo* fishery. Mortality cap landings will be tracked by NMFS Fishery Statistics Office and its quota monitoring program. Discard rates generated though a new observer program (detailed in later sections) will be applied to mortality cap landings of *Loligo* to estimate mortality cap discards. For example, consider we knew that on average, **1** pound of butterfish was discarded per **20** pounds of *Loligo* kept. If **4000** pounds of *Loligo* were kept on a trip, one could estimate that 200 pounds of butterfish were discarded (**4000/20*1=200**). When the sum of mortality cap butterfish landings plus mortality cap estimated butterfish discards reaches a specified trigger (described below) in each *Loligo* trimester, the directed *Loligo* fishery would be closed.

Alternatives 1B-D would require the development of a completely new system to monitor and regulate the mortality levels of butterfish in the directed *Loligo* fishery that include substantially increased observer coverage levels (industry-funded), vessel catch reporting, and possible changes to dealer catch reporting. A description of the level of sea sampling required to achieve acceptable levels of precision of estimates of total butterfish mortality (landings and discards) in the *Loligo* fishery is given in Appendix iii and the *Loligo* sea sampling protocol is described in Appendix iv. In summary, vessels which intend to participate in the directed *Loligo* fishery would be required to notify NMFS of their intention to make a directed *Loligo* trip and could be required to carry an observer. Vessels that do not notify for a specific trip would not be permitted to possess more than 2,500 pounds of *Loligo* for that trip.

Industry would be required to pay the at-sea portion of this program. The level of coverage necessary to estimate the butterfish bycatch rate in the directed *Loligo* fishery with an acceptable level of precision (30% CV) would require a roughly 5-6 fold increase in observer coverage relative to recent levels of sea sampling by NMFS. In addition to the greatly increased cost to industry, the increased level of observer coverage would substantially increase NMFS administrative costs associated with implementation of the new management system. Another consideration is that regulation of the *Loligo* fishery under this system would be additionally based on a statistical estimate of total butterfish mortality (calculated by NMFS in cooperation with Council staff) in that fishery rather than just the current relatively simple accounting of *Loligo* landings. The statistical estimation procedure would be accompanied by an associated statistical risk that the resulting butterfish mortality estimates are either too high or too low.

Under Alternative 1E, the directed fishery for butterfish would be limited per the fishing mortality rates specified above and in the FMP, and a permanent minimum codend mesh size requirement of 3 inches would be implemented in the *Loligo* fishery (would not include a mortality cap for the *Loligo* fishery feature). The details of a 3-inch codend mesh size measure are described below in measure 2 (codend mesh requirements), but a codend mesh size of 3 inches will reduce the discard of most butterfish juveniles and some spawners, thereby increasing spawning stock biomass (assuming effort did not increase in the future so as to offset the effect of the greater rate of escapement of butterfish spawners).

The process for closing directed butterfish fishing will generally remain the same as in the 2008 specifications (80% of DAH). All butterfish landings would count against DAH to determine when the directed butterfish fishery was closed. If the directed butterfish fishery is closed, *Loligo* moratorium vessels and all other vessels would be subject to the closure-related incidental trip limits set in the annual specifications. These limits would control directed fishing for butterfish.

<u>Potential impacts on butterfish and *Loligo* stocks</u>

The action alternatives relative to the butterfish mortality cap for the *Loligo* fishery (1B - 1D) are intended to directly control total fishing mortality for butterfish in the *Loligo* fishery, the primary source of fishing mortality for the overfished butterfish stock (NEFSC 2004), on a year-round basis. Because these alternatives would directly control butterfish fishing mortality in the *Loligo* fishery, it is expected that they would provide the best chance of controlling fishing mortality on butterfish relative to other alternatives considered in this amendment, especially in the long run, by protecting both juveniles and spawners. Therefore, the action alternatives 1B-1D, as stand alone measures, have the best chance of achieving the goal of rebuilding the butterfish stock to B_{msy} and/or to maintain the butterfish stock at a sustainable level in the long term once the B_{msy} level is reached.

The impact of these alternatives on the *Loligo* stock will depend on the level of fishing effort expended in the *Loligo* fishery prior to a fishery closure compared to the status quo (no action - alternative 1A). As stand alone measures, whether or not the mortality cap on butterfish for the *Loligo* fishery is reached prior to the *Loligo* quota being taken depends on a number of factors. The first is the level of ABC specified for a given year. Determining when a fishery closure will occur due to the mortality cap for the *Loligo* fishery being is reached for a given level of ABC is difficult to quantify. Since ABC for butterfish will increase as a function of butterfish abundance, encounter rates with butterfish in the *Loligo* fishery will also be expected to increase as ABC for butterfish is increased. Therefore, higher ABC specifications for butterfish in the future would not necessarily translate into a longer season before the mortality cap is triggered and the *Loligo* fishery is closed (see section 7.5.1 for additional description and quantitative treatment of this issue).

Perhaps the most important factor in this regard is the degree to which *Loligo* fishermen are capable of reducing their incidental take of butterfish over the range of butterfish stock sizes likely to occur during the rebuilding horizon (i.e., between ½ B_{msy} and B_{msy}). The primary purpose of action alternatives 1B-1D was to give the *Loligo* fishing industry the opportunity to find novel and innovative ways to reduce their discard rate of butterfish. If *Loligo* fishermen are successful in avoiding butterfish to a greater degree than in the past, then it is possible that the *Loligo* quota could be the limiting factor which would trigger closure of the directed *Loligo* fishery in a given trimester under action alternatives 1B-1D (assuming the appropriate ABC for butterfish is specified; see Section 7.5.1). If this is the case, then the level of fishing effort under action alternatives 1B-1D would not differ from those under the no action alternative (status quo). If this scenario occurs, then the butterfish mortality targets specified under the rebuilding plan for the *Loligo* fishery may be met with minimal change in fishing effort in the *Loligo* fishery relative to the status quo.

Given the degree of spatial and temporal overlap of *Loligo* and butterfish throughout the range of both species identified in analyses conducted by the FMAT, it is unlikely that *Loligo* fishermen will be able to avoid the incidental take of butterfish. In addition, Figure 70 shows the spatial distribution patterns of co-occurrence during fall and winter in relation to *Loligo* fishery effort during these two seasons. It is important to note that high bycatch rates of butterfish can occur on a per-tow basis as a result of the species' schooling behavior. Thus, it appears likely that *Loligo* fishermen will be required to significantly alter their current fishing practices to reduce their incidental take of butterfish (e.g., introduce novel gear modifications). If *Loligo* fishermen are unable to alter their fishing practices in a manner that significantly reduces either their encounter rates with butterfish or the retention rate of butterfish encountered, then it is likely that the butterfish morality cap for the *Loligo* fishery under alternatives 1B-1D would be reached prior to the *Loligo* quota being taken and the fishery would close earlier relative to the status quo (see section 7.5.1). In this case, fishing effort in the *Loligo* fishery would be reduced relative to the no action alternative (i.e., status quo). Under this scenario, fishing effort reductions due to the mortality cap for the *Loligo* fishery under the action alternatives 1B-1D being reached first would reduce fishing mortality on *Loligo* thus reducing the chance that overfishing of the *Loligo* stock could occur. However, early closure of the fishery prior to the *Loligo* quota being taken would have negative economic consequences for the *Loligo* fleet which are discussed in Section 7.5.1. None the less, the primary purpose of the action alternatives 1B- 1D was to give the *Loligo* fleet the opportunity to find innovative ways to reduce their butterfish bycatch as opposed to other, more indirect methods, which would generally compromise the efficiency of the *Loligo* fishery in the process of reducing butterfish discards. Another issue that arises is the potential for exacerbation of the derby aspects of the *Loligo* fishery related to the attainment of the butterfish mortality cap for the *Loligo* fishery. That is, it is possible that *Loligo* fishermen will engage in a secondary derby in a race to catch *Loligo* prior to the butterfish mortality cap being reached. While it is impossible to quantify the change in overall effort by trimester under this exacerbated derby scenario, effort would most likely shift temporally to the earlier portion of each trimester.

As stand alone measures, alternatives 1B and 1C are expected to have similar impacts since there is not much contrast between the two alternatives in terms of the seasonal distribution of the butterfish mortality cap for the *Loligo* fishery. Alternative 1B is based on the current seasonal allocation of the *Loligo* quota, so it is more closely aligned with the Council's intent relative to the seasonal distribution of the *Loligo* quota. Alternative 1C is based on the seasonal distribution of recent *Loligo* landings. During the most recent period of landings upon which the distribution of the mortality cap for the *Loligo* fishery is based under alternative 1C, there has been a seasonal effort shift to the first trimester relative to the historical distribution of landings. In contrast, alternative 1D would allow for a higher amount of the total annual mortality cap for the *Loligo* fishery for butterfish to be allocated to trimester 1 because of the higher *Loligo* allocation in that period and bycatch rates are historically highest during that period. Since this alternative accounts for both the level of *Loligo* quota allocation and the expected butterfish bycatch rate, it likely has the best chance of accomplishing the butterfish mortality cap goal and minimizing the chance of a closure related to butterfish in any given trimester (relative to alternatives 1B and 1C). However, given that the mortality cap allocation to trimester 2 is relatively low, the chance of premature closure in period 2 would appear to be greater relative to alternatives 1B and 1C. It should also be noted that since alternative 1D has the lowest mortality cap during the summer months, is provides the greatest amount of protection to butterfish spawners. As noted above, while these alternatives would achieve the fishing mortality goals for butterfish outlined in the rebuilding plan, negative economic consequences for participants in the *Loligo* fishery are likely under this scenario (see section 7.5.1). In addition, because Alternative 1D has the lowest butterfish cap during Trimester II (i.e. during the butterfish spawning period), earlier Trimester II closures would protect spawning butterfish.

Butterfish landings are and will be capped by closing the directed fishery once an annual harvest limit is reached. Because the mortality cap program for the *Loligo* fishery places a cap on total mortality for the *Loligo* fishery, it caps discards of butterfish by that fleet which accounts for most butterfish discards. With landings capped, and with discards by the fleet which accounts for most of the discards capped, the most significant sources of human-related butterfish (all sizes) mortality will be controlled. This will help increase the spawning stock biomass of butterfish, increasing the probability of high recruitment, and in turn protect future age classes entering the fishery to help perpetuate healthy butterfish populations.

Another issue relative to the action alternatives 1B-1D achieving the butterfish mortality rates goals established in this amendment is the level of discards that would occur in other fisheries. The mixed species management system proposed in this amendment only explicitly controls butterfish mortality in the *Loligo* fishery. Since NMFS Observer data show that the majority of butterfish bycatch occurs in the *Loligo* fishery, the Council is only proposing a mortality cap program for the *Loligo* fishery and the cap amount would be 75% of the ABC (allocated by *Loligo* trimesters). The remaining 25% of the ABC would cover harvest and discard mortality in other fisheries. Council staff, in coordination with the SMB Monitoring Committee will analyze NMFS dealer weighout data and observer program data on an ongoing basis to check if this system constrains overall mortality and the Council will consider changes to the rebuilding program as necessary.

Perhaps the most important factor relative to the mortality cap program for the *Loligo* fishery achieving it's objectives is the degree to which the level of butterfish stock abundance is accurately assessed prior to setting the butterfish ABC for given year. If butterfish abundance is overestimated, then the mortality cap would set at too high a level and stock recovery could be compromised. Conversely, if the ABC is set too low, then rebuilding would be accelerated but at significant economic costs to the *Loligo* industry (see section 7.1.5).

Under alternative 1E, the Council would not implement a butterfish mortality cap under the rebuilding plan, but rather would rely on an increasing the minimum mesh requirement in the *Loligo* fishery to 3 inches (76 mm) to achieve the necessary reductions in butterfish discards to rebuild the butterfish stock to B_{msy}. As a stand alone measure, the impacts of this alternative are identical to alternative 2E discussed under the options to increase the minimum codend mesh size in the *Loligo* fishery. As noted in that section, an increase in butterfish spawning biomass will be required to rebuild the butterfish stock. 50 % of butterfish are mature at a length of 12cm (4 ¾ inches) (O'Brien et al. 1983). In a pound net, a codend mesh size of 67mm or 2 5/8 inches will provide escapement for most juveniles, half of 12cm (4 ¾ inches) individuals (O'Brien et al. 1983 indicates these are half juveniles and half adults), and a portion (less than half) of individuals who are greater than 12cm or 4 ¾ inches (i.e. mostly larger spawners) (Meyer and Merriner 1976). 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 escapements (pers com L. Hendrickson). A year-round reduction in the retention of butterfish in the *Loligo* fishery would increase the spawning biomass of the butterfish stock under alternative 1E (identical to alternative 2E) relative to the status quo. As a result, the chances of stock rebuilding under alternative 1E are greatly increased relative to no action (status quo).

Impacts Associated with Butterfish Mortality Cap Program for the *Loligo* fishery Combined with Mesh Size Increase

If the Council chooses one of the action alternatives relative to the establishment of a butterfish morality cap program for the *Loligo* fishery (i.e., alternatives 1B, 1C, or 1D), then an additional measure relative to increasing the minimum mesh size in the *Loligo* fishery could also be selected. It is assumed that if one of the action alternatives for the butterfish mortality cap is selected, then the upper range of mesh sizes for the *Loligo* fishery that would be considered by the Council would be limited to 2 ½ inches (64 mm) because the butterfish mortality cap would be providing the primary protection for butterfish and, while Amendment 10 seeks to reduce discards in general, discards of butterfish are most critical for the purposes of this Amendment. Also, any mesh increase would add to the substantial economic burden imposed by the mortality cap program (see 7.5.1 (mortality cap costs) and 7.5.2 (mesh increase costs)) and the mortality cap program alone will reduce general discarding to the extent that the *Loligo* fishery is closed. Combining the mortality cap with a 3 inch mesh was not contemplated by the Council.

There is a possible interaction between the butterfish mortality cap and a codend mesh size increase that Council staff thought warranted additional discussion. This interaction hinges on whether retention of *Loligo* or butterfish is reduced more by a codend mesh size increase. If *Loligo* retention is reduced more than butterfish retention by a codend mesh size increase, then, butterfish discard rates per unit of *Loligo* would go up, in effect closing the *Loligo* fishery earlier. If butterfish retention is reduced more than *Loligo* retention by a codend mesh size increase, then butterfish discard rates per unit of *Loligo* would go down, in effect extending the directed *Loligo* season under a mortality cap.

So the question becomes will a codend mesh size increase affect butterfish or *Loligo* retention rates more? As noted in section in section 7.1.2, there is little published mesh selectivity information for *Loligo pealeii*. Therefore, it is difficult to reliably quantify the reductions in retention by size class for squid encountered in the *Loligo* fishery for a given mesh size based on a published selection factor specific to *L. pealeii*. The only direct method currently available to quantify the relative retention of *Loligo* by mesh size, other than using selection factors published for *Loligo* congeners, is an evaluation of the relative catch rates of *Loligo* and butterfish using unpublished data collected in the NMFS at sea observer program. Analyses detailed in section 7.1.2 indicate that increasing the minimum mesh size in the *Loligo* fishery from 50mm (just above the current minimum) to 55mm (alternative 2B) would decrease *Loligo* catch rates by 22%, butterfish by 64%, and all other species combined by 35%. The analysis also indicates that increasing the *Loligo* minimum mesh from 50mm to 60mm (alternative 2C) would decrease *Loligo* catch rates by 15%, butterfish by 67%, and all other species combined by 21%. Butterfish retention reductions appear to be greater than *Loligo* retention reductions. In other words, under a butterfish mortality cap system for the *Loligo* fishery, a mesh size increase would either mean less butterfish taken by the time the *Loligo* quota is reached or more *Loligo* taken by the time the butterfish quota is reached, at which time the *Loligo* fishery would be closed before the full *Loligo* quota had been taken.

7.1.2 *Loligo* minimum mesh size requirements

- Alternative 2A: No Action (Maintain 1 $^{7/8}$ inch (48 mm) minimum codend mesh requirement)
- Alternative 2B: Increase minimum codend mesh size to $2^{1/8}$ inches (54 mm)
- Alternative 2C: Increase minimum codend mesh size to $2^{3/8}$ inches (60 mm)
- Alternative 2D: Increase minimum codend mesh size to 2 1/2 inches (64 mm)
- Alternative 2E: Increase minimum codend mesh size to 3 inches (76 mm)

Potential impacts on butterfish stock

The action alternatives (2B - 2E) are primarily intended to reduce the incidence of butterfish discarding in the *Loligo* fishery. Over 2001-2006, directed *Loligo* trips accounted for 68% of all butterfish discards recorded by the NMFS Observer Program (**Table 15**). The potential for a codend mesh size increase in the *Loligo* fishery to positively impact the butterfish stock is primarily dependent on: the magnitude of the mesh size increase, the frequency of encounters by the fishery with butterfish, the degree to which a given mesh size increase will reduce the retention of butterfish (compared to the current retention level), and escapement survival rates. 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. For example, Figure 70 shows the spatial distribution patterns of co-occurrence during fall and winter in relation to *Loligo* fishery effort during these two seasons. It is important to note that high bycatch rates of butterfish can occur on a per-tow basis as a result of the species' schooling behavior. 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.

50 % of butterfish are mature at a length of 12cm (4 ¾ inches) (O'Brien et al. 1983). In a pound net, a codend mesh size of 67mm or 2 5/8 inches will provide escapement for most juveniles, half of 12cm (4 ¾ inches) individuals (O'Brien et al. 1983 indicates these are half juveniles and half adults), and a portion (less than half) of individuals who are greater than 12cm or 4 ¾ inches (i.e. mostly larger spawners) (Meyer and Merriner 1976). 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 escapements (pers com L. Hendrickson).

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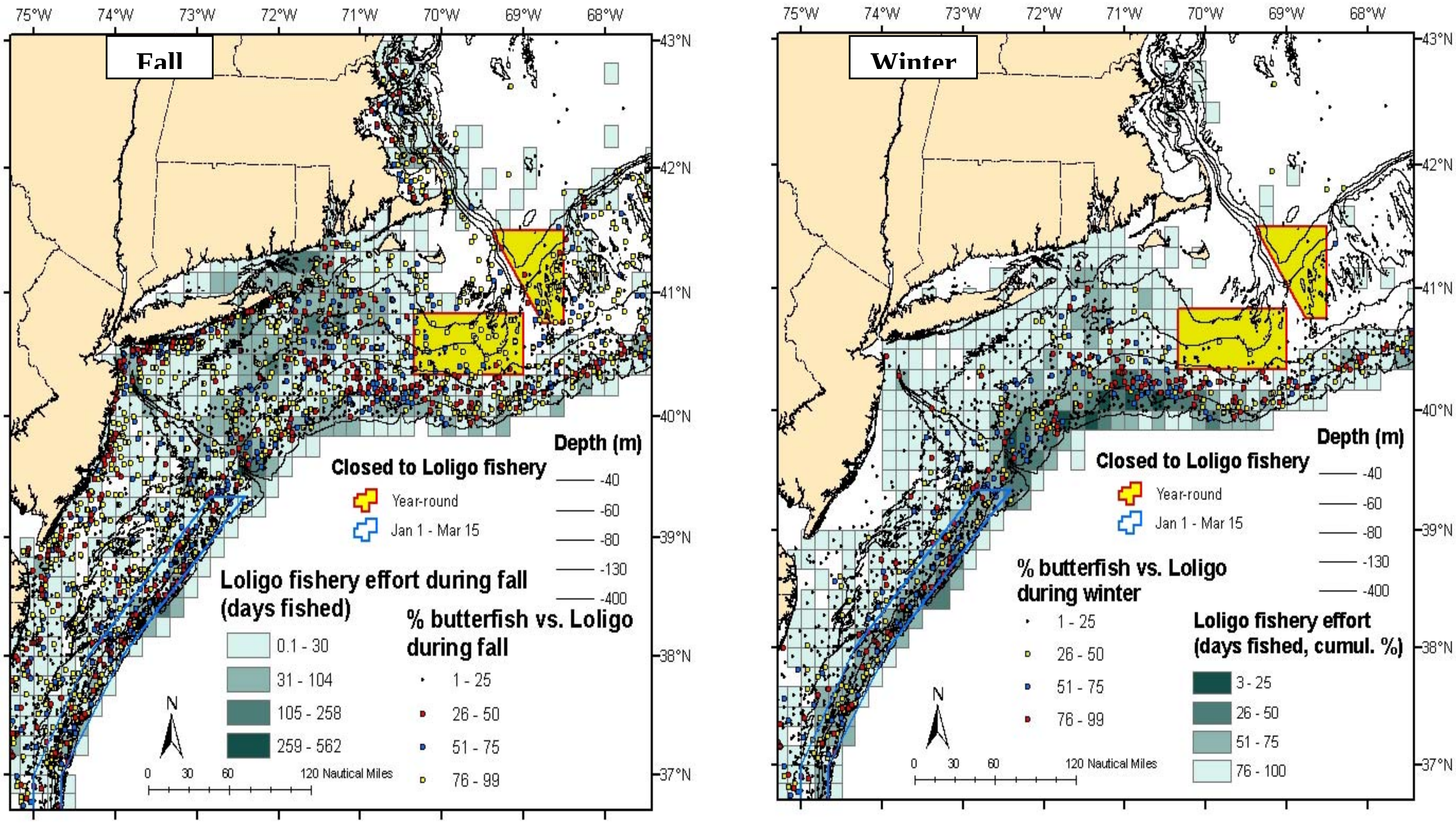


Figure 70. Spatial distribution of butterfish and *Loligo* co-occurrence (% butterfish vs. *Loligo* numbers per tow) during fall and winter, based on NEFSC bottom trawl surveys (1992-2003), in relation to *Loligo* fishery effort (days fished, 1997-2004) during these two seasons.

As an example, a codend mesh size of 76 mm (3 inches) would retain 50% of the butterfish 13.7 cm (5 $^{3/8}$ inches) in fork length.

As long as effort does not increase dramatically, a year-round reduction in the retention of butterfish greater than or equal to 12 cm in the *Loligo* fishery would increase butterfish spawning biomass, which would increase the probability of higher recruitment. Increased recruitment and increased butterfish spawning biomass are necessary to rebuild the butterfish stock and mesh size increases will decrease fishing related mortality and facilitate rebuilding.

For all of the codend mesh size increase alternatives, the “effective" codend mesh sizes will actually be smaller than estimated due to masking effects of the codend strengtheners (codend covers) used in the *Loligo* fishery (pers com Hendrickson, Hendrickson 2005). The use of covers will result in less butterfish escapement (lower L_{50} values) than estimated from butterfish L_{50} values for a codend liner without a cover. While the effect has not been quantified, selecting the next larger mesh size option than one would initially select could at least partially compensate, and possibly overcompensate, for the cover issue. The amount of butterfish escapement associated with each alternative will depend on the characteristics of the codend covers used in the *Loligo* fishery: the length and circumference of the cover, as well as the cover mesh size and orientation (square versus diamond mesh) and hanging ratio. NEFSC Observer data indicate that most codend covers used in the *Loligo* fishery consist of double-twine, diamond mesh with chaffing gear but some covers are also hung square. Both cover types consist of mesh sizes larger than the regulatory minimum (4.5 inches/ 114mm); with a mode at 155 mm (6.1 in.) for diamond mesh covers and a mode of 240 mm (9.4 in.) for square mesh covers (Figure 71). Diamond mesh codend covers allow less escapement than square mesh codends because the latter hold their shape and remain open under load and diamond meshes do not.

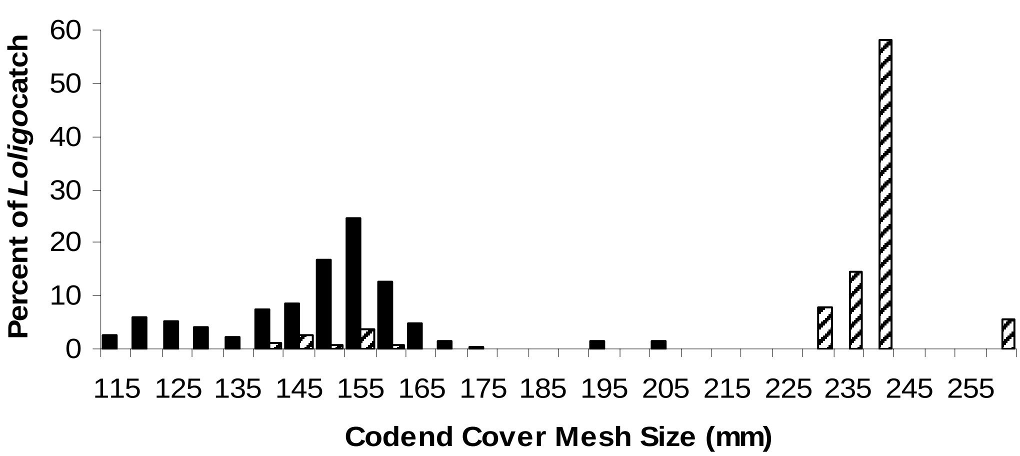


Figure 71. Percentage of *Loligo* landings in the directed fishery by codend cover mesh size, for diamond mesh versus square mesh covers, based on Observer Program data from 1996-2006.

Especially considering the codend cover issue, Alternative 2E (codend mesh size increase to 76 mm) would provide the most benefit to the butterfish stock among the alternatives under consideration because it would increase spawning biomass (by allowing 50% of 13.7 cm butterfish to escape and thereby reducing the retention level of partially mature age 1 butterfish) as well as allowing a larger fraction of the age 0 fish to survive. According to actual codend mesh size measurements for all otter trawl tows sampled by the NEFSC Observer Program during 1996-2006, the highest percentage (45%) of butterfish discards (weight) (Figure 28 A) and the highest number of tows (frequency of encounter) containing butterfish (20%, Figure 28 B) occur with the use of 46-50 mm mesh codends (inside stretched mesh). Both the Observer Database and the Vessel Trip Report Database indicate a codend mesh size mode in the *Loligo* fishery of 51-55 mm, representing 30% and 34% of the *Loligo* kept weight and estimated landings, respectively (Figure 28C). However, because of the possibility of differential methods of reporting mesh size in the VTR database (inside stretched versus knot-center-to-knot-center) and observed misreporting of larger codend mesh sizes than actually used on some *Loligo* trips (in order to meet the hake trip limit regulatory requirements), the Observer Database is used to characterize codend mesh sizes currently used in the *Loligo* fishery.

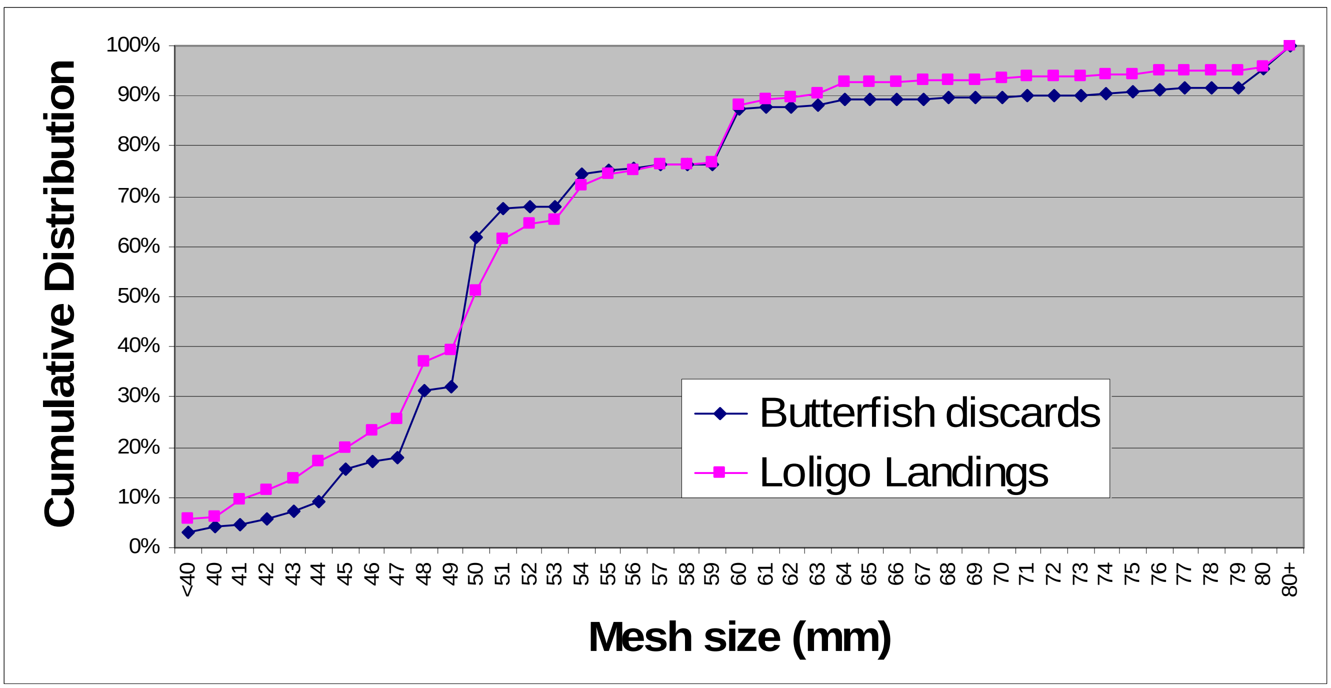
For the action alternatives, benefits to the butterfish stock will increase as codend mesh size increases. A mesh size increase to 2 $^{1}/_{8}$ inches (54 mm) would have the least positive impact, followed by increases to 2 $^{3}/_{8}$ inches (60 mm), 2 $^{1}/2$ inches (64 mm), and 3 inches (76mm). Although mesh sizes less than 3 inches will increase juvenile butterfish escapement, they are not large enough to increase butterfish spawner escapement. Table 78 shows the cumulative percentages of observed discards accounted for by mesh sizes less than the proposed Alternatives (these are the discards that would be affected, though quantification of the effects is not reported). Table 79 shows the cumulative amounts of observed butterfish discards and *Loligo* landings accounted for by mesh size based on data from the Observer Database. The similarity in mesh sizes associated with butterfish discards and *Loligo* landings is noticeable and especially evident when the cumulative distribution of each is graphed by mesh size (Figure 72). While most butterfish discards occur with codend mesh sizes ≤ 51mm, the available escapement information suggests that there will still not be much (if any) escapement of spawners for codend mesh size increases to 2 $^{1}/_{8}$ inches (54 mm), 2$^{3}/_{8}$ inches (60 mm), or 2 $^{1}/2$ inches (64 mm). Only Alternative 2E will allow some escapement (50%) of butterfish spawners (≥12 cm FL).

Table 77. Cumulative percentages of butterfish discard weight and Loligo kept portion (pounds) affected by the various proposed codend mesh size increases. 1997-2006 Observer data.

Increasing mesh minimum to	Affects this percentage of butterfish discards	Affects this percentage of *Loligo* landings
54mm	68%	65%
60mm	76%	77%
64mm	88%	90%
76mm	91%	94%

Source: unpublished NMFS observer data

Figure 72. Cumulative distribution of butterfish discards and Loligo landings by mesh size. 1997-2006 Observer data.



Source: unpublished NMFS observer data

Table 78. Distribution of observed butterfish discards, Loligo landings by mesh size.
Source: Unpublished NMFS observer data 1997-2006)

Mesh Size (mm)	% Butterfish discards accounted for by mesh size	Cumulative % Butterfish discards accounted for by mesh size	% *Loligo* landings accounted for by mesh size	Cumulative % *Loligo* kept accounted for by mesh size
<40	3%	3%	6%	6%
40	1%	4%	0%	6%
41	1%	5%	3%	10%
42	1%	6%	2%	12%
43	2%	7%	2%	14%
44	2%	9%	4%	17%
45	6%	16%	3%	20%
46	2%	17%	3%	23%
47	1%	18%	2%	25%
48	13%	31%	11%	37%
49	1%	32%	2%	39%
50	30%	62%	12%	51%
51	6%	67%	10%	61%
52	0%	68%	3%	65%
53	0%	68%	1%	65%
54	6%	74%	7%	72%
55	1%	75%	2%	75%
56	0%	75%	1%	75%
57	1%	76%	1%	76%
58	0%	76%	0%	76%
59	0%	76%	0%	77%
60	11%	87%	12%	88%
61	0%	88%	1%	89%
62	0%	88%	1%	90%
63	0%	88%	1%	90%
64	1%	89%	2%	93%
65	0%	89%	0%	93%
66	0%	89%	0%	93%
67	0%	89%	0%	93%
68	0%	90%	0%	93%
69	0%	90%	0%	93%
70	0%	90%	1%	94%
71	0%	90%	0%	94%
72	0%	90%	0%	94%
73	0%	90%	0%	94%
74	1%	91%	0%	94%
75	0%	91%	0%	94%
76	0%	91%	1%	95%
77	0%	91%	0%	95%
78	0%	91%	0%	95%
79	0%	91%	0%	95%
80	4%	95%	0%	96%
80+	5%	100%	4%	100%

Continuing to allow fishing with 1 $^{7}/_{8}$ inch (48 mm) mesh codends (no action alternative) will maintain the current negative impacts, in terms of discard mortality, on the butterfish stock. For stocks that are overfished, such as butterfish, the no-action alternative will contribute to further deterioration of the stock and constrain rebuilding.

Potential impacts on the *Loligo* stock

Landings-related mortality

The quantitative 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. However, increased codend mesh sizes in the *Loligo* fishery should not increase landings-related fishing mortality on the *Loligo* stock because harvesting is currently controlled by seasonal (trimester) quotas.

Escapement-related mortality

In theory, *Loligo* fishing mortality could increase as a result of a mesh size increase if more *Loligo* escape (increasing the harvest effort needed), and if the *Loligo* that do escape are injured and die. However, 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 (though skin and fin damage from abrasions in tanks has been a significant source of mortality for *Loligo opalescens* held captive in tanks) (Yang et al 1986)). There are studies of other loliginid squid suggesting "loliginid squid are size-selected (by trawl codends) in a similar fashion to fish" (Hastie 1996). While it is likely that retention of at least smaller *Loligo* will be reduced as mesh size increases, the percent losses associated with such increases are unquantifiable due to the lack of published selectivity parameters for *L. pealeii.* If *Loligo* fishing mortality is increased as a result of increased effort due to escapement-related mortality, bottom trawl selectivity studies of other squid species indicate such increases will be rapidly mitigated by the fact that an initial 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). 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.

Among other data, data recorded in the unpublished NMFS Observer program include inside stretched mesh size, haul time in hours, and catch. Catch divided by haul time provides an estimate of catch rates (pounds per hour) and grouping by mesh size allows comparison of catch rates by mesh size. An analysis of unpublished NMFS Observer data indicates that *Loligo* catch rates for 55-60mm codend mesh are 22% less than catch rates for 50-55mm codend mesh (the 50-55mm range includes the largest number of directed *Loligo* hauls). Catch rates for 60-65mm codend mesh are 15% less than catch rates for 50-55mm codend mesh (Figure 78). These predicted reductions may be supported by the fact that a minimum codend mesh size of 60 mm inside stretched mesh historically supported an economically viable *Loligo pealeii* fishery in U.S. waters in 1978 (ICNAF 1978).

The no action alternative (2A) will maintain the same level of impact currently experienced by the *Loligo* stock. 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 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.

NEFSC Observer Program data for 1997-2006, while a subset of the total number of trips, indicate that mesh sizes less than 54 mm accounted for 65% of landed *Loligo* (Table 78). However, assuming that mortality related to escapement is minimal, the proposed alternative mesh sizes of 2 $^{1}/_{8}$ in. (54 mm), 2 3/8 (60 mm) and 2 ½ in. (64 mm) may have minimal impacts on the *Loligo* fishery because Observer data indicate that *Loligo* can be caught above these mesh sizes. In the Observer database, the proportions of *Loligo* caught above 2 $^{1}/_{8}$ in. (54 mm), 2 3/8 (60 mm) and 2 ½ in. (64 mm) are 25%, 11%, and 7% respectively. These percentages can also be viewed as the percent of *Loligo* kept in the Observer data that would not be affected by the relevant mesh size increase (Table 78).

In addition to the evaluation of the NEFSC Observer Program data, a 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 *Loligo* 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. A mesh selection factor of 1.9 was reported by Chris Glass (Northeast Consortium at the University of New Hampshire), in Fonseca et al. (2002), for *L. pealeii* caught in U.S. waters with codend mesh sizes of 1 $^{7/8}$ versus 2 $^{1/2}$ inches (diamond). Hastie (1996) reported similar selection factors, ranging from 1.86 to 1.99, for the congener *Loligo forbesi* and Ordines et al. (2006) reported selection factors of 0.85 and 1.45 for nominal mesh sizes of 40 mm diamond and square mesh, respectively, for the same species. Fonseca et al. (2002) reported a selection factor of 1.3 for *Loligo vulgaris* based on a covered codend mesh selectivity study. 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 1.3 and 1.9 for codend mesh sizes which retained a majority of the *Loligo* landings during 1997-2006.

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). Based on unpublished NMFS Observer data for 2001-2006, about 3% of *Loligo* caught on directed *Loligo* trips was discarded. 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 may be 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* landings in the U.S. directed fishery (Figure 73) and includes data for a codend mesh size of 2 $^{5/9}$ inches (65 mm), similar to the Alternative 2D mesh size increase of 2 $^{1/2}$ inches (64 mm).

The impacts of a codend mesh increase depend on relative difference in selectivity between the previous codend mesh size and the new mesh size. Table 79 shows relative increases in *Loligo* L50 (length at 50% retention) values, for codend liner mesh size increases to 54, 60, 64 and 76 mm diamond mesh, based on selection factors (SF) of 1.3 (for *Loligo vulgaris*) and 1.9 (*Loligo pealeii*). Codend mesh size bins are also described in terms of the percentage of the 1996-2006 landings that they represent. For example, the table indicates that for Alt. 2B (mesh size increase to 54 mm) and a SF of 1.3, an increase of 8mm is expected for vessels currently using 48 mm codend mesh (41-48 mm meshes comprised 28% of the *Loligo* kept during 1996-2006) and an increase of 4 mm in *Loligo* L_{50} is expected for vessels currently using 51 mm codend mesh (49-51 mm meshes comprised 26% of the *Loligo* kept during 1996-2006). It should be noted that the L_{50} ranges vary widely for the two selection factors and the precision of these estimates is unknown. As noted above, the trawl gear deployed in the *Loligo* fishery commonly includes a codend which has a large mesh cover or net strengthener surrounding the small mesh codend which tends have a masking effect. This masking effect of the actual codend mesh sizes would likely result in a decrease in escapement of small *Loligo* relative to the theoretical values reported here (i.e., the actual L50 value for a given codend mesh size would be lower due to masking by the cover).

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 74). Based on the *L. pealeii* size composition in the directed fishery, partial selectivity occurs at 70-260 mm. Given that 50% retention by the *Loligo* fishery occurs at a length of 140 mm (Figure 74), 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 1.3 (the L_{50} for *L. vulgaris*). Therefore, the results for the selection factor of 1.9 may be more appropriate.

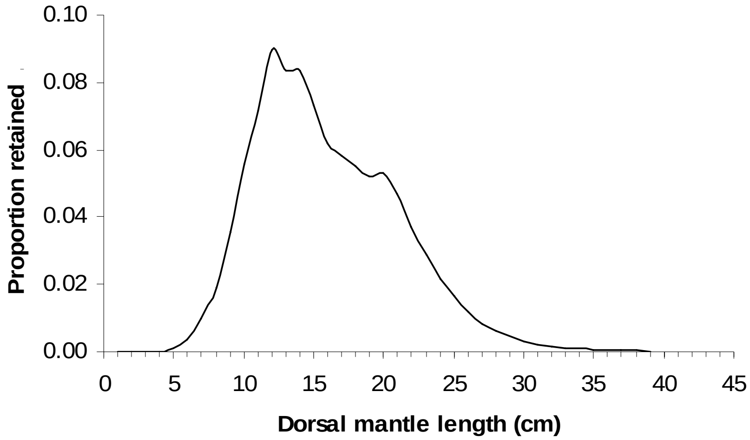


Figure 73. Length composition (proportion at length, cm) of *Loligo pealeii* landings from the U.S. directed fishery (during all months of the year) in 1991-2001.

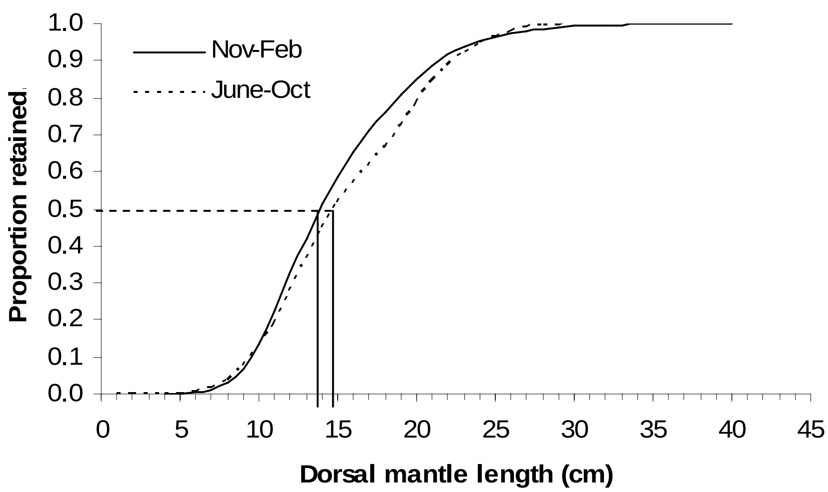


Figure 74. Proportion of *Loligo pealeii* landed, by length, in the directed fishery during November through February versus June through October, in 1991-2001.

Table 79. Loligo L50 Increases relative to current and increased mesh sizes.

Relative increases in *Loligo* L_{50} (length at 50% retention) values, for codend liner mesh size increases to 54, 60, 64 and 76 mm diamond mesh, based on selection factors (SF) of 1.3 (for *Loligo vulgaris*) and 1.9 (*Loligo pealeii*). Codend mesh sizes are shown as a percentage of the 1996-2006 landings that they represent. For example, the table indicates that for Alt. 2B (mesh size increase to 54 mm) and a SF of 1.3, an increase of 8mm is expected for vessels currently using 48 mm codend mesh (41-48 mm meshes comprised 28% of the *Loligo* landings during 1996-2006) and an increase of 4 mm in *Loligo* L_{50} is expected for vessels currently using 51 mm codend mesh (49-51 mm meshes comprised 26% of the *Loligo* landings during 1996-2006).

Codend liner mesh size bins (mm)	% of current *L. pealeii* landings in each mesh size bin	Mesh sizes (mm) used to calculate *Loligo* L_{50} increases	*Loligo* L_{50} (mm)		Resulting relative increase in *Loligo* L_{50} (mm) for each Alternative							
			SF = 1.3	SF = 1.9	Mesh increase to **54 mm (2B)**		Mesh increase to **60 mm (2C)**		Mesh increase to **64 mm (2D)**		Mesh increase to **76 mm (2E)**	
selection					1.3	1.9	1.3	1.9	1.3	1.9	1.3	1.9
≤ 40	4											
41-**48**	28	**48**	62	91	8	12	16	23	21	31	37	53
49-**51**	26	**51**	66	97	4	6	12	17	17	25	33	47
52-**54**	14	**54**	70	103	0	0	8	11	13	19	29	41
55-**57**	6	**57**	74	108	0	0	4	6	9	14	25	36
58-**60**	12	**60**	78	114	0	0	0	0	5	8	21	30
61-**64**	6	**64**	83	122	0	0	0	0	0	0	16	22
65-**76**	2	**76**	99	144	0	0	0	0	0	0	0	0
> 76	1											

NMFS Observer Mesh Catch Rate Analysis

Analyses of unpublished observer data suggest that increasing mesh sizes from 50mm (just above the current minimum and the most frequent mesh size (inside stretched) used for observed directed *Loligo* hauls) to 55mm would decrease *Loligo* catch rates by 22% and butterfish by 64%. Increasing mesh sizes from 50mm (50mm and 51mm are the most frequently used mesh sizes in the NMFS Observer data) to 60mm would decrease *Loligo* catch rates by 15% and butterfish by 67%. The analysis of observer data, which will be detailed below, suggests that an increase from the current mesh size of 1 7/8" (48mm) inches to 55mm (~2 1/8) or 60mm (~2 3/8) reduces catch rates of butterfish (and all incidental species combined) more than it would reduce catch rates of *Loligo*. Thus, even if effort is increased to make up for the reduced efficiency related to catching *Loligo*, the catch of butterfish would likely still be less based on these data. The reader should note the discussion on mesh size measurements in the areas of controversy section of the executive summary above.

The analysis examined observer data from 2001 (post scup GRAs) to 2006. First, trips where landings were comprised of at least 50% *Loligo* were selected. From these trips, only hauls where *Loligo* was identified as the target and that were actually observed were used in the analysis. This selection criterion resulted in a data subset of 320 directed *Loligo* trips and 2934 individual hauls (average haul duration equaled 2.85 hours). The observer data also include codend mesh measurements, haul duration, and amount of fish caught (landed and discarded by species). The catch rate of different species in pounds per hour by different cod-end mesh sizes was compared. The assumption here is that if (on average) a larger mesh size is catching less fish per hour, then some selectivity and escapement of smaller fish through the codend is occurring. There are a number of caveats to using the observer data for this analysis. First, the result technically only applies directly to this subset of observed trips with an average vessel, averaged across all observed fishing locations. Using this data set to predict the behavior of the *Loligo* fishery requires the assumption that the 320 observed trips are representative of all *Loligo* fishing trips in time and space. Recently, the observer program has attempted to survey a representative portion of the *Loligo* fleet. A comparison of the 2001-2006 monthly proportions of directed *Loligo* hauls of A) landings (NE Dealer Weighout Data) and B) numbers of observed hauls (Observer Data) in this subset shows rough agreement in terms of time, suggesting it may be reasonable to extrapolate the observer data to the entire *Loligo* fleet (Figure 75). Figure 75 should be interpreted as follows: over 2001-2006, February accounted for 14% of NMFS-observed hauls and 16% of landings in the dealer weighout database.

Figure 75 . Proportions of monthly directed *Loligo* observer hauls vs. Directed *Loligo* Dealer Weighout Landings

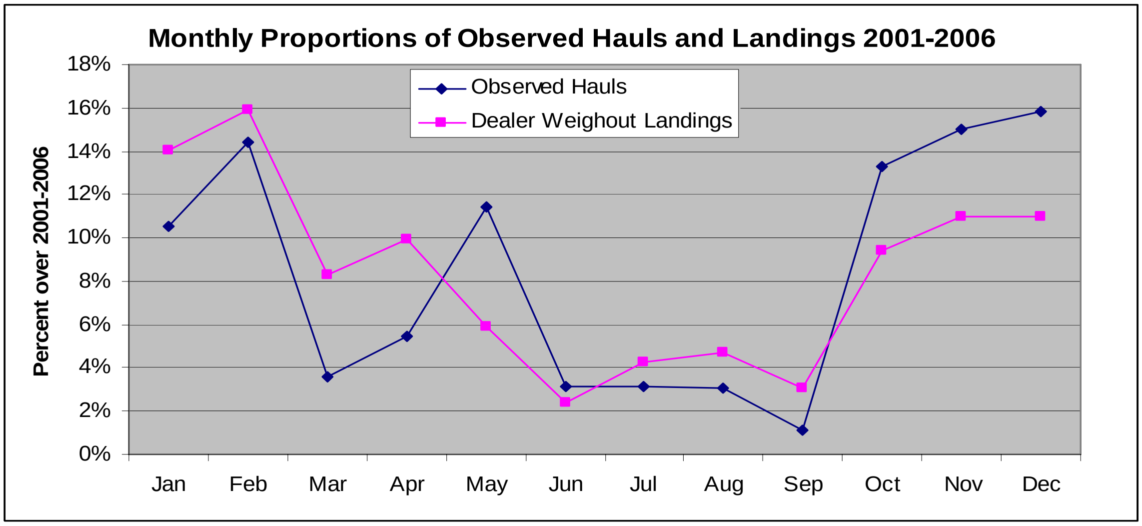


Figure 76 (winter) and Figure 77 (summer) show the allocation of the main statistical areas sampled of the directed *Loligo* observer trip landings and directed *Loligo* VTR trip landings 2001-2006. While not in perfect alignment, the distributions do show that the observer data is generally covering the areas where most of the *Loligo* effort is occurring.

Figure 76. Winter proportions of directed *Loligo* trips by STAT area VTR vs. Observer

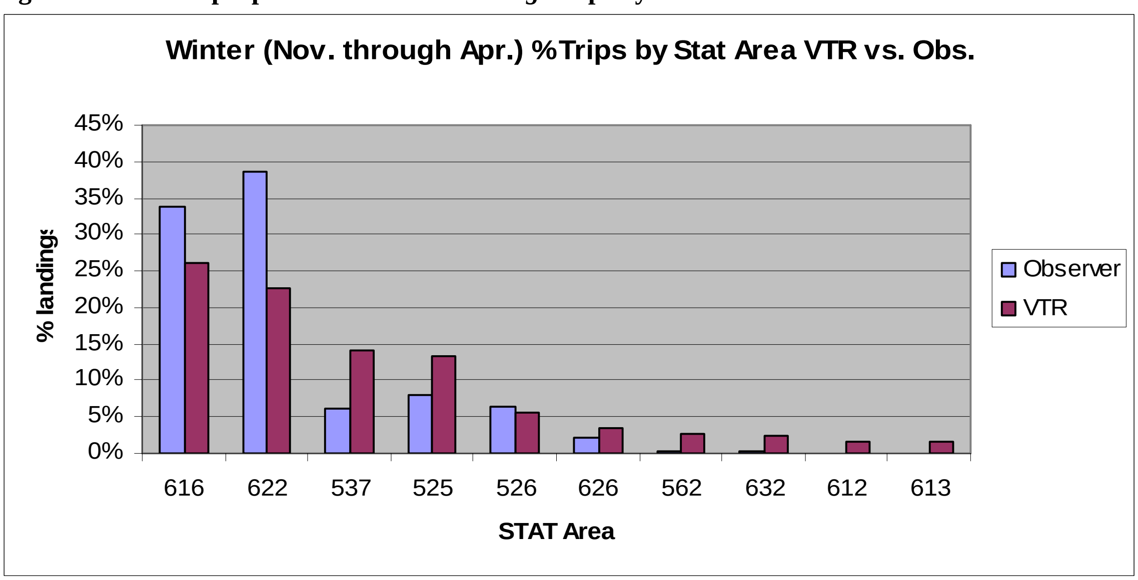
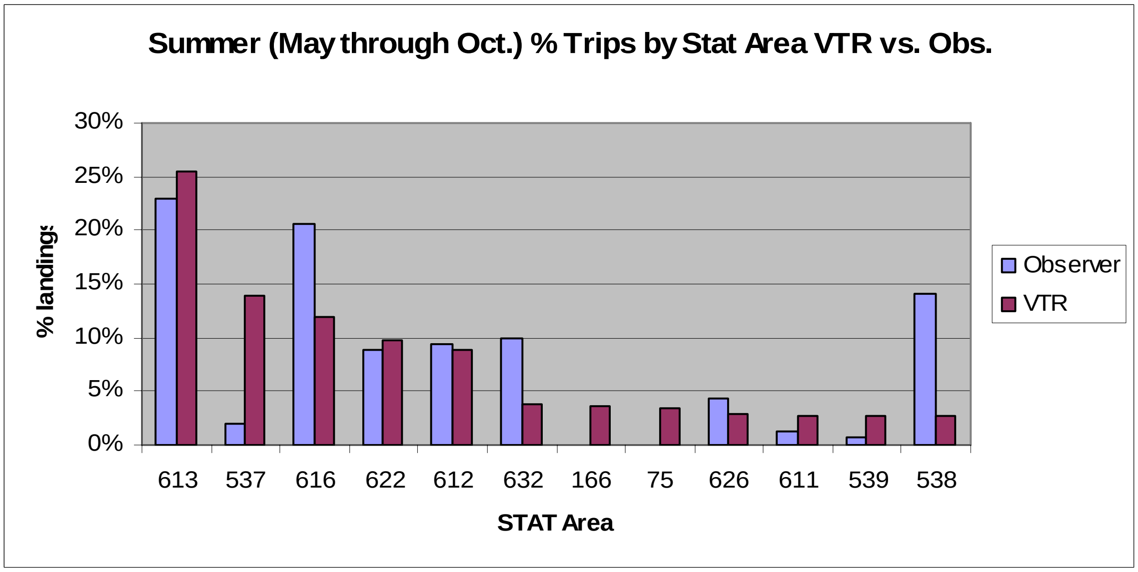


Figure 77. Summer proportions of directed *Loligo* trips by STAT area VTR vs. Observer



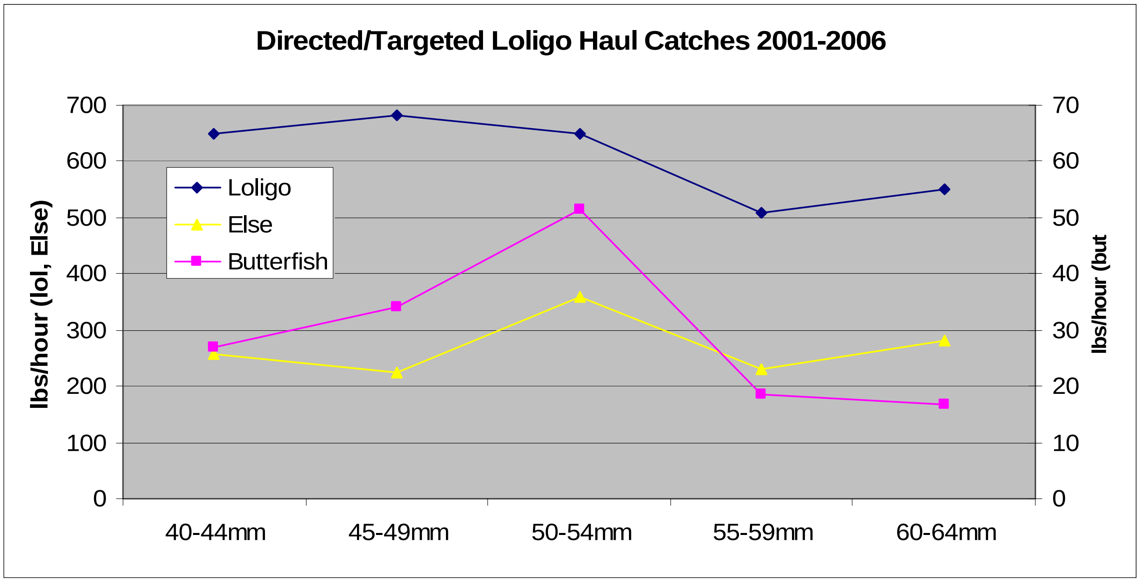
Codend mesh sizes were grouped into the categories described in Table 80. Analysis focused on those categories that had more than 200 hauls, such that sample size in the analyzed hauls would be relatively high. Table 80 indicates that the majority of the gear being used on observed hauls was in the 50-54mm range, i.e., slightly above the current *Loligo* minimum mesh size of 1 7/8 inches. Also, this measurement is the inside stretched mesh measurement and roughly corresponds to a 60mm mesh size that includes one knot (the measurement which includes one knot is often how the codend "mesh size" is described or reported by the fishing industry).

Table 80. Number of Hauls by mesh size in Mesh Analysis

Mesh Size Range	Number of Hauls
< 35mm	98
35-39mm	63
40-44mm	333
45-49mm	608
50-54mm	1051
55-59mm	229
60-64mm	401
65mm+	151

Figure 78 summarizes the findings of the analysis. It appears that the current most-used category of mesh size (50-54mm) has the highest catch rate per hour of butterfish. The reason why the 50-54mm mesh category has an apparent catch rate higher than smaller mesh sizes is unclear.

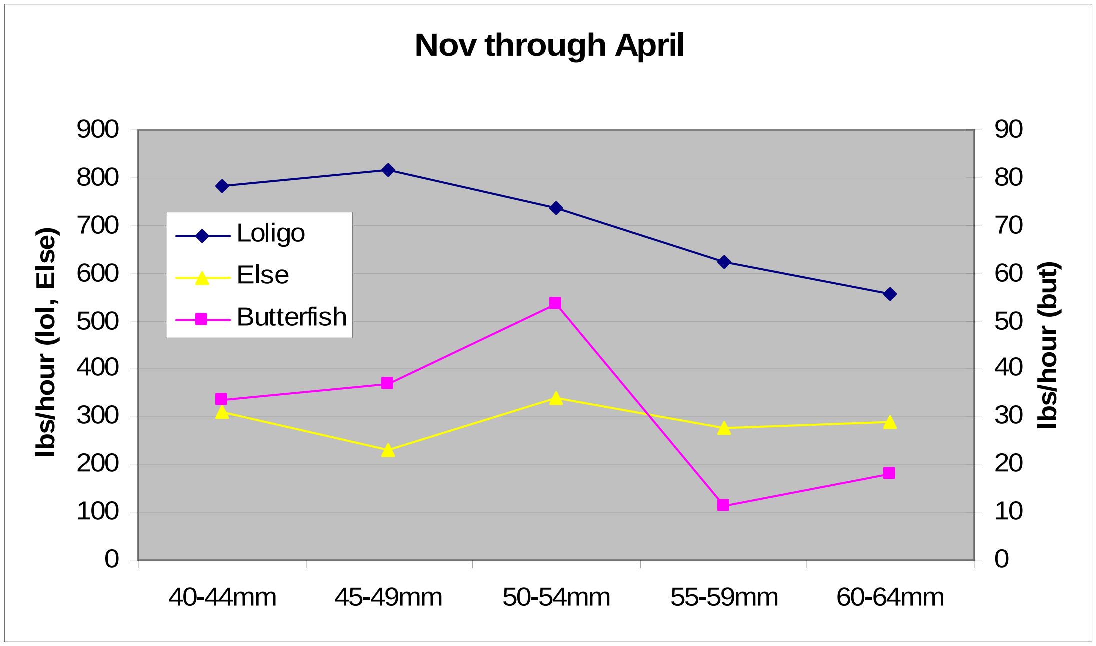
Figure 78. Directed/Targeted Loligo Haul Catches 2001-2006



Source: unpublished NMFS observer data

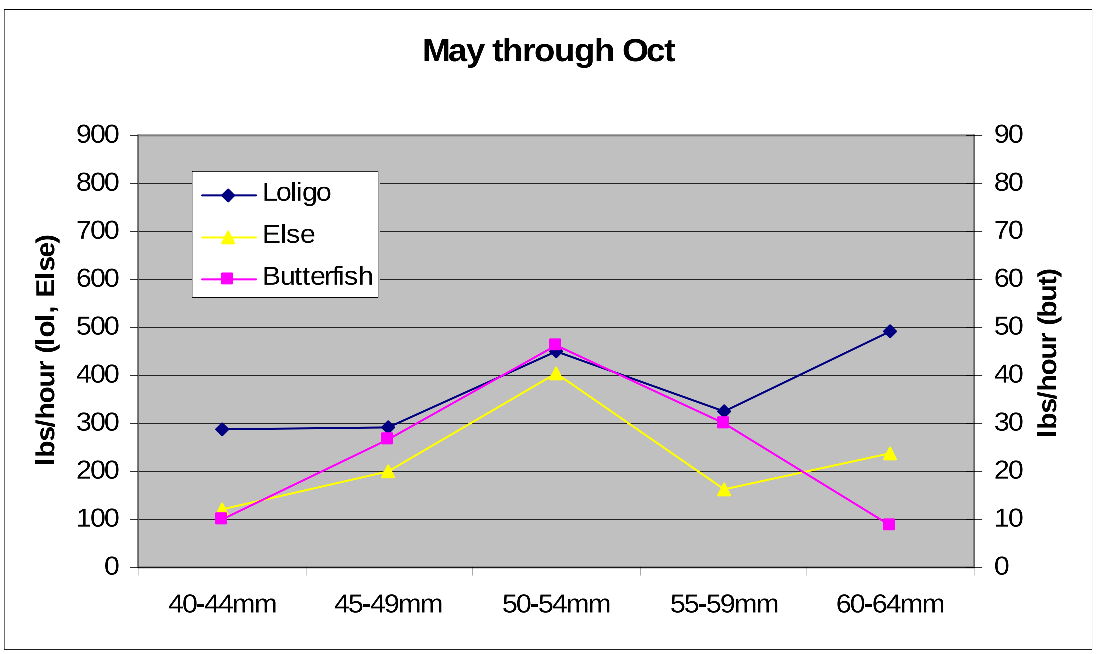
At this point in the analysis, discussion will focus on the differences in the catch rate per hour that observed between the 50-54mm category and the next two higher categories. It is assumed that the codend mesh sizes used by most vessels would fall into the 55-59mm category if a 55mm minimum mesh size was instituted, as one would expect the majority of meshes used to be at or slightly above the minimum specified. Likewise, the 60-64mm category should be representative of what would happen if a 60mm minimum codend mesh size was specified instituted. Figure 78 indicates that increasing the minimum codend mesh size required in the *Loligo* fishery 50mm (just above the current minimum) to 55mm would decrease *Loligo* and butterfish catch rates by 22% and 64%, respectively. Figure 78 also indicates that increasing the required codend mesh size from 50mm (just above the current minimum) to 60mm would decrease *Loligo* and butterfish catch rates by 15% and 67%, respectively. Industry has voiced concerns that the reduction in *Loligo* appeared relatively small only because there were likely other species "clogging" the net, but this does not appear to be the case since the grouping of "all other species combined" did decline with the larger mesh. Average *Loligo* catch rates over the course of the fishing year may not be reduced as much as indicated here because if all *Loligo* vessels are required to use larger codend mesh sizes, the small squid that escape may be available to the larger mesh size later in the season after they have grown. However, recall that experiments culturing squid have concluded that fin and skin damage is a major factor in cultured squid mortality (Yang et al., 1986), and that it is not clear what proportion of small squid extruded through the codend will actually survive to be caught later in the season. Figure 79 and Figure 80 show the catch rate changes by mesh by season.

Figure 79. Directed/Targeted Loligo Haul Catches 2001-2006 Nov-Apr



Source: unpublished NMFS observer data

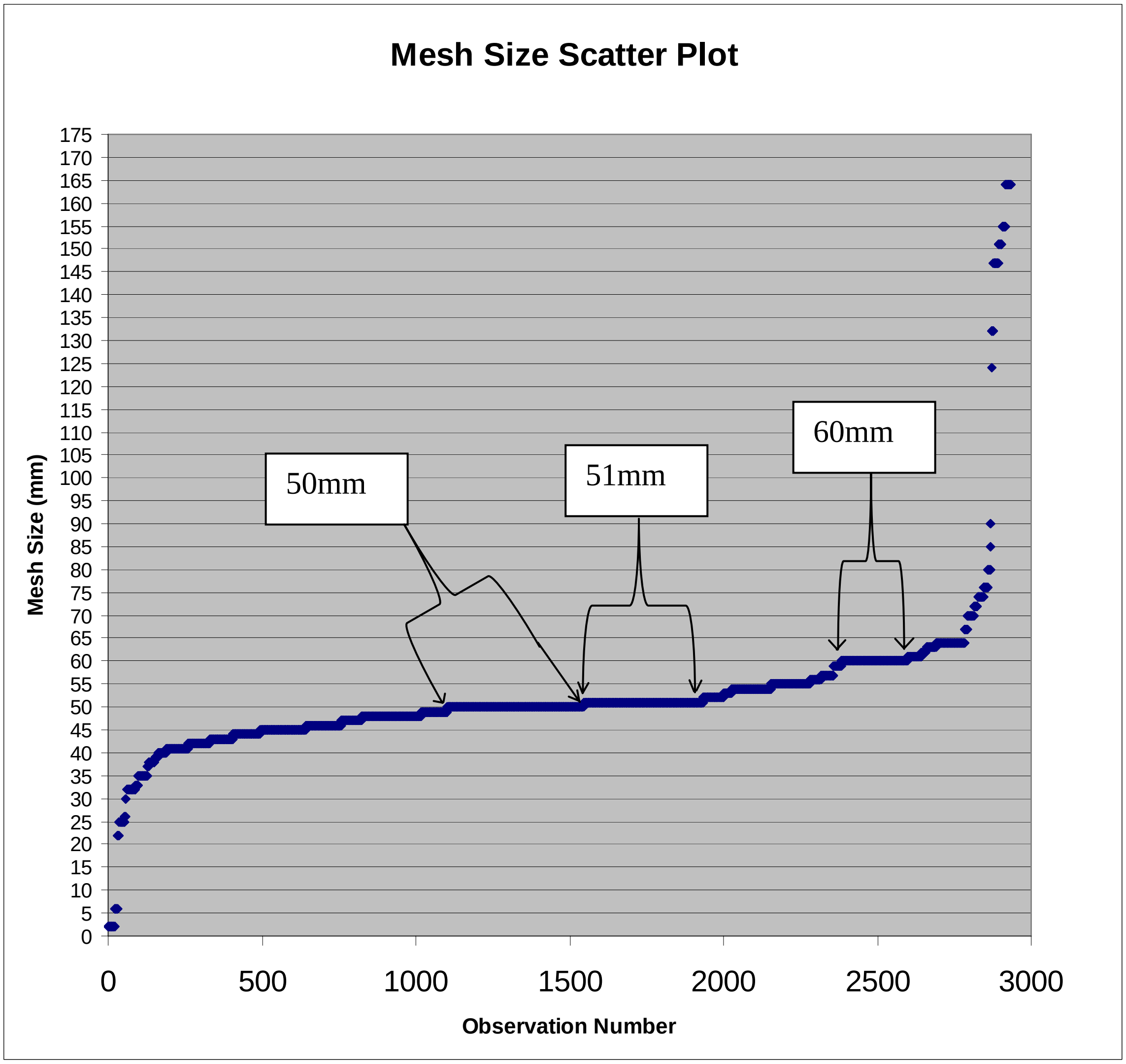
Figure 80. Directed/Targeted Loligo Haul Catches 2001-2006 May-Oct



Source: unpublished NMFS observer data

Figure 81 displays the distribution of mesh sizes of the 2934 individual observer data hauls used in the mesh-size analysis.

Figure 81. Mesh size scatter plot



The long horizontal sections of the line in Figure 81 at 50mm and 51mm indicate that these are the most frequent mesh sizes in the data set. The same data for the 45mm-76mm mesh sizes is displayed in a bar graph in Figure 82. To spot check the data, observations that were exactly 50mm and 60mm (60 mm is the most frequent larger unique size) were compared in terms of the composition of the catch for those hauls. The top ten species by percentage of catch composition for these two mesh sizes is shown in Table 81.

Figure 82. Numbers of hauls by mesh size 2001-2006 Directed Loligo Trips, 45mm-76mm sizes.

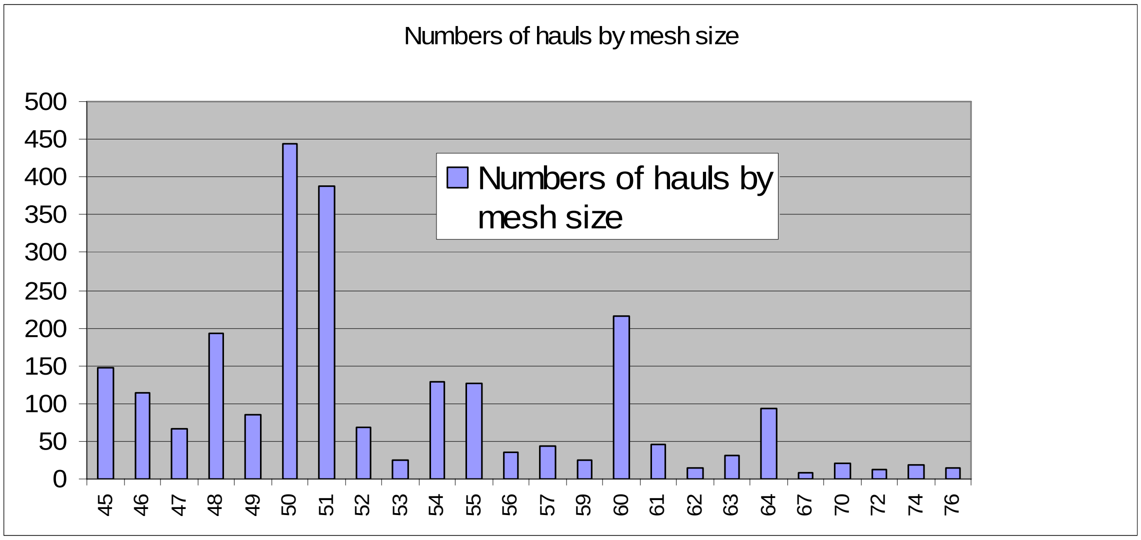


Table 81. Top ten species by percentage of catch composition for two mesh sizes in the NMFS unpublished sea sampling data base, 2001-2006.

50mm Mesh			60mm Mesh	
Common_Name			Common_Name	
SQUID (*LOLIGO*)	55%		SQUID (*LOLIGO*)	66%
HAKE, SILVER	9%		HAKE, SILVER	10%
BUTTERFISH	8%		HAKE, SPOTTED	7%
MACKEREL, ATLANTIC	4%		SQUID (*ILLEX*)	3%
SQUID (*ILLEX*)	4%		DOGFISH SPINY	2%
HAKE, RED	4%		BUTTERFISH	2%
HAKE, SPOTTED	3%		FLOUNDER, SUMMER	2%
HAKE, NK	1%		FLOUNDER, FOURSPOT	2%
DOGFISH SPINY	1%		ANGLER	1%
BLUEFISH	1%		BLUEFISH	1%

Noteworthy is that *Loligo* constituted a greater proportion of the total catch for the 60mm mesh size than the 50mm mesh size (i.e. there were apparently less "other" fish potentially "clogging" the net in the 60mm mesh size). Butterfish comprised 8% of the catch in the 50mm mesh hauls to 2% of the catch in the 60mm mesh hauls. Also, the percentage of hake (all hake species combined) was about the same in these two mesh sizes.

7.1.3 Eliminating Exemptions from *Loligo* minimum mesh requirements[1] for *Illex* vessels

- **Alternative 3A: No Action (*Illex* vessels are exempt from *Loligo* minimum mesh requirements in the months of June through September)**
- Alternative 3B: 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 3C: 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 3D: Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels

[1]For the set of alternatives described under section 5.3.3 and evaluated here, the maximum mesh size that would be required in the *Illex* fishery would be 1 7/8 inches (48 mm).

The action alternatives (3B-3D) 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. Unpublished NMFS 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 (note that this analysis subject to the same caveats discussed above in Section 7.1.2 relative to self reporting of mesh sizes by fishermen in the VTR data base). The U.S. *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 2001-2006 suggest that butterfish discards are the second largest source of discards (in terms of weight), not including *Illex* discards, in the *Illex* fishery (Table 13 A in Section 6.2). The ratio of butterfish discard weight to kept weight is fairly high in the *Illex* fishery and was 2.63 during 2001-2006 (Table 13A). A primary reason for the incidental bycatch of butterfish is a result of the co-occurrence of *Illex* and butterfish during September and October (**Figure 83**) 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 3B) 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 (3D) 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). However, since the mesh size increase would be limited to the current *Loligo* minimum codend mesh size (48 mm), losses would be expected to be much lower. Like other cephalopods, *Illex* losses through the codend may 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 slightly under Alternative 3D. If none of the action alternatives are implemented (3A), 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 3D, 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. To the extent that bycatch occurs in the *Illex* fishery (7% of all butterfish discards) and to the extent that this mesh size increase does facilitate escapement, bycatch could be marginally reduced and butterfish spawning stock size could be marginally increased.

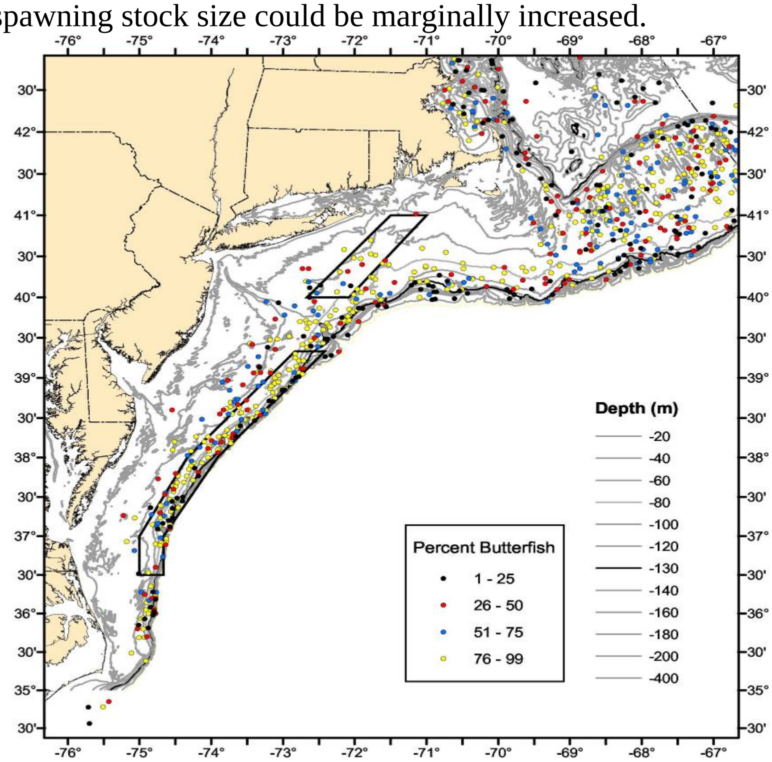


Figure 83. Co-occurrence (percent butterfish versus *Illex*) of butterfish and *Illex* during NEFSC autumn research bottom trawl surveys (September-October, 1992-2003).
The polygons shown represent Gear Restricted Areas that are seasonally closed to fishing with a codend mesh size smaller than 11.43 cm diamond.

7.1.4 Implementation of seasonal gear restricted areas (GRAs) to reduce butterfish discards

- Alternative 4A: No Action (No butterfish GRAs)
- Alternative 4B: Minimum of 3 inch codend mesh size in Butterfish GRA1
- Alternative 4C: Minimum of 3 inch codend mesh size in Butterfish GRA2
- Alternative 4D: Minimum of 3 ¾ inch codend mesh size in Butterfish GRA3
- Alternative 4E: Minimum of 3 ¾ inch codend mesh size in Butterfish GRA4

The effective areas for Butterfish GRAs 1 – 4 are illustrated in Figures 1-4 in Section 5 of this document. The effective time period for all of the GRAs would be January 1 – April 30. The action alternatives (4B-4E) are intended to decrease butterfish discarding in the small mesh bottom otter trawl fishery.

With respect to butterfish, the areas delineated by the GRAs 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 small mesh fishery effort and high butterfish discard rates. Lange and Waring (1992) found high butterfish bycatch in the domestic small mesh *Loligo* fishery and attributed it to overlapping habitats of the two species. As such, GRAs are likely to be effective at reducing butterfish discarding in the proposed areas during the GRA effective period.

The alternative GRAs in this amendment were originally analyzed in Amendment 9 to this FMP using data from 1997 through 2003. The GRAs in this document reflect analyses based on Observer Program discard and VTR fishery effort data from 2001 through 2006. Based on the update, an adjustment in the GRA corresponding to 50% of discards from mesh sizes less than 3 inches (Alt 4B) was not necessary; however the configuration of the GRAs related to Alternative 4C, 4D, and 4E are modified from Amendment 9. Table 82 is provided to compare in relative and absolute terms the discard estimates associated with the GRA alternatives.

Absolute discards are greater in the more inclusive observer data set, i.e., that which includes codend mesh sizes up to 3 $^{3/4}$ inches. Because of this, the area representing 50 % or 90% of the estimated discards under Alt 4D and 4E represent 21.4% or 22.6 % more discards by weight, respectively, than the GRAs under Alternatives 4B and 4C. Escapement of reproductively mature butterfish is also expected to be more probable under Alternatives 4D and 4E.

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). Winter and Spring NEFSC trawl survey catches of butterfish in the scup GRA account for an additional 28% of total survey catches (data from 2001-2007). Importantly, spatial analyses were conducted to address the possibility that current butterfish discards patterns are a result of shifted effort from areas closed through the establishment of the scup GRAs in 2001. The data show that butterfish discards in Jan-Apr from 1997 – 2000 were concentrated in the same general area as in the more recent timeframe (compare Figure 84 and Figure 85 below with Figures 1-**4** in Section 5). Therefore, the area along the shelf break northeast of the existing scup GRAs has been an area with high butterfish discarding since at least 1997.

It should be noted that the analysis is not intended to suggest discards will be reduced by 50% or 90% depending on the GRA chosen. The percents of total bottom otter trawl butterfish discards that occur in GRAs 1, 2, 3, and 4 are only about 16%, 29%, 20%, and 36% respectively. These percents are the maximum bottom otter trawl butterfish discards affected by the GRAs. Actual reductions would be some amount less than these due to probable transfer of effort to areas outside the GRAs.

Because the proposed butterfish GRAs are of limited geographic scope, 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. However, increases in discarding of butterfish outside of the proposed GRAs as a result of effort shifts could be ameliorated if the Council chooses to implement an increase in the general codend mesh size required in the *Loligo* fishery outside the areas delineated under each of the proposed GRA alternatives. The impacts of mesh size increases in the *Loligo* fishery are described above in section 7.1.2. 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 7.5.4 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: 4E, 4D, 4C, 4B, with the no-action alternative (4A) 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.

Table 82. 2001-2006 discards (lbs) for two mesh ranges (3.0/3.75 inches and less) estimated by expansion of discard rates through effort by 10 minute squares (limited to January through April, bottom otter trawl gear only) and reductions associated with current (Amendment 10) and prior (Amendment 9) proposed GRAs.

		Coverage relative to AM10 GRAs				Coverage relative to AM9 GRAs			
		50% GRA [a]		90% GRA [b]		50% GRA [c]		90% GRA [c]	
Min mesh Size	Total Discards (lbs)	lbs	pct	lbs	pct	lbs	pct	lbs	pct
le 3"	6,294,253	3,198,065	50.8%	5,697,457	90.5%	3,198,065	50.8%	5,072,323	80.6%
le 3.75"	7,598,170	3,882,976	51.1%	6,984,997	91.9%	3,549,126	46.7%	6,211,959	81.8%
Additive coverage from 3.75" GRAs		21.4%		22.6%					

[a] different areas needed to achieve target reduction using 3" or 3.75" min mesh based on 2001-2006 data

[b] same areas may achieve target reduction using 3" or 3.75" min mesh based on 2001-2006 data

[c] same areas would achieve target reductions using 3" or 3.75" min mesh based on 1996-2003 data

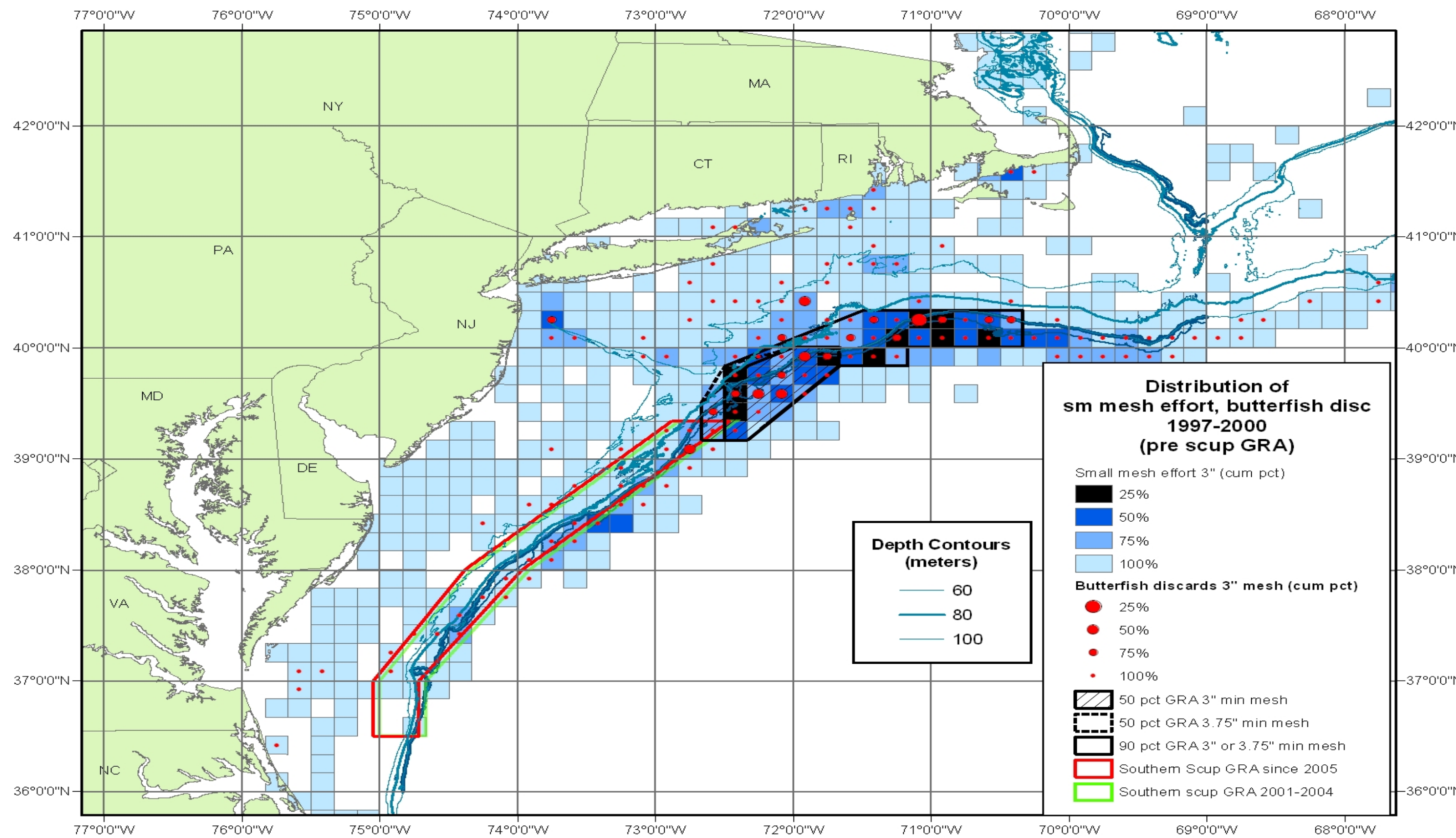


Figure 84. Distribution of small mesh (< 3 inch mesh) bottom otter trawl effort and associated butterfish discards from 1997 – 2000. Shading in the highlighted ten-minute squares (10 Lat min 4 10 Long min) reflects fishing effort from vessels using bottom otter trawls with less than 3 inch codend mesh, while the circles indicate the distribution and magnitude of butterfish discarding in these ten-minute squares. The e4isting scup GRA and proposed butterfish GRAs are also shown.

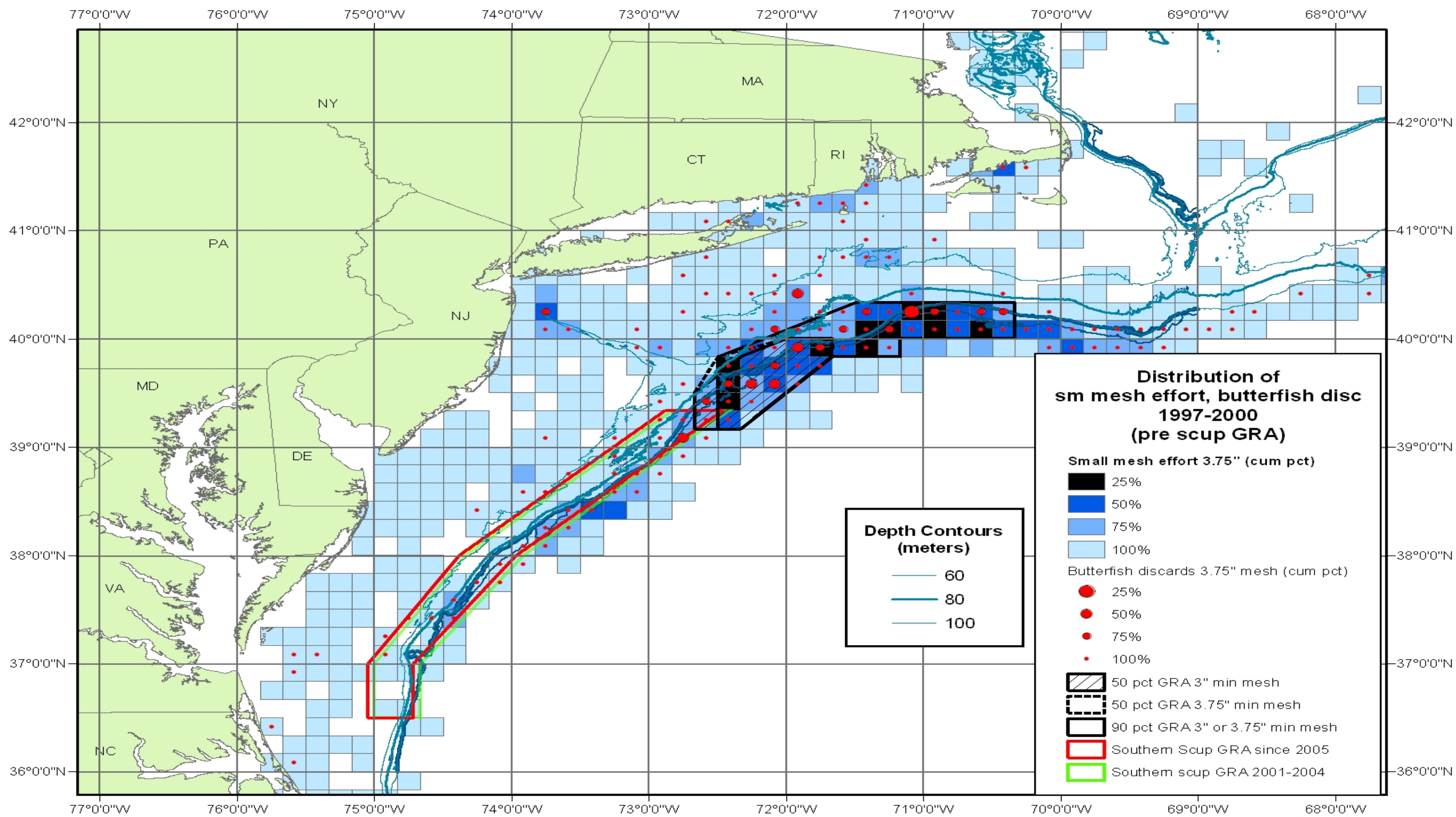


Figure 85. Distribution of small mesh (< $3^{3/4}$ inch mesh) bottom otter trawl effort and associated butterfish discards from 1997 – 2000. Shading in the highlighted ten-minute squares (10 Lat min 4 10 Long min) reflects fishing effort from vessels using bottom otter trawls with less than 3 inch codend mesh, while the circles indicate the distribution and magnitude of butterfish discarding in these ten-minute squares. The e4isting scup GRA and proposed butterfish GRAs are also shown.

7.2 IMPACTS ON NON-TARGET SPECIES

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 largely 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 15**a-b) may be used as a reference when considering which non-target species are more or less likely to be affected by a given alternative.

As stated before, the *Loligo* fishery is the most problematic SMB fishery in terms of bycatch. Table 83a provides additional discard information for the *Loligo* fishery. 2001-2006 NMFS observer program data on key discard species was broken down by trimester for trips landing at least 50% *Loligo* by weight. The key discard species were identified via two criteria: A) By weight, the *Loligo* fishery annually accounted for at least 10% of the total observed discards for the species and B) By weight, the species annually accounted for at least 2% of *Loligo* discards. The species are ranked according to the first criteria, e.g. the *Loligo* fishery as defined in this analysis accounted for 83% of all unclassified hake (HAKE, NK) discards. For each trimester (Jan-Apr, May-Aug, Sept-Dec), two statistics are provided: 1) How much of the discards in the *Loligo* fishery for a given species came from each trimester, and 2) The ratio of the pounds of the species discarded to the pounds of *Loligo* kept (D:K ratio). Note the first statistic is dependent on how observer trips were allocated among the trimesters. Mackerel and fourspot flounder appear to be most problematic in trimester one and all other species appear to be most problematic in trimester three.

Table 83a. Key *Loligo* Discards by Trimester

	Annual discards observed in <u>Loligo</u> <u>fishery</u> account for this % of observed <u>total</u> discards	% observed *Loligo* discards from T1	T1 D:K Ratio (Species discarded / *Loligo* Kept)	% observed *Loligo* discards from T2	T2 D:K Ratio (Species discarded / *Loligo* Kept)	% observed *Loligo* discards from T3	T3 D:K Ratio (Species discarded / *Loligo* Kept)
HAKE, NK	83%	20%	0.004	0%	0.000	**80%**	**0.017**
HAKE, SPOTTED	83%	30%	0.042	0%	0.000	**70%**	**0.111**
BUTTERFISH	68%	48%	0.056	3%	0.025	**49%**	**0.063**
HAKE, SILVER	56%	41%	0.053	0%	0.002	**59%**	**0.085**
SQUID (*ILLEX*)	51%	29%	0.029	0%	0.000	**71%**	**0.080**
MACKEREL, ATLANTIC	47%	**95%**	**0.045**	0%	0.000	5%	0.003
HAKE, RED	31%	40%	0.021	0%	0.000	**60%**	**0.036**
FLOUNDER, FOURSPOT	24%	**67%**	**0.021**	1%	0.002	32%	0.011
DOGFISH SPINY	10%	37%	0.041	11%	**0.090**	**52%**	0.065

7.2.1 Alternatives Considered for Implementing the Butterfish Rebuilding Plan

- Alternative 1A: No Action (Maintain 2008 annual specifications for butterfish)
- Alternative 1B: Butterfish rebuilding program with butterfish mortality cap implemented to control total annual fishing mortality on butterfish with the seasonal allocation of the butterfish mortality based on the current allocation of *Loligo* quota distribution by trimester
- Alternative 1C: Butterfish rebuilding program with butterfish mortality cap implemented to control total annual fishing mortality on butterfish with the seasonal allocation of the butterfish mortality cap based on recent *Loligo* landings (2002-2006) by trimester
- Alternative 1D: Butterfish rebuilding program with butterfish mortality cap implemented to control total annual fishing mortality on butterfish with the

seasonal allocation of the butterfish mortality based on the butterfish bycatch rate approach
- Alternative 1E: Implement a 3.0 inch minimum mesh requirement in the directed *Loligo* fishery **(no mortality cap)**

<u>Potential impacts on non-target species</u>

The action alternatives (1B-1D) are intended to control butterfish fishing mortality in the *Loligo* fishery by specifying a total mortality cap for butterfish. The species not managed under this FMP that would likely derive the greatest benefit through reductions in fishing effort that might result from the action alternatives (1B-1D) include the following bycatch species: spotted hake, silver hake, spiny dogfish, red hake, four spot flounder, summer flounder, little skate and angler (monkfish). This list of species is based on the most recent bycatch data available for the directed *Loligo* fishery based on unpublished NMFS Observer Program data for the period 2001-2006. The impact of these alternatives on these non-target species will depend on the level of fishing effort in the *Loligo* fishery prior to a directed *Loligo* fishery closure compared to the status quo (no action - alternative 1A). As stand alone measures, whether or not the mortality cap on butterfish is reached prior to the *Loligo* quota being taken depends on a number of factors. The first is the level of ABC specified for a given year. Determining when a fishery closure will occur due to the butterfish mortality cap being is reached for a given level of ABC is difficult to quantify. Since ABC for butterfish will increase as a function of butterfish abundance, encounter rates with butterfish in the *Loligo* fishery will also be expected to increase as ABC is increased. Therefore, higher ABC specifications for butterfish in the future would not necessarily translate into a longer season before the mortality cap is triggered and the *Loligo* fishery is closed.

Perhaps the most important factor in this regard is the degree to which *Loligo* fishermen are capable of reducing their incidental take of butterfish over the range of butterfish stock sizes likely to occur during the rebuilding horizon (i.e., between ½ B_{msy} and B_{msy}). The primary purpose of action alternatives 1B-1D was to give the *Loligo* fishing industry the opportunity to find novel and innovative ways to reduce their discard rate of butterfish. If *Loligo* fishermen are successful in avoiding butterfish to a greater degree than in the past, then it is possible that the *Loligo* quota could be the limiting factor which would trigger closure of the directed *Loligo* fishery in a given trimester under action alternatives 1B-1D. If this is the case, then the level of fishing effort under action alternatives 1B-1D would not differ from those under the no action alternative (status quo). If this scenario occurs, then the butterfish mortality targets specified under the rebuilding plan for the *Loligo* fishery would be met with no change in fishing effort in the *Loligo* fishery relative to the status quo. In this case there would be no change in terms of impact on the non-target species listed above, because effort in the *Loligo* fishery would remain unchanged relative to the status quo.

However, if *Loligo* fishermen are unable to alter their fishing practices in a manner that significantly reduces their encounter rates with butterfish, then it is likely that the butterfish morality cap under alternatives 1B-1D would be reached prior to the *Loligo* quota being taken and the fishery would close early relative conditions under the status quo. In this case, fishing effort in the *Loligo* fishery would be reduced relative to the no action alternative (i.e., status quo). Under this scenario, fishing effort reductions due to the mortality cap under the action alternatives 1B-1D being reached first would likely reduce the bycatch levels of non-target species taken in the *Loligo* fishery along with any associated negative impacts on them.

Another issue that arises is the potential for exacerbation of the derby aspects of the *Loligo* fishery related to the attainment of the butterfish mortality cap. That is, it is possible that *Loligo* fishermen will engage in a secondary derby in a race to catch *Loligo* prior to the butterfish mortality cap being reached. While it is impossible to quantify the change in overall effort by trimester under this exacerbated derby scenario, effort would most likely shift temporally to the earlier portion of each trimester, which could also potentially affect non-target species taken as bycatch in the *Loligo* fishery, but the degree to which they would be affected is difficult to estimate .

As stand alone measures, alternatives 1B and 1C are expected to have similar impacts since there is not much contrast between the two alternatives in terms of the seasonal distribution of the butterfish mortality cap. Alternative 1B is based on the current seasonal allocation of the *Loligo* quota, so it is more closely aligned with the Council's intent relative to the seasonal distribution of the *Loligo* quota. Alternative 1C is based on the seasonal distribution of recent *Loligo* landings. During the most recent period of landings upon which the distribution of the mortality cap is based under alternative 1C, there has been a seasonal effort shift to the first trimester relative to the historical distribution of landings. In contrast, alternative 1D would allow for a higher amount of the total annual mortality cap for butterfish to be allocated to trimester 1 because of the higher *Loligo* allocation in that period and that bycatch rates are historically highest during that period. Since this alternative accounts for both the *Loligo* quota allocation and the expected butterfish bycatch rate, it would appear to have the best chance of accomplishing the butterfish mortality cap goal without causing a early closure in the *Loligo* fishery (relative to alternatives 1B and 1C). However, given that the mortality cap allocation to trimester 2 is relatively low, the chance of premature closure in period 2 would appear to be greater relative to alternatives 1B and 1C. Overall reductions in fishing effort under alternatives 1B-1D would likely reduce the bycatch levels of non-target species taken in the *Loligo* fishery under each alternative compared to the status quo.

Under alternative 1E, the Council would not implement a butterfish mortality cap under the rebuilding plan, but rather would rely on an increase the minimum mesh requirement in the *Loligo* fishery to 3 inches (76 mm) to achieve the necessary reductions in butterfish discards to rebuild the butterfish stock to B_{msy}. As a stand alone measure, the impacts of this alternative are identical to alternative 2E discussed under the options to increase the minimum codend mesh size in the *Loligo* fishery. Selectivity studies, if available, would be useful in quantifying escapement probabilities at this alternative mesh size. In the absence of this information, it is generally expected that escapement, and hence benefit to non-target species stocks, is positively correlated with increased minimum mesh size requirements in the *Loligo* fishery. As such, Alternative 1E should generate the greatest benefit to non-target species relative to the range of mesh sizes considered under alternative 2 A-F. However, even though this alternative would implement the largest mesh size within the range of proposed codend mesh size increases, only the juveniles stages of some of the bycatch species have the potential to escape the codend

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7.2.2 *Loligo* minimum mesh size requirements

- Alternative 2A: No Action (Maintain 1 $^{7/8}$ inch (48 mm) minimum codend mesh requirement)
- Alternative 2B: Increase minimum codend mesh size to $2^{1/8}$ inches (54 mm)
- Alternative 2C: Increase minimum codend mesh size to $2^{3/8}$ inches (60 mm)
- Alternative 2D: Increase minimum codend mesh size to 2 1/2 inches (64 mm)
- Alternative 2E: Increase minimum codend mesh size to 3 inches (76 mm)

The action alternatives (2B – 2E) are intended to reduce discard mortality of bycatch species, especially for butterfish but also other species, in the directed *Loligo* fishery as part of the Magnuson-Stevens Act requirement to minimize bycatch to the extent practicable and minimize mortality of unavoidable bycatch. If you use the criteria that A) discards should be less than 5 % of the trip catch and B) the percent of the species discarded should be less than 5%, there were eight non-managed (in this FMP) species that were the most problematic in the three directed fisheries during 1997-2006 (no directed butterfish fishery, so it is not included here). They, along with their L50 (length at 50% maturity) values if available (O'Brien et al. 1993) are:

Silver hake (S. GB-MA stock = 23.2 and GOM-N. GB = 23.1), Red hake (S. GB-MA stock = 25.1 and GOM-N. GB = 26.9), Scup (15.5), Spiny dogfish, Spotted hake, Atlantic herring (25.4), Blueback herring, and Chub mackerel

Selectivity studies, if available, would be useful in quantifying escapement probabilities at the alternative mesh sizes considered in this amendment. In the absence of this information, it is generally expected that escapement, and hence benefit to non-target species stocks, is positively correlated with increasing the minimum codend mesh required 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 magnitude of the mesh size increase, the frequency of encounters by the fishery with specific species, and the degree to which a given mesh size increase will reduce the retention of specific species (compared to the current retention level).

Continuing to allow fishing with 48-51 mm mesh codends (no action alternative) will maintain the current negative impacts, in terms of discard mortality, on the all discard species of concern. For stocks that are overfished, such as scup, or that are rebuilding (southern silver hake), the no-action alternative will maintain current discarding levels and contribute to either further deterioration of the stocks or constrain rebuilding. As such, Alternative 2E should generate the greatest benefit to non-target species, while Alternative 2A is expected to do nothing to decrease discard mortality for non-target species relative to baseline levels. The range of proposed codend mesh size increases is limited such that only the juveniles stages of some of the bycatch species would have the potential to escape the codend.

Analysis of Catch Rate by Mesh Size Based on NMFS Observer Data

An analysis of unpublished observer data suggests that increasing mesh sizes from 50mm (just above the current minimum and the most frequent mesh size (inside stretched) used for observed directed *Loligo* hauls) to 55mm would decrease catch rates of all species besides *Loligo* and butterfish combined by 35%. Increasing mesh sizes from 50mm (just above the current minimum and the most frequent mesh size (inside stretched) used for observed directed *Loligo* hauls) to 60mm would decrease catch rates of all species besides *Loligo* and butterfish combined by 21% (the 35% and 21% are not additive - they are each from the 50mm baseline. The analysis of observer data (detailed in section 7.1.2), suggests that an increase from the current mesh size of 1 7/8" (48mm) inches to 55mm (~2 1/8) or 60mm (~2 3/8) reduces catch rates of all incidental species combined more than it would reduce catch rates of *Loligo*. Thus, even if effort is increased to make up for the reduced efficiency related to catching *Loligo*, the catch of all other incidental species combined would likely still be slightly less (Figure 78).

It is assumed that if one of the action alternatives for the butterfish mortality cap is selected, then the upper range of mesh sizes for the *Loligo* fishery that would be considered by the Council would be limited to 2 ½ inches (64 mm) because the butterfish mortality cap would be providing the primary protection for butterfish and, while Amendment 10 seeks to reduce discards in general, discards of butterfish are most critical for the purposes of this Amendment. Also, any mesh increase would add to the substantial economic burden imposed by the mortality cap program (see 7.5.1 (mortality cap costs) and 7.5.2 (mesh increase costs)) and the mortality cap program alone will reduce general discarding to the extent that the *Loligo* fishery is closed. Combining the mortality cap with a 3 inch mesh was not contemplated by the Council.

7.2.3 Eliminating Exemptions from *Loligo* minimum mesh requirements for *Illex* vessels

- **Alternative 3A: No Action (*Illex* vessels are exempt from *Loligo* minimum mesh requirements in the months of June through September**
- Alternative 3B: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding month of September from current mesh exemption for *Illex* fishery
- Alternative 3C: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding months of August and September from current mesh exemption for *Illex* fishery
- Alternative 3D: Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels

The action alternatives (3B-3D) 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: butterfish, dory bucklers, hake, chub mackerel ,and Atlantic mackerel (see **Table 15**A in Section 6.2). By taking no action (Alternative 3A) no reductions in status quo discarding by the *Illex* fishery is expected.

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7.2.4 Implementation of seasonal gear restricted areas (GRAs) to reduce butterfish discards

- Alternative 4A: No Action (No butterfish GRAs)
- Alternative 4B: Minimum of 3 inch codend mesh size in Butterfish GRA1
- Alternative 4C: Minimum of 3 inch codend mesh size in Butterfish GRA2
- Alternative 4D: Minimum of 3 ¾ inch codend mesh size in Butterfish GRA3
- Alternative 4E: Minimum of 3 ¾ inch codend mesh size in Butterfish GRA4

The action alternatives (4B-4E) 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. Northeast Fisheries Observer Program data indicate that the small-mesh *Loligo* fishery (**Table 15**a) is associated with high discards of butterfish, spotted hake, silver hake, spiny dogfish, red hake, buckler dories, four spot, flounder, and some sea robins. In addition to reducing butterfish discards, the GRAs are also likely to reduce discards in the GRAs of silver hake, red hake, scup, and spotted hake that occur in the *Loligo* fishery, particularly the GRAs associated with Alternatives 4D or 4E (because of the larger minimum codend mesh size of 3 $^{3/4}$ in.). Winter distributions of red hake and silver hake (Susie and Cadrin 2006) have been shown to overlap with the proposed GRA boundaries during the effective time period. In addition, the GRAs may reduce discarding in the GRAs such that they could aid in rebuilding the southern stock of silver hake and the scup stock.

Table 83 describes the overlap of the potential GRAs with NEFSC winter and spring survey trawl catches of non-target species known to occur as bycatch in small mesh SMB fisheries. The additive protection of the existing scup GRA is also provided. Note that the catch of spiny dogfish is less in the (larger) 90% GRA than in the (smaller) 50% 3 ¾ GRA. This occurred because the westward edge of the 90% GRA is ten minutes to the east of the 50% GRAs and the catch in that "exposed" area is greater than the catches picked up by the extended eastward arm of the larger 90% GRA. The percentages indicated in the table are not expected to correspond directly to levels of protection that the GRA alternatives may provide. Nevertheless, the values may reflect relative levels of protection. Among the non-target species, the alternative GRAs are likely to primarily benefit silver hake and red hake, and to a lesser extent spiny dogfish.

In Section 7.5.4, 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. The no action alternative (4A), which would not establish any butterfish GRAs, would result in no changes in discarding patterns relative to baseline conditions.

Table 83. Abundance of SMB bycatch species in GRAs

NEFSC Trawl survey catch of species occurring as bycatch in SMB fisheries (winter and spring survey, 2001 fwd) in relation to GRAs under consideration in AM 10. The identification of these species as major components of non-target species catch in SMB fisheries is provided in **Table 15**. The additional coverage provided by the e4isting scup GRA is provided in the rightmost column. The additive coverage of the proposed butterfish and e4isting scup GRAs is in the bottom table. Unclassified skates, chub mackerel, sea robins and herring are included in **Table 15** but are not presented here.

		50% 3" GRA		50% 3.75" GRA		90% 3" or 3.75" GRA		Scup GRA	
Species	Total catch (N)	Catch (N)	Pct of Total	Catch (N)	Pct of Total	Catch (N)	Pct of Total	Catch (N)	Pct of Total
Atlantic herring	114,165	165	0.1%	179	0.2%	3,543	3.1%	733	0.6%
Atlantic mackerel	111,815	1,423	1.3%	1,524	1.4%	3,503	3.1%	2120	1.9%
Blueback herring	11,928	9	0.1%	9	0.1%	26	0.2%	12	0.1%
Butterfish	192,426	16,479	8.6%	18,057	9.4%	35,687	18.5%	54187	28.2%
Ille4 squid	5,707	419	7.3%	419	7.3%	754	13.2%	972	17.0%
Loligo squid	629,963	45,817	7.3%	49,305	7.8%	91,775	14.6%	183195	29.1%
Red hake	24,656	581	2.4%	608	2.5%	2,535	10.3%	563	2.3%
Scup	193,848	243	0.1%	2,277	1.2%	12,737	6.6%	117474	60.6%
Silver hake	101,581	2,645	2.6%	2755	2.7%	7,223	7.1%	1277	1.3%
Spiny dogfish	275,524	4,912	1.8%	5,636	2.0%	5,035	1.8%	69112	25.1%
Spotted hake	114,958	1,102	1.0%	1,342	1.2%	2,051	1.8%	10017	8.7%

		[50% 3" GRA] + [Scup GRA]		[50% 3.75" GRA] + [Scup GRA]		[90% 3" or 3.75" GRA] + [Scup GRA]	
Species	Total catch (N)	Catch (N)	Pct of Total	Catch (N)	Pct of Total	Catch (N)	Pct of Total
Atlantic herring	114,165	898	0.8%	912	0.8%	4,276	3.7%
Atlantic mackerel	111,815	3,543	3.2%	3,644	3.3%	5,623	5.0%
Blueback herring	11,928	21	0.2%	21	0.2%	38	0.3%
Butterfish	192,426	70,666	36.7%	72,244	37.5%	89,874	46.7%
Ille4 squid	5,707	1,391	24.4%	1,391	24.4%	1,726	30.2%
Loligo squid	629,963	229,012	36.4%	232,500	36.9%	274,970	43.6%
Red hake	24,656	1,144	4.6%	1,171	4.7%	3,098	12.6%
Scup	193,848	117,717	60.7%	119,751	61.8%	130,211	67.2%
Silver hake	101,581	3,922	3.9%	4,032	4.0%	8,500	8.4%
Spiny dogfish	275,524	74,024	26.9%	74,748	27.1%	74,147	26.9%
Spotted hake	114,958	11,119	9.7%	11,359	9.9%	12,068	10.5%

If effort does not shift to areas outside the GRAs, discards would be reduced overall. If effort does shift to areas outside the GRAs, overall discards would go down if only a small amount of effort shifted and/or if the relative abundance of discarded species was lower outside the GRAs. If effort does shift to areas outside the GRAs, overall discards could go up if the total effort increased and/or the relative abundance of discarded species was higher outside the GRAs. Some effort shifting is expected, but available time and information resources were insufficient to model possible effort shifts relative to areas of target and bycatch species densities.

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 on habitat (including EFH). 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 of Amendment 9. In that analysis, the use of bottom otter trawls in the prosecution of the Atlantic mackerel, *Illex*, *Loligo*, and butterfish fisheries was evaluated.

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 bottom otter trawls due to changes in fishing effort expected a result of the proposed alternatives 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 of Amendment 9.

7.3.1 Alternatives Considered for Implementing the Butterfish Rebuilding Plan

- Alternative 1A: No Action (Maintain 2008 annual specifications for butterfish)
- Alternative 1B: Butterfish rebuilding program with butterfish mortality cap implemented to control total annual fishing mortality on butterfish with the seasonal allocation of the butterfish mortality based on the current allocation of *Loligo* quota distribution by trimester
- Alternative 1C: Butterfish rebuilding program with butterfish mortality cap implemented to control total annual fishing mortality on butterfish with the seasonal allocation of the butterfish mortality cap based on recent *Loligo* landings (2002-2006) by trimester
- Alternative 1D: Butterfish rebuilding program with butterfish mortality cap implemented to control total annual fishing mortality on butterfish with the seasonal allocation of the butterfish mortality cap based on the butterfish bycatch rate method
- Alternative 1E: Implement a 3.0 inch minimum mesh requirement in the directed *Loligo* fishery **(no mortality cap)**

The action alternatives (1B-1D) are intended to control butterfish fishing mortality in the *Loligo* fishery by specifying a total mortality cap for butterfish in association with the *Loligo* fishery. The impact of these alternatives on habitat will depend on the level of fishing effort with bottom otter trawls in the *Loligo* fishery prior to a fishery closure compared to the status quo (no action - alternative 1A). As stand alone measures, whether or not the mortality cap on butterfish is reached prior to the *Loligo* quota being taken depends on a number of factors. The first is the level of ABC specified for a given year. Determining when a fishery closure will occur due to the butterfish mortality cap being is reached for a given level of ABC is difficult to quantify. Since ABC for butterfish will increase as a function of butterfish abundance, encounter rates with butterfish in the *Loligo* fishery will also be expected to increase as ABC is increased. Therefore, higher ABC specifications for butterfish in the future would not necessarily translate into a longer season before the mortality cap is triggered and the *Loligo* fishery is closed.

Perhaps the most important factor in this regard is the degree to which *Loligo* fishermen are capable of reducing their incidental take of butterfish over the range of butterfish stock sizes likely to occur during the rebuilding horizon (i.e., between ½ B_{msy} and B_{msy}). The primary purpose of action alternatives 1B-1D was to give the *Loligo* fishing industry the opportunity to find novel and innovative ways to reduce their discard rate of butterfish. If *Loligo* fishermen are successful in avoiding butterfish to a greater degree than in the past, then it is possible that the *Loligo* quota itself could be the limiting factor which would trigger closure of the directed *Loligo* fishery in a given trimester under action alternatives 1B-1D. If this is the case, then the level of fishing effort under action alternatives 1B-1D would not differ from those under the no action alternative (status quo). If this scenario occurs, then the butterfish mortality targets specified under the rebuilding plan for the *Loligo* fishery would be met with no change in fishing effort in the *Loligo* fishery relative to the status quo. In this case there would be no change in terms of impact on habitat because effort in the *Loligo* fishery would remain unchanged relative to the status quo.

However, if *Loligo* fishermen are unable to alter their fishing practices in a manner that significantly reduces their encounter rates with butterfish, then it is likely that the butterfish morality cap under alternatives 1B-1D would be reached prior to the *Loligo* quota being taken and the fishery would close prematurely relative to the status quo. In this case, fishing effort in the *Loligo* fishery would be reduced relative to the no action alternative (i.e., status quo). Under this scenario, fishing effort reductions due to the mortality cap under the action alternatives 1B-1D being reached first would likely reduce any existing impacts on habitat as a result of the use of bottom otter trawls in the *Loligo* fishery.

Another issue that arises is the potential for exacerbation of the derby aspects of the *Loligo* fishery related to the attainment of the butterfish mortality cap. That is, it is possible that *Loligo* fishermen will engage in a secondary derby in a race to catch *Loligo* prior to the butterfish mortality cap being reached. While it is impossible to quantify the change in overall effort by trimester under this exacerbated derby scenario, effort would most likely shift temporally to the earlier portion of each trimester, which could also potentially affect the current of bottom trawls used in the *Loligo* fishery, but the degree to which any changes to existing impacts on habitat would occur is difficult to estimate.

As stand alone measures, alternatives 1B and 1C are expected to have similar impacts since there is not much contrast between the two alternatives in terms of the seasonal distribution of the butterfish mortality cap. Alternative 1B is based on the current seasonal allocation of the *Loligo* quota, so it is more closely aligned with the Council's intent relative to the seasonal distribution of the *Loligo* quota. Alternative 1C is based on the seasonal distribution of recent *Loligo* landings. During the most recent period of landings upon which the distribution of the mortality cap is based under alternative 1C, there has been a seasonal effort shift to the first trimester relative to the historical distribution of landings. In contrast, alternative 1D would allow for a higher amount of the total annual mortality cap for butterfish to be allocated to trimester 1 because of the higher *Loligo* allocation in that period and that bycatch rates are historically highest during that period. Since this alternative accounts for both the *Loligo* quota allocation and the expected butterfish bycatch rate, it would appear to have the best chance of accomplishing the butterfish mortality cap goal without causing a premature closure in the *Loligo* fishery (relative to alternatives 1B and 1C). However, given that the mortality cap allocation to trimester 2 is relatively low, the chance of premature closure in period 2 would appear to be greater relative to alternatives 1B and 1C. Overall reductions in fishing effort under alternative 1D would likely reduce any existing impacts on habitat due to the use of bottom otter trawls in the *Loligo* fishery during trimester 2 compared to the status quo.

Under alternative 1E, the Council would not implement a butterfish mortality cap under the rebuilding plan, but rather would rely on an increase the minimum mesh requirement in the *Loligo* fishery to 3 inches (76 mm) to achieve the necessary reductions in butterfish discards to rebuild the butterfish stock to B_{msy}. As a stand alone measure, the impacts of this alternative are identical to alternative 2E discussed under the options to increase the minimum codend mesh size in the *Loligo* fishery. In general, effort levels could increase under alternative 1E and, therefore, some additional impacts due to the use of bottom otter trawls in the *Loligo* fishery could be expected relative to the status quo.

7.3.2 *Loligo* minimum mesh size requirements

- Alternative 2A: No Action (Maintain 1 $^{7/8}$ inch (48 mm) minimum codend mesh requirement)
- Alternative 2B: Increase minimum codend mesh size to $2^{1/8}$ inches (54 mm)
- Alternative 2C: Increase minimum codend mesh size to $2^{3/8}$ inches (60 mm)
- Alternative 2D: Increase minimum codend mesh size to 2 1/2 inches (64 mm)
- Alternative 2E: Increase minimum codend mesh size to 3 inches (76 mm)

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. If one assumes that the *Loligo* quota is taken in full, then any measure (like a mesh size increase) that has the potential to decrease the effectiveness of a given time of effort, also has the potential to cause fishermen to spend more time fishing to land the same amount of *Loligo*.

Mesh selectivity studies on *Loligo*, which are unfortunately 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 2E.

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. Bottom trawl selectivity studies of other squid species indicate that 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).

7.3.3 Eliminating Exemptions from *Loligo* minimum mesh requirements for *Illex* vessels

- **Alternative 3A: No Action (*Illex* vessels are exempt from *Loligo* minimum mesh requirements in the months of June through September**
- Alternative 3B: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding month of September from current mesh exemption for *Illex* fishery
- Alternative 3C: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding months of August and September from current mesh exemption for *Illex* fishery
- Alternative 3D: Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels

The action alternatives (3B-3D) are intended to reduce finfish bycatch in the directed *Illex* fishery. As described in Section 7.1.3, the alternative that is most likely to achieve that goal without a corresponding increase in fishery effort is Alternative 3B. Alternatives 3C and 3D may result in extra effort needed to achieve *Illex* harvest targets. However, since the mesh size increase in the *Illex* fishery would be limited to the current *Loligo* minimum mesh size, effort increases are expected to be minimal. As such, these alternatives may increase fishery impacts on habitat, but these impacts are expected to be minimal. Alternative 3A (no action) is not expected to change the incidence of habitat impacts by *Illex* gear relative to baseline conditions.

7.3.4 Implementation of seasonal gear restricted areas (GRAs) to reduce butterfish discards

- Alternative 4A: No Action (No butterfish GRAs)
- Alternative 4B: Minimum of 3 inch codend mesh size in Butterfish GRA1
- Alternative 4C: Minimum of 3 inch codend mesh size in Butterfish GRA2
- Alternative 4D: Minimum of 3 ¾ inch codend mesh size in Butterfish GRA3
- Alternative 4E: Minimum of 3 ¾ inch codend mesh size in Butterfish GRA4

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 7.5.4, 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 (4A) is associated with Alternative 4E, while the action alternative that is the least likely to change patterns in bottom otter trawl activity is Alternative 4B. 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 10 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. Figure 86 is 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 butterfish GRAs.

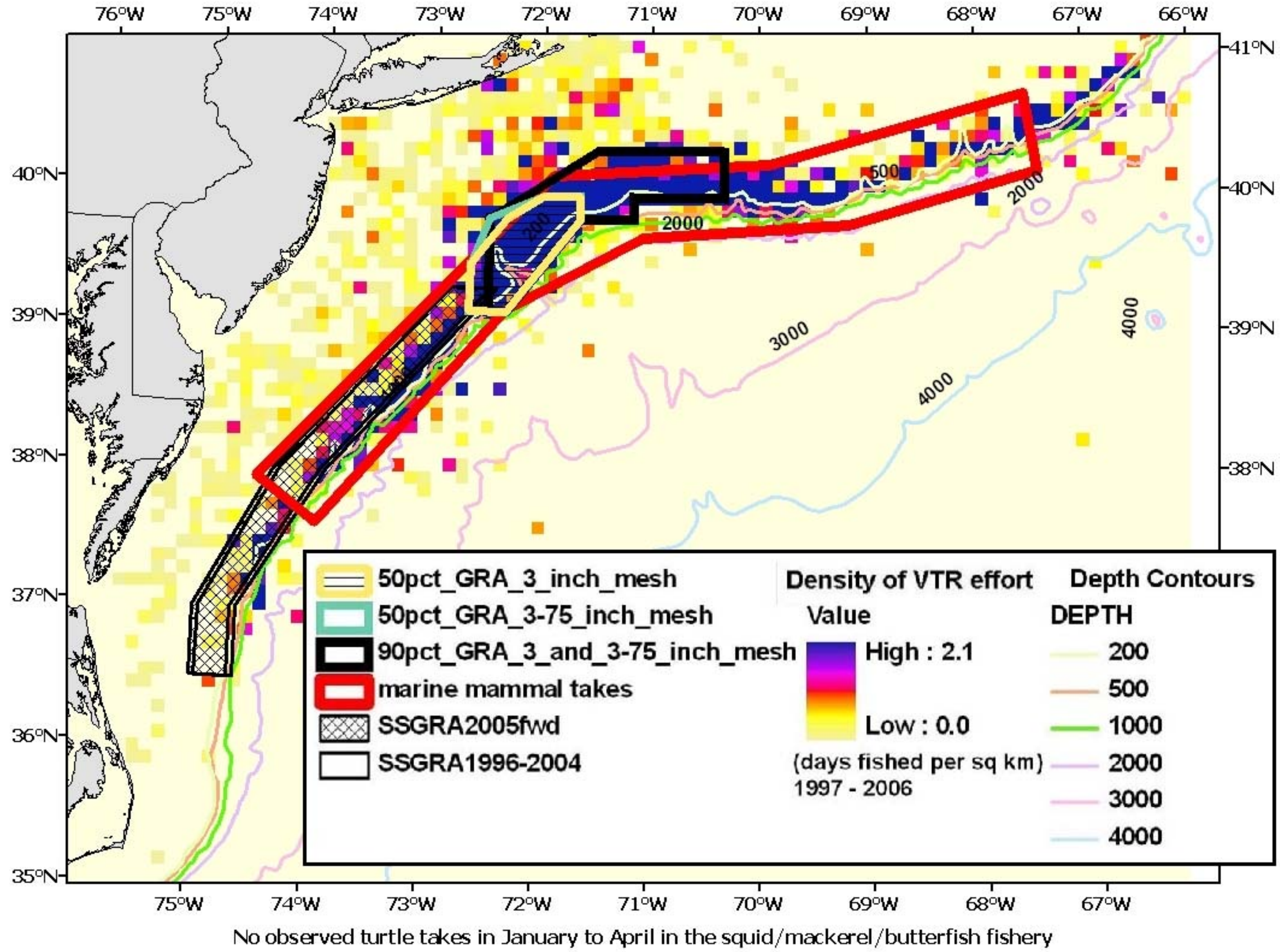

Figure 86. Distribution of SMB fishing effort, proposed area closures, existing area closures, and observed encounters with protected resources during winter (Jan-Apr) 1997-2006. There are no observed turtle encounters in the winter fishery. Source: NEFSC Protected Species Branch.

7.4.1 Alternatives Considered for Implementing the Butterfish Rebuilding Plan

- Alternative 1A: No Action (Maintain 2008 annual specifications for butterfish)
- Alternative 1B: Butterfish rebuilding program with butterfish mortality cap implemented to control total annual fishing mortality on butterfish with the seasonal allocation of the butterfish mortality based on the current allocation of *Loligo* quota distribution by trimester
- Alternative 1C: Butterfish rebuilding program with butterfish mortality cap implemented to control total annual fishing mortality on butterfish with the seasonal allocation of the butterfish mortality cap based on recent *Loligo* landings (2002-2006) by trimester

- Alternative 1D: Butterfish rebuilding program with butterfish mortality cap implemented to control total annual fishing mortality on butterfish with the seasonal allocation of the butterfish mortality based on the butterfish bycatch rate approach
- Alternative 1E: Implement a 3.0 inch minimum mesh requirement in the directed *Loligo* fishery **(no mortality cap)**

The action alternatives (1B-1D) are intended to control butterfish fishing mortality in the *Loligo* fishery by specifying a total mortality cap for butterfish. The impact of these alternatives on protected resources will depend on the level of fishing effort expended in the *Loligo* fishery prior to a fishery closure compared to the status quo (no action - alternative 1A). As stand alone measures, whether or not the mortality cap on butterfish is reached prior to the *Loligo* quota being taken depends on a number of factors. The first is the level of ABC specified for a given year. Determining when a fishery closure will occur due to the butterfish mortality cap being is reached for a given level of ABC is difficult to quantify. Since ABC for butterfish will increase as a function of butterfish abundance, encounter rates with butterfish in the *Loligo* fishery will also be expected to increase as ABC is increased. Therefore, higher ABC specifications for butterfish in the future would not necessarily translate into a longer season before the mortality cap is triggered and the *Loligo* fishery is closed.

Perhaps the most important factor in this regard is the degree to which *Loligo* fishermen are capable of reducing their incidental take of butterfish over the range of butterfish stock sizes likely to occur during the rebuilding horizon (i.e., between ½ B_{msy} and B_{msy}). The primary purpose of action alternatives 1B-1D was to give the *Loligo* fishing industry the opportunity to find novel and innovative ways to reduce their discard rate of butterfish. If *Loligo* fishermen are successful in avoiding butterfish to a greater degree than in the past, then it is possible that the *Loligo* quota itself could be the limiting factor which would trigger closure of the directed *Loligo* fishery in a given trimester under action alternatives 1B-1D. If this is the case, then the level of fishing effort under action alternatives 1B-1D would not differ from those under the no action alternative (status quo). If this scenario occurs, then the butterfish mortality targets specified under the rebuilding plan for the *Loligo* fishery would be met with no change in fishing effort in the *Loligo* fishery relative to the status quo. In this case there would be no change in terms of impact on protected resources (especially common dolphin) because of effort increases in the *Loligo* fishery would remain unchanged relative to the status quo.

However, if *Loligo* fishermen are unable to alter their fishing practices in a manner that significantly reduces their encounter rates with butterfish, then it is likely that the butterfish morality cap under alternatives 1B-1D would be reached prior to the *Loligo* quota being taken and the fishery would close prematurely relative to the status quo. In this case, fishing effort in the *Loligo* fishery would be reduced relative to the no action alternative (i.e., status quo). Under this scenario, fishing effort reductions due to the mortality cap under the action alternatives 1B-1D being reached first would likely reduce any existing impacts on protected resources (especially common dolphin) as a result of interactions with the *Loligo* fishery.

Another issue that arises is the potential for exacerbation of the derby aspects of the *Loligo* fishery related to the attainment of the butterfish mortality cap. That is, it is possible that *Loligo* fishermen will engage in a secondary derby in a race to catch *Loligo* prior to the butterfish mortality cap being reached. While it is impossible to quantify the change in overall effort by trimester under this exacerbated derby scenario, effort would most likely shift temporally to the earlier portion of each trimester. This could also potentially affect the current dynamic relative to interactions between the *Loligo* fishery and protected resources. However, the degree to which any changes to existing impacts on protected resources (especially common dolphin), would occur is difficult to estimate.

As stand alone measures, alternatives 1B and 1C are expected to have similar impacts since there is not much contrast between the two alternatives in terms of the seasonal distribution of the butterfish mortality cap. Alternative 1B is based on the current seasonal allocation of the *Loligo* quota, so it is more closely aligned with the Council's intent relative to the seasonal distribution of the *Loligo* quota. Alternative 1C is based on the seasonal distribution of recent *Loligo* landings. In contrast, alternative 1D would allow for a higher amount of the total annual mortality cap for butterfish to be allocated to trimester 1 because of the higher *Loligo* allocation in that period and that bycatch rates are historically highest during that period. Since this alternative accounts for both the *Loligo* quota allocation and the expected butterfish bycatch rate, it would appear to have the best chance of accomplishing the butterfish mortality cap goal without causing a premature closure in the *Loligo* fishery (relative to alternatives 1B and 1C). However, given that the mortality cap allocation to trimester 2 is relatively low, the chance of premature closure in period 2 would appear to be greater relative to alternatives 1B and 1C. Overall reductions in fishing effort under alternative 1D would likely reduce the number of existing interactions between the *Loligo* fishery and protected resources during trimester 2 compared to the status quo, (especially loggerhead sea turtles).

Under alternative 1E the Council would not implement a butterfish mortality cap under the rebuilding plan, but rather would rely on an increase the minimum mesh requirement in the *Loligo* fishery to 3 inches (76 mm) to achieve the necessary reductions in butterfish discards to rebuild the butterfish stock to B_{msy}. As a stand alone measure, the impacts of this alternative are identical to alternative 2E discussed under the options to increase the minimum codend mesh size in the *Loligo* fishery. In general, effort levels could increase under alternative 1E and, therefore, some additional interactions between protected resources (especially common dolphin and loggerhead sea turtles) and the *Loligo* fishery could be expected relative to the status quo,

7.4.2 *Loligo* minimum mesh size requirements

- Alternative 2A: No Action (Maintain 1 $^{7/8}$ inch (48 mm) minimum codend mesh requirement)
- Alternative 2B: Increase minimum codend mesh size to $2^{1/8}$ inches (54 mm)
- Alternative 2C: Increase minimum codend mesh size to $2^{3/8}$ inches (60 mm)
- Alternative 2D: Increase minimum codend mesh size to 2 1/2 inches (64 mm)
- Alternative 2E: Increase minimum codend mesh size to 3 inches (76 mm)

As with all protected species impacts, the primary factor to consider is the degree to which fishing effort is affected by the alternatives. Mesh selectivity studies for *Loligo*, which are currently poorly known, 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 (primarily common dolphin and loggerhead sea turtles). Any potential increase in fishing effort would be time-limited by fuel capacity and daylight hours when the squid are available to bottom trawls, though fishermen often have an array of options available to increase their effective fishing effort. Effort (days at sea) would also be limited by 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. Bottom trawl selectivity studies of other squid species indicate that 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).

Under this scenario, the greatest (albeit inestimable) increase in protected resource encounters would occur under Alternative 2E. 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. The distribution of mesh sizes observed in the NMFS observer data relative to *Loligo* and butterfish landings is displayed in Figure 72.

7.4.3 Eliminating Exemptions from *Loligo* minimum mesh requirements for *Illex* vessels

- **Alternative 3A: No Action (*Illex* vessels are exempt from *Loligo* minimum mesh requirements in the months of June through September)**
- Alternative 3B: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding month of September from current mesh exemption for *Illex* fishery
- Alternative 3C: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding months of August and September from current mesh exemption for *Illex* fishery
- Alternative 3D: Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels

The action alternatives (3B-3D) are intended to reduce finfish bycatch in the directed *Illex* fishery. As described in Section 7.1.3, the alternative that is most likely to achieve that goal without a corresponding increase in fishery effort is Alternative 3B. Alternatives 3C and 3D may result in extra effort needed to achieve *Illex* harvest targets. However, since the mesh size increase in the *Illex* fishery would be limited to the current *Loligo* minimum mesh size, effort increases are expected to be minimal. As such, these alternatives may increase fishery encounters with protected resources, but the increases are expected to be minimal. Because the *Illex* fishery has numerous documented encounters with pilot whales, fishery interactions with this species are likely to increase, albeit minimally. Alternative 3A (no action) is not expected to change the incidence of protected species encounters relative to baseline conditions.

7.4.4 Implementation of seasonal gear restricted areas (GRAs) to reduce butterfish discards

- Alternative 4A: No Action (No butterfish GRAs)
- Alternative 4B: Minimum of 3 inch codend mesh size in Butterfish GRA1
- Alternative 4C: Minimum of 3 inch codend mesh size in Butterfish GRA2
- Alternative 4D: Minimum of 3 ¾ inch codend mesh size in Butterfish GRA3
- Alternative 4E: Minimum of 3 ¾ inch codend mesh size in Butterfish GRA4

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 7.5.4, 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 4E, while the action alternative that is the least likely to change patterns in bottom otter trawl activity is Alternative 4B.

The no action alternative (4A) is expected to result in no change in the distribution and intensity of bottom otter trawl 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 4B 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. **Figure 86** provides information on the spatial relationship between SMB fishery effort, the configuration of the butterfish GRAs, and protected species encounters by the SMB fisheries. No change in turtle encounters are expected since turtle encounters with the SMB fisheries have not been observed in the winter or spring.

The primary small mesh fishery affected by the GRAs would be the *Loligo* fishery, and, as such, 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 4E 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 4D, 4C, and 4B. This order matches the characterization of likely shifts in fishery behavior produced by the economic analysis of these alternatives in Section 7.5.4.

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 10 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 Considered for Implementing the Butterfish Rebuilding Plan

- Alternative 1A: No Action (Maintain 2008 annual specifications for butterfish)
- Alternative 1B: Butterfish rebuilding program with butterfish mortality cap implemented to control total annual fishing mortality on butterfish with the seasonal allocation of the butterfish mortality based on the current allocation of *Loligo* quota distribution by trimester
- Alternative 1C: Butterfish rebuilding program with butterfish mortality cap implemented to control total annual fishing mortality on butterfish with the seasonal allocation of the butterfish mortality cap based on recent *Loligo* landings (2002-2006) by trimester
- Alternative 1D: Butterfish rebuilding program with butterfish mortality cap implemented to control total annual fishing mortality on butterfish with the seasonal allocation of the butterfish mortality based on the bycatch rate approach
- Alternative 1E: Implement a 3.0 inch minimum mesh requirement in the directed *Loligo* fishery **(no mortality cap)**

Alternative 1A: No action

No economic impact is expected from selecting the no-action alternative. *Loligo* vessels would continue to fish the 17,000 mt annual *Loligo* quota that is allocated by trimester. *Loligo* vessels (and vessels in other small mesh fisheries) would be limited to 1,000 pounds of butterfish per trip. If they fish with mesh greater than 3”, the trip limit is increased to 5,000 lbs. Annual butterfish landings would be capped at 500 metric tons.

Alternatives 1B-D: Butterfish Rebuilding Program

<u>Industry Funded Increased Observer Coverage</u>

Costs

Alternatives 1B-D propose to increase the number of observer days in the *Loligo* limited access fishery in order to adequately estimate when the trimester butterfish mortality cap is reached. The cost of deploying an observer on a vessel for a day is $1,150 which includes direct observer costs (salary, equipment, travel, and contractor management) and data management costs (entry, editing, etc.). Alternatives 1B-D propose that limited access permit *Loligo* vessels will fund the direct observer costs while the NMFS NE Observer Program will fund the data management costs. The cost per day for direct observer costs is $775 and the cost per day for data management are $375. Further, under Alternatives 1B-D this analysis assumes that the direct observer costs that the NE Observer Program would normally provided would still be funded by NMFS. It should be noted that neither of the assumptions about NMFS funding levels may be met in the future because of either reduced funding to NMFS for the observer program or shifting priorities within the observer program. In either case, actual NMFS funds available for at sea monitoring and administration of the *Loligo* mortality cap program may be less than the levels assumed in the analysis that follows. Lacking any additional source of funding of this program, any reduction in NMFS funding would result in a proportional increase in costs to industry.

In order to evaluate the cost of increased observer coverage to both the limited access *Loligo* vessels and to the Observer Program, the number of days the Observer Program would normally allocate to this fishery was estimated based on a query of the observer database for 2004 through 2006. The query was limited to observed trips on vessels using otter trawl with < 3” mesh as the primary gear and whose primary target species was *Loligo* squid. The query was further refined to include only trips that landed greater than 2,500 pounds of *Loligo* (a directed trip as defined in the proposed *Loligo* observer program). Based on this definition, the average for the three years was 220 days sampled and this value was used in the subsequent analysis (Table 84).

Table 84 Number of Observer Days by State of Landing and Year in the Directed *Loligo* Trawl Fishery.

YEAR	CT	MA	ME	NJ	NY	RI	Grand Total
2004	10.7	20.8		36.9	29.3	146	243.7
2005	22.2	13.2		31.6	36.2	149.1	252.3
2006		4.6	6.9	20.7	50.6	82.3	165.1
Grand Total	32.9	38.6	6.9	89.2	116.1	377.4	661.1

To obtain a CV level of 30%, which is the National Standard for SBRM monitoring, the total number of observer days under two scenarios were calculated (see Appendix ii). As noted in Appendix ii, since the available SBRM analysis for estimating samples sizes was conducted on a quarterly basis, the sample sizes necessary to achieve a 30% CV for butterfish in the *Loligo* fishery by trimester had to be interpolated from the quarterly data. Using the average of adjacent quarters method (i.e., simply averaging the quarters that a trimester spans (a trimester, being four months, spans 2 quarters, since a quarter is 3 months), a total of 1,087 days (an increase of 867 days over the historical average of 220 days) are required and using the weighted average method (by weighting the quarterly estimates by fishing effort in those quarters before interpolating), 1,369 days (an increase of 1,149) days are required. To evaluate the incremental cost to the NMFS for the data management portion, the rate of $375 per day was applied to the increase in days. The cost to limited access *Loligo* vessels for the additional days was calculated using the rate of $775 per day (Table 85).

Table 85 Annual Costs to NMFS and Limited Access *Loligo* Vessels from Increased Observer Coverage.

	Adjacent Quarters	Weighted Average
Annual number of additional observer days needed to reach 30% CV Level	867	1,149
Additional data management costs to NMFS (at $375 per day)	$325,125	$430,875
Additional direct observer costs to *Loligo* vessels (at $775 per day)	$671,925	$890,475

Of the 426 vessel that possess a limited access *Loligo* permit, 234 vessels were active in 2006 (based on landings reported in the VTR). Of these active limited access vessels, 150 recorded having 1 or more directed trip (greater than 2,500 pounds of *Loligo*). There were 1,856 of these directed trips with a total number of 6,063 days at sea. Although in any given year all *Loligo*/butterfish moratorium permit holders could potentially be affected, this pool of vessels/trips was used to represent the universe of vessels that would be affected by the increased observer days. If the cost is distributed evenly across all 150 vessels, the annual cost per vessel is $4,479 (adjacent quarter method) or $5,936 (weighted average method) per vessel. However, vessels take different numbers of trips and trip lengths (Table 86). Assuming that the process for selecting vessels to carry observers is random, the cost per vessel would be proportional to the number of days at sea per year. For this analysis it is assumed vessels will be chosen at random. If the adjacent quarters method for projecting increased observer days is used (867 additional observer days), the additional cost per day at sea would be 14.3% of the $775 ($111) per day direct observer cost (867 days is 14.3% of the 6,063 days-at-sea on directed trips in 2006). In other words, this calculation shows it would take a fee of $111 on every day at sea of every directed *Loligo* trip to pay for the program. If the weighted average method is used (1,149 additional observer days), the cost per day at sea is 19% of the $775 ($147) per day direct observer cost (1,149 days is 19% of the 6,063 directed trips in 2006). In other words, this calculation shows it would take a fee of $147 on every day at sea of every directed *Loligo* trip to pay for the program. Since a $111 or $147 fee (tax) on days at sea can not be implemented upon the fleet, costs will actually vary since each trip must pay the full cost ($775 per day) of an observer and some vessels may be selected more often than others by chance. The $111/$147 values are used for calculating average impacts.

Table 86 Distribution of limited access directed *Loligo* days-at-sea based on 2006 VTR data.

Annual Number of Days-at-sea	*Number of Vessels*	*Annual Cost per Vessel (using maximum in range) – adjacent quarters method*	*Annual Cost per Vessel (using maximum in range) – weighted average method*
1 - 10	46	$1,110	$1,470
11 - 20	19	$2,220	$2,940
21 - 30	14	$3,330	$4,410
31 - 40	8	$4,440	$5,880
41 - 50	5	$5,550	$7,350
51 - 60	12	$6,660	$8,820
61 - 70	12	$7,770	$10,290
71 - 80	8	$8,880	$11,760
81 - 90	6	$9,990	$13,230
91 - 100	7	$11,100	$14,700
101 - 110	6	$12,210	$16,170
111 - 120	3	$13,320	$17,640
121 - 130	3	$14,430	$19,110
131 - 150	1	$16,650	$22,050

This analysis assumes that fishing effort in the *Loligo* limited access fishery remains similar to recent activity. If effort changes due to other regulatory actions, the number of observer days needed to maintain the target CV level would also change. Also, as with any random selection process the distribution of costs may not be evenly distributed.

Benefits

Compared to the No Action Alternative, there is no apparent increase in benefits (to *Loligo* vessels) from increased observer days. Under the No Action Alternative, revenue is expected to remain at current levels (subject to the 17,000 mt cap on *Loligo* landings). Revenue under Alternatives 1B-1D would not increase (and may decrease – see discussion of economic impacts of the butterfish mortality cap) but the additional cost of increased observer coverage would be incurred by the limited access *Loligo* fishery.

The primary benefit of increasing observer days in the limited access *Loligo* fishery is to provide a higher degree of accuracy in monitoring the butterfish mortality cap. Therefore, the benefit of increased observer days is improved information for monitoring and decision making as it relates to the butterfish rebuilding program.

The benefit to limited access *Loligo* vessels of bearing the observer costs described above ($111 to $147 per day per vessel) will be in relation to the success of the butterfish mortality cap program. As compared to Alternative 1E (and other measures in Amendment 10 that may reduce

Loligo revenue), the observer costs may be offset if *Loligo* vessels find innovative ways of staying within the mortality cap thereby maintaining *Loligo* revenue.

Butterfish Mortality cap

Analysis

The focus of this analysis is the impact of the butterfish mortality cap on the limited access *Loligo* fishery. Under Alternatives 1B-1D, limited access *Loligo* vessels will still operate under a trimester-based *Loligo* landings quota allocation and, in addition, a trimester-based butterfish mortality cap. While both of these specifications may result in closures, an analysis of a closure from reaching the *Loligo* landings quota allocation is not provided since that specification is set under a different regulatory action. Although there will be interactions between the *Loligo* quota allocation and butterfish mortality cap, this analysis assumes the rate at which the *Loligo* quota allocation is reached remains the same (in 2007 the first trimester quota allocation was reached by April 13).

Alternatives 1B-1D propose a total butterfish allowable biological catch (ABC) of 1,500 mt in the first year of implementation with progressively higher amounts as the stock rebuilds. Seventy-five percent of the butterfish ABC is then allocated to the limited access *Loligo* fleet as a cap on both landings and discards. In addition, three methods for allocating the cap by trimester are proposed (see Appendix i). Note that landings of butterfish by any vessel (not just limited access *Loligo* vessels) will be limited by a total butterfish landings quota which is set annually during the quota specifications setting process. Therefore, the amount of butterfish limited access *Loligo* vessels will be able to land will partially be determined by the actions of other vessels. The proposed quota (landings) for butterfish for 2007 is 500 mt.

To evaluate the potential impact of each allocation method, recent levels of butterfish bycatch in the limited access *Loligo* fleet was estimated. This estimate is then compared with the three mortality cap allocations to determine the degree to which each might limit *Loligo* fishing activity. For the estimate, observer data from 2000 through 2006 was used. The query was limited to: 1) trips using otter trawl gear, 2) trips on which the captain stated to the observer that the target species was *Loligo*, and 3) trips with *Loligo* landings greater than 2,500 pounds (the definition of a directed trip). Table 87 reports the results of the query.

Table 87. Observed Trips Using Otter Trawl Gear, Targeting *Loligo*, and with *Loligo* Landings Greater than 2,500 Pounds.

		Trimester 1	Trimester 2	Trimester 3
2000	Number of observed trips	10	1	
	Loligo landings (lbs)	249,571	2,890	
	Butterfish bycatch (lbs) (landings + discards)	33,241	354	
	Percent butterfish bycatch	13.3%	12.2%	
2001	Number of observed trips	7	4	6
	Loligo landings (lbs)	180,035	9,700	121,122
	Butterfish bycatch (lbs) (landings + discards)	22,147	26	15,001
	Percent butterfish bycatch	12.3%	0.3%	12.4%
2002	Number of observed trips	7	6	3
	Loligo landings (lbs)	132,800	38,712	37,345
	Butterfish bycatch (lbs) (landings + discards)	17,919	63	11,449
	Percent butterfish bycatch	13.5%	0.2%	30.7%
2003	Number of observed trips	2	2	7
	Loligo landings (lbs)	8,230	7,958	86,124
	Butterfish bycatch (lbs) (landings + discards)	7,071	91	58,973
	Percent butterfish bycatch	85.9%	1.1%	68.5%
2004	Number of observed trips	18	5	39
	Loligo landings (lbs)	587,093	65,231	1,157,669
	Butterfish bycatch (lbs) (landings + discards)	68,917	1,443	30,576
	Percent butterfish bycatch	11.7%	2.2%	2.6%
2005	Number of observed	21	2	31

	trips			
	Loligo landings (lbs)	712,011	17,357	865,888
	Butterfish bycatch (lbs) (landings + discards)	51,252	68	13,797
	Percent butterfish bycatch	7.2%	0.4%	1.6%
2006	Number of observed trips	27	17	12
	Loligo landings (lbs)	928,443	115,236	152,839
	Butterfish bycatch (lbs) (landings + discards)	23,111	1,224	29,193
	Percent butterfish bycatch	2.5%	1.1%	19.1%
	Number of observed trips	92	37	98
	Total *Loligo* landings (lbs)	2,798,183	257,084	2,420,986
	Total Butterfish bycatch (lbs) (landings + discards)	223,657	3,269	158,988
	Percent butterfish bycatch	8.0%	1.3%	6.6%

The rate of butterfish bycatch in the *Loligo* fishery depends (among other factors) on the size of the butterfish stock. That is, it is assumed that with greater stock sizes the chance of encountering butterfish while fishing for *Loligo* will increase. The estimate for 2002 butterfish abundance was 7,800 metric tons based on the results of the most recent stock assessment. It is assumed that the abundance estimates for 2003 – 2005 (2006 stock conditions are uncertain) were similar to 2002.

To account for different bycatch rates under different stock sizes, three rates are chosen which correspond with low, medium, and high butterfish abundance. Observer data was used to establish the rate in the low abundance years (computed as the weighted average based on 2002 – 2005 *Loligo* landings and butterfish bycatch from the observer data base). Since there are too few observations in the data to establish medium and high rates in years prior to 2002, the low abundance rates are scaled up to medium and high (relative to recent years) abundances. The assumption made is that if butterfish abundance doubles, the percent of butterfish bycatch will double due to the higher numbers of butterfish and the presumed larger average size of butterfish at a rebuilt stock size. In 2002 the butterfish average biomass was 7,800. The target biomass at MSY is 22,800. Since 22,800 is 2.92 times as large as the low biomass in 2002, the percent butterfish bycatch in 2002 was multiplied by 2.92 to estimate the bycatch at high abundance levels. The medium abundance bycatch levels were estimated as the mid-point between the low and high abundance rates. For example, the medium abundance rate for trimester 1 (19.8%) is simply in the mid-point between 10.1% and 29.5%. These results are presented in Table 88 and are used to assess the potential for limited access *Loligo* fishery closures under each of the three mortality cap allocation methods.

Note that even though the 2006 observer data (which has a high number of observations) reported in Table 88 are not used, the bycatch rates are similar to the weighted average rates for 2002 – 2005.

Table 88. Estimated butterfish bycatch rates in the directed *Loligo* fishery by trimester for three levels of butterfish abundance.

	Trimester 1	Trimester 2	Trimester 3
Low abundance years (2002 through 2005)			
Number of observed trips	48	15	80
Loligo landings (lbs)	1,440,134	129,258	2,147,026
Butterfish bycatch (lbs) (landings + discards)	145,159	1,665	114,794
Percent butterfish bycatch	10.1%	1.3%	5.3%
Medium abundance			
Percent butterfish bycatch	19.8%	2.5%	10.5%
High abundance			
Percent butterfish bycatch	29.5%	3.8%	15.6%

The bycatch rates for the low, medium, and high abundance scenarios presented in Table 88 are multiplied by 95% of the trimester based *Loligo* quota (the limited access fishery has historically caught 95% of the quota). The result, presented in the last three columns of Tables 89-91, is an estimate of butterfish bycatch for the low, medium, and high abundance scenarios. These bycatch estimates assume no change in the bycatch rate from other measures such as mesh size increases. For purposes of comparing the estimates to the three mortality cap alternatives, it is also assumed that fishermen will not change their *Loligo* fishing methods in order to avoid butterfish bycatch (however, see a discussion of relaxing this assumption below).

Tables 89-91 also show the three butterfish mortality cap allocation methods for ABCs of 1,500 mt, 3,000 mt, and 5,000 mt. ABCs greater that 5,000 mt are not reported since at those levels the butterfish mortality caps exceed the bycatch estimates.

Table 89 Comparison of Butterfish Bycatch Estimates with Three Butterfish Allocation Methods (Butterfish ABC of 1,500 mt)

		Butterfish cap allocation (mt)			Butterfish bycatch estimate (mt)		
Trimester	95% of *Loligo* quota (mt)	*Loligo* quota allocation method	*Loligo* landings method	Butterfish bycatch rate method	Low abund. years	Medium abund. years	High abund. years
1	6,945	484	563	731	701	1,375	2,049
2	2,746	191	191	37	36	69	104
3	6,460	450	371	357	342	678	1,008
Total	16,150	1,125	1,125	1,125	1,079	2,122	3,161

Table 90 Comparison of Butterfish Bycatch Estimates with Three Butterfish Allocation Methods (Butterfish ABC of 3,000 mt)

		Butterfish cap allocation (mt)			Butterfish bycatch estimate (mt)		
Trimester	95% of *Loligo* quota (mt)	*Loligo* quota allocation method	*Loligo* landings method	Butterfish bycatch rate method	Low abund. years	Medium abund. years	High abund. years
1	6,945	967	1,125	1,462	701	1,375	2,049
2	2,746	383	383	74	36	69	104
3	6,460	900	742	714	342	678	1,008
Total	16,150	2,250	2,250	2,250	1,079	2,122	3,161

Table 91 Comparison of Butterfish Bycatch Estimates with Three Butterfish Allocation Methods (Butterfish ABC of 5,000 mt)

		Butterfish cap allocation (mt)			Butterfish bycatch estimate (mt)		
Trimester	95% of *Loligo* quota (mt)	*Loligo* quota allocation method	*Loligo* landings method	Butterfish bycatch rate method	Low abund. years	Medium abund. years	High abund. years
1	6,783	1,612	1,875	2,437	701	1,375	2,049
2	2,907	638	638	124	36	69	104
3	6,460	1,500	1,237	1,189	342	678	1,008
Total	16,150	3,750	3,750	3,750	1,079	2,122	3,161

The percentage difference between the projected bycatch and the mortality cap is used to estimate the potential loss in *Loligo* revenue from early closures. Estimated losses in revenue are calculated by applying the projected percentage decreases in bycatch to the 2006 revenue received by limited access *Loligo* vessels. This estimate assumes the bycatch rates in Table 88 remain constant throughout the trimester. That is, the rate at the beginning of the trimester is the same as the rate at the end of the trimester and fishermen do not adopt bycatch avoidance methods. The results of the estimated revenue losses are reported in Tables 92-94.

Results show that as the butterfish ABC increases, the mortality caps become less constraining, regardless of the allocation method. At a butterfish ABC of 1,500 mt, the butterfish bycatch allocation method would result in the least reduction in bycatch in trimester 1 and the greatest reduction in trimesters 2 and 3. The *Loligo* quota allocation method would result in the greatest reduction in bycatch in trimester 1 and the least reduction in trimesters 2 and 3.

Table 92 Estimated percentage reductions in bycatch by mortality cap allocation method and associated loss in limited access *Loligo* revenue (1,500 mt ABC)

		Loligo quota allocation Method			*Loligo* landings method			Butterfish bycatch rate method		
		Low ab.	Med ab.	High ab.	Low ab.	Med ab.	High ab.	Low ab.	Med ab.	High ab.
Trimester 1 (2006 revenue: $11.5 million)	Bycatch reduction	31.0%	64.8%	76.4%	19.7%	59.1%	72.5%	none	46.8%	64.3%
	Revenue loss	$3.6 m	$7.5 m	$8.8 m	$2.3 m	$6.8 m	$8.3 m		$5.4 m	$7.4 m
Trimester 2 (2006 revenue: $5.5 million)	Bycatch reduction	none	none	none	none	none	none	none	45.8%	64.3%
	Revenue loss								$2.5 m	$3.5 m
Trimester 3 (2006 revenue: $7.6 million)	Bycatch reduction	none	33.7%	55.3%	none	45.3%	63.2%	none	47.4%	64.6%
	Revenue loss		$2.6 m	$4.2 m		$3.4 m	$4.8 m		$3.6 m	$4.9 m
Full year (2006 revenue: $24.7 million)	Revenue loss	$3.6 m	$10.0 m	$13.0 m	$2.3 m	$10.2 m	$13.1 m	none	$11.5 m	$15.8 m

Table 93 Estimated Percentage Reductions in Bycatch by Mortality cap Allocation Method and Associated Loss in Limited Access *Loligo* Revenue (3,000 mt ABC)

		Loligo quota allocation Method			*Loligo* landings method			Butterfish bycatch rate method		
		Low ab.	Med ab.	High ab.	Low ab.	Med ab.	High ab.	Low ab.	Med ab.	High ab.
Trimester 1 (2006 revenue: $11.5 million)	Bycatch reduction Revenue loss	none	29.7% $3.4 m	52.8% $6.1 m	none	18.2% $2.1 m	45.1% $5.2 m	none	none	28.6% $3.3 m
Trimester 2 (2006 revenue: $5.5 million)	Bycatch reduction Revenue loss	none	none	none	none	none	none	none	none	28.7% $1.6 m
Trimester 3 (2006 revenue: $7.6 million)	Bycatch reduction Revenue loss	none	none	10.7% $0.8 m	none	none	26.4% $2.0 m	none	none	29.3% $2.2 m
Full year (2006 revenue: $24.7 million)	Revenue loss	none	$3.4 m	$6.9 m	none	$2.1 m	$7.2 m	none	none	$7.1 m

Table 94 Estimated Percentage Reductions in Bycatch by Mortality cap Allocation Method and Associated Loss in Limited Access Loligo Revenue (5,000 mt ABC)

		Loligo quota allocation Method			*Loligo* landings method			Butterfish bycatch rate method		
		Low ab.	Med ab.	High ab.	Low ab.	Med ab.	High ab.	Low ab.	Med ab.	High ab.
Trimester 1 (2006 revenue: $11.5 million)	Bycatch reduction Revenue loss	none	none	21.3% $2.5 m	none	none	8.5% $1.0 m	none	none	none
Trimester 2 (2006 revenue: $5.5 million)	Bycatch reduction Revenue loss	none	none	none	none	none	none	none	none	none
Trimester 3 (2006 revenue: $7.6 million)	Bycatch reduction Revenue loss	none	none	none	none	none	none	none	none	none
Full year (2006 revenue: $24.7 million)	Revenue loss	none	none	$2.5 m	none	none	$1.0 m	none	none	none

The revenue losses on a per vessel basis will be proportional to a vessel's effort and resulting revenue. That is, revenue losses will not be shared equally. To provide this perspective, Table 95 shows the distribution of annual *Loligo* revenue among the 219 limited access vessels that reported landings in the NE dealer reporting system in 2006.

Table 95 Distribution of Limited Access Loligo Vessel Revenue (2006)

2006 Annual Loligo Revenue Range	*Number of Vessels in Range*
$1 - $1,000	46
$1,000 - $10,000	38
$10,000 – $50,000	31
$50,000 – $100,000	27
$100,000 - $200,000	29
$200,000 - $300,000	18
$300,000 - $400,000	15
$400,000 - $500,000	6
$500,000 - $600,000	5
Greater than $600,000	4

Discussion

The analysis presented above provides an estimate of potential impacts from a mortality cap management system – under the assumption that butterfish bycatch rates stay at recently observed levels. However, it is likely that these losses will not be fully realized because vessel owners/captains will have the incentive to avoid butterfish so that the directed *Loligo* fishery does not close early. While the extent to which butterfish can be avoided is uncertain (since there are strong indications that *Loligo* and butterfish co-occur), some strategies may be developed that were not used in the past when there was no consequence to discarding butterfish.

Bycatch avoidance measures employed to minimize *Loligo* revenue loss may result in reduced efficiency -- the degree, however, is difficult to predict. Vessels operators will have to balance any loss in efficiency with the revenue they expect to maintain by keeping the *Loligo* fishery open.

Even though the limited access *Loligo* fleet (as a whole) will have an incentive to stay within the butterfish mortality cap, that incentive may be in conflict with a different incentive created by quota management. That is, the race to fish for *Loligo* quota may be exacerbated by the butterfish mortality cap. Since limited access *Loligo* vessels will not have a formal means to cooperate around the mortality cap (or the *Loligo* quota), such as a sector allocation or a tradable cap, an incentive is created for individual vessels to fish earlier in the trimester before both the *Loligo* quota and the butterfish bycatch are used up by other vessels. This does not mean that *Loligo* vessels may not find ways to cooperate through informal mechanisms.

Based on the comparison of projected bycatch with each of the bycatch allocation methods, fishing effort may move to trimester 2 since the caps are the least restrictive in that time period. There may be reductions in profit associated with this if *Loligo* is not as abundant as in trimesters 1 and 3.

The revenue losses estimated in this analysis assume a direct relation between bycatch reduction and *Loligo* revenue loss. It does not consider that unused *Loligo* quota from Trimesters 1 and 2 roll into Trimester 3 under current regulations.

The performance of the butterfish mortality cap is dependent on what catches (discards + landings) will be observed at higher levels of observer coverage. Current discard projections (using the process established in SARC 38 or the process developed to project revenue losses in this document) suggest that the *Loligo* fishery may catch an amount of butterfish similar to the allocated cap. However, SARC 38 characterized discards as "imprecisely estimated," and likely "underestimated." If increased observer coverage reveals discarding of butterfish to be much higher than anticipated, the *Loligo* fishery may close earlier (because it would hit the cap much earlier). In analyses conducted for this proposed action, other ways to calculate discards were explored; one model was developed that resulted in a higher estimation of discards. A description of this model follows.

(1) (Total catch) * (% landed) = Landings

For example: (100 fish) * (10% landed) = 10 fish.

Just rearranging (1): (2) (**Landings**) / (**% landed**) = Total catch. (10/.1=100)

So if Landings and percent landed can be estimated, "Total catch" can be estimated.

Percent landed: The observer data provide an estimate of percent landed. In case there were different discard rates for winter and summer, 2002-2006 winter (Nov-Apr) and summer (May-Oct) observer trips landing at least 2,500 pounds of *Loligo* were examined to estimate the percent of caught butterfish that were landed. The average results for butterfish were winter: **11.63% landed**/kept (N= 31/year) and summer: **8.61% landed**/kept (N=14/year). If vessels discard less than usual when an observer is onboard, these rates are high and the total catch and discard estimates below would be underestimates.

Landings: NE dealer weighout data provides an estimate of Landings. 2002-2006 NE dealer weighout trips that landed at least 2,500 pounds of *Loligo* produced average annual butterfish **Landings** of **162.51** MT in the winter (N=930/year) and **61.64** MT in the summer (N=385/year). Substituting these numbers into the above equation (2) gives:

Winter	Summer
(**Landings**) / (**% landed**) = Total catch	(**Landings**) / (**% landed**) = Total catch
162.51 / .1163 = 1397 MT winter total	**61.64 / .0861** = 716 MT summer total

Combining the winter and summer total catches produces an estimated annual butterfish catch of 2113 MT just for these selected trips that landed at least 2,500 pounds of *Loligo*. Subtracting out the landings (equation 1) produces a discard estimate of 1889 MT for just these same selected trips. These estimates are considerably higher than the estimates given in SARC 38 . In the initial years of the butterfish mortality cap program, the directed *Loligo* fishery would be closed when boats landing at least 2,500 pounds of *Loligo* accumulated 1,125 MT of butterfish catch (landings + discards). 1,125 MT is about half of the total catch predicted with this method, and if this method was correct, it would mean that the *Loligo* fishery may only get to take about half of the *Loligo* quota because of the constraint imposed by the butterfish mortality cap (assuming fishermen fish in the same way under the cap compared to before). This example demonstrates that the performance of the butterfish mortality cap will depend on what butterfish catches are observed in the new butterfish mortality cap program, and that current estimates are likely imprecise and perhaps underestimated.

7.5.3 Alternative 1E: Rebuilding Program with 3 Inch Minimum Mesh Size

<u>3 Inch Minimum Mesh Size</u>

This is limited information relative to *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.

The quantitative 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. There are studies of other loliginid squid suggesting "loliginid squid are size-selected (by trawl codends) in a similar fashion to fish" (Hastie 1985). However, there are no published studies of *Loligo pealeii* selectivity. Therefore, while it is likely that retention of at least smaller *Loligo* will be reduced as mesh size increases, the percent losses associated with such increases are unquantifiable based on published selectivity parameters for *L. pealeii*. The economic impacts associated with this alternative are discussed below in Section 7.5.2 under alternative 2E.

7.5.2 *Loligo* minimum mesh size requirements

- Alternative 2A: No Action (Maintain 1 $^{7/8}$ inch (48 mm) minimum codend mesh requirement)
- Alternative 2B: Increase minimum codend mesh size to $2^{1/8}$ inches (54 mm)
- Alternative 2C: Increase minimum codend mesh size to $2^{3/8}$ inches (60 mm)
- Alternative 2D: Increase minimum codend mesh size to 2 1/2 inches (64 mm)
- Alternative 2E: Increase minimum codend mesh size to 3 inches (76 mm)

Two major factors must be considered in determining the socio-economic impacts of the action alternatives (2B – 2G). 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. Providing lead time before mesh size increases are required can allow fishery participants time to plan purchases and thereby minimize costs associated with purchasing new codends due to regulatory changes.

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 published studies have been conducted.

NEFSC Observer Program data for 1997-2006, while a subset of the total number of trips, indicate that mesh sizes less than 54 mm accounted for 65% of landed *Loligo* (Table 78). In the Observer database, the proportions of *Loligo* caught above 2 $^{1}/_{8}$ in. (54 mm), 2 3/8 (60 mm) and 2 ½ in. (64 mm) are 25%, 11%, and 7% respectively, indicating that *Loligo* can be caught above these mesh sizes.

Because *Loligo* can be captured in these larger mesh sizes, it is likely that fishing would still be possible if any of the action alternatives is implemented. Industry representatives, however, have indicated repeatedly that the loss of *Loligo* would be substantial under the action alternatives. 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 2B, 2C, 2D, and 2E with the loss being greatest under Alternative 2E. If the mesh analysis described above in Section 7.1.2 is accurate, the *Loligo* fishery could experience catch rate declines of around 15%-20% by moving to a 55mm or 60mm minimum mesh size. In the short run, this would increase costs to catch the same quantity of squid, lowering profits (or exacerbating losses) even if revenues remain unchanged. The rapid growth of squid may allow fishermen to minimize losses by shifting effort to a later date, thereby targeting larger squid which have a higher retention rate with the larger mesh.

The no-action alternative (2A) 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 might largely 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 7.1.2 must be made with the potential loss of *Loligo* under each mesh size increase as described above and in Section 7.1.2

7.5.3 Eliminating Exemptions from *Loligo* minimum mesh requirements for *Illex* vessels

- **Alternative 3A: No Action (*Illex* vessels are exempt from *Loligo* minimum mesh requirements in the months of June through September)**
- Alternative 3B: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding month of September from current mesh exemption for *Illex* fishery
- Alternative 3C: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding months of August and September from current mesh exemption for *Illex* fishery
- Alternative 3D: Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels

As with Alternatives 2B – 2E above, the socio-economic impacts of action alternatives 3B through 3D 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 7.1.3, 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 3B. Alternatives 3C and 3D are associated with a greater probability of extra harvest effort, while Alternative 3A is not expected to increase harvest costs relative to baseline conditions.

7.5.4 Implementation of seasonal gear restricted areas (GRAs) to reduce butterfish discards

- Alternative 4A: No Action (No butterfish GRAs)
- Alternative 4B: Minimum of 3 inch codend mesh size in Butterfish GRA1
- Alternative 4C: Minimum of 3 inch codend mesh size in Butterfish GRA2
- Alternative 4D: Minimum of 3 ¾ inch codend mesh size in Butterfish GRA3
- Alternative 4E: Minimum of 3 ¾ inch codend mesh size in Butterfish GRA4

Description of Impacted Vessels and Ports by Alternative

Logbook (VTR database), permit and dealer data (Weighout database), for 2004-2006, 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.

Table 96 describes the vessels that would be impacted under each alternative. These alternatives would impact 104 (Alt. 4B) to 144 (Alt.4E) vessels. The average value per trip from fishing under the conditions described by these alternatives range from $17,068 under Alternative 4E to $19,290 under Alternative 4B. The average number of affected trips per vessel ranges from 7.3 under Alternative 4B to 15.6 under Alternatives 4E. The average trip length was from 3 days (Alts 4C and 4E) to 4 days (Alts 4B and 4D).

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 97-98 provide the value of the landings (all species), by port landed, from the trips identified by each alternative. Point Judith, RI is the port with the greatest potential impacts with a range of affected landed value from $1.0 million under Alternative 4B to $3.5 million under Alternative 4E. Montauk, NY is the next most significantly impacted port with a range of landed value from $1.0 million (Alt 4B) to $2.8 million (Alt 4E).

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 (2004 through 2006) using otter trawl gear with mesh less than 3.0 inches and with mesh less than 3.75 inches was queried. Five species make up approximately 90% to 93% of the landed value. These are *Loligo* squid, whiting, mackerel, fluke, and scup. Percentage composition is provided in Table 99.

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*, mackerel, whiting, fluke, and scup 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 Table 101 (3 inch minimum mesh size) and Table 101 (3.75 inch minimum mesh size).

Based on total value (all species landed on the affected trip), the rank of alternatives from most significant to least significant is: Alternative 4E, Alternative 4D, Alternative 4C, then Alternative 4B.

Depending on the alternative, scup, fluke, and whiting fishing activity have the largest percentage of regional fishing with the confines (time and space) of the GRAs. For example, under Alternative 4E 83.8% of the whiting value is potentially impacted. *Loligo* percentages across the alternatives indicate that fishing activity occurs nearly evenly within and without the confines of the proposed GRAs. Even though mackerel fishing occurs primarily in the winter months, the activity falls outside of the geographical boundaries of the GRAs. At most, 6.0% (under Alternative 4C) of mackerel value would be impacted.

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 4E which restricts catch in the largest area and requires the larger minimum mesh size. The alternative with the least biological benefit is Alternative 4B 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 decreased revenues 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 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 revenue as offset by the decreased steaming costs. Presumably, the loss of 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 since 2001 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 species in the region, Table 102 reports the regional landings by season. While about 32.7% to 37.2% of the number of trips are during January through April, the landings and value of *Loligo* and whiting are evenly split between the January through April season and the May through December season. Fluke and scup are not as evenly distributed between seasons and mackerel fishing occurs primarily in the January through April period (but, as is seen in Table 100 and 101, the majority of mackerel fishing occurs outside the GRAs). 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.

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 by trimester 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.

Strategy C: Increasing Mesh Size to the Minimum and Continuing to Fish Inside the GRA

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*, mackerel, whiting, fluke, and scup catch at incremental changes in mesh size.

Combination of Strategies

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 100-101, there is the potential for losses up to $11.1 million (see Table 101, Alternative 4E – this represents 46.9% 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.

Table 96. Average Vessel Characteristics, Landings, Value, and Effort of Vessels Impacted by Alternative - Otter Trawl Gear During January through April (2004-2006)

	Alternative 4B	Alternative 4C	Alternative 4D	Alternative 4E
Total Number of Vessels	104	124	122	144
Average Length	73	72	73	73
Average Gross Tons	118	116	122	117
Average Horsepower	581	579	602	581
Average Year Built	1,979	1,979	1,979	1,979
Average Number of Trips per Vessel	7.3	10.7	9.5	15.6
Average Crew Size per Trip	3.7	3.6	3.7	3.5
Average Total Lbs Landed per Trip	33,543	31,834	39,940	30,229
Average Total Value Landed per Trip	19,290	17,182	20,503	17,068
Average Number of Days-at-Sea per Trip	4	3	4	3

Table 97. Average Annual Landings, Value, and Number of Trips by Port (2004 - 2006) for Alternatives using 3” Minimum Mesh Size

	Alternative 4B			Alternative 4C		
Port Landed	Landings (lbs)	Value ($)	Number of Trips	Landings (lbs)	Value ($)	Number of Trips
POINT JUDITH	1,355,056	1,004,708	43	2,331,959	1,834,483	122
MONTAUK	1,216,901	965,565	48	1,499,267	1,187,177	65
BOSTON	1,034,054	485,584	16	1,428,164	765,773	29
WAKEFIELD	160,862	342,773	4	362,749	500,815	15
SHINNECOCK	336,733	265,850	38	341,573	271,419	40
POINT PLEASANT	229,150	191,187	25	211,249	178,315	23
NEW YORK	185,981	139,072	13	296,884	242,415	32
BELFORD	149,898	116,500	17	145,457	112,520	17
NEWPORT	155,893	112,866	7	269,357	203,347	15
NEW BEDFORD	151,793	110,586	4	201,945	150,960	8
NARRAGNASETT	76,250	56,124	3	200,983	170,723	17

Table 98. Average Annual Landings, Value, and Number of Trips by Port (2004 - 2006) for Alternatives using 3.75" Minimum Mesh Size

	Alternative 4D			Alternative 4E		
Port Landed	Landings (lbs)	Value ($)	Number of Trips	Landings (lbs)	Value ($)	Number of Trips
POINT JUDITH	2,501,832	1,816,663	81	4,516,957	3,451,662	231
MONTAUK	2,537,156	1,932,720	89	3,723,034	2,787,010	141
BOSTON	1,574,314	769,750	20	1,943,900	1,026,153	35
WAKEFIELD	221,887	389,489	6	583,170	664,377	27
SHINNECOCK	456,661	346,512	49	450,816	341,937	49
POINT PLEASANT	264,985	219,516	29	239,061	197,899	26
NEW BEDFORD	293,682	209,002	8	551,600	375,933	20
NEW YORK	244,558	183,613	17	382,892	304,898	36
NEWPORT	221,700	162,086	10	465,743	371,010	25
BELFORD	171,578	137,043	20	154,043	117,635	18
NARRAGANSETT	176,215	107,402	7	222,341	186,468	19
STONINGTON				122,848	144,117	29
NEW LONDON				232,213	155,838	5

Table 99. Species Composition of Regional Landed Value – January through April (2004 - 2006)

	Less than 3.75 inch mesh	Less than 3 inch mesh
Loligo Value	27.6%	51.5%
Whiting Value	15.7%	2.8%
Mackerel Value	39.0%	23.2%
Fluke Value	9.3%	9.2%
Scup Value	1.9%	3.1%
All other species value	6.5%	10.2%

Table 100. Average Annual Pounds and Value of Landings (2004 - 2006) for Alternatives using 3" Minimum Mesh Size

	Regional Landings	Alternative 4B		Alternative 4C	
	Jan thru Apr (<3" mesh)	Lbs/value/#	% of Regional Landings	Lbs/value/#	% of Regional Landings
Total Landings	29,333,642	5,736,224	19.6%	8,275,908	28.2%
Total Value	13,713,365	4,170,081	30.4%	6,226,174	45.4%
Number of Trips	732	253	34.6%	441	60.3%
Loligo Landings	10,031,648	3,782,570	37.7%	5,381,353	53.6%
Mackerel Landings	12,016,543	713,254	5.9%	824,887	6.9%
Whiting Landings	649,615	305,723	47.1%	538,910	83.0%
Fluke Landings	687,996	251,724	36.6%	525,689	76.4%
Scup Landings	603,708	344,499	57.1%	334,838	55.5%
Loligo Value	7,059,540	2,657,754	37.6%	3,786,586	53.6%
Mackerel Value	3,175,122	75,345	2.4%	191,412	6.0%
Whiting Value	386,225	177,349	45.9%	315,687	81.7%
Fluke Value	1,263,913	463,339	36.7%	962,266	76.1%
Scup Value	418,138	243,798	58.3%	246,489	58.9%

Table 101. Average Annual Pounds and Value of Landings (2004 - 2006) for Alternatives using 3.75" Minimum Mesh Size

	Regional Landings	Alternative 4D		Alternative 4E	
	Jan thru Apr (<3.75" mesh)	Lbs/value/#	% of Regional Landings	Lbs/value/#	% of Regional Landings
Total Landings	55,423,858	10,712,604	19.3%	15,410,943	27.8%
Total Value	23,637,244	7,042,901	29.8%	11,084,351	46.9%
Number of Trips	1,202	384	32.0%	748	62.2%
Loligo Landings	13,895,100	5,819,411	41.9%	8,346,365	60.1%
Mackerel Landings	29,416,380	1,855,321	6.3%	1,415,868	4.8%
Whiting Landings	3,362,125	1,343,456	40.0%	2,836,407	84.4%
Fluke Landings	1,165,779	388,586	33.3%	889,821	76.3%
Scup Landings	850,507	487,433	57.3%	499,780	58.8%
Loligo Value	9,797,419	4,092,031	41.8%	5,876,752	60.0%
Mackerel Value	7,043,206	359,794	5.1%	380,937	5.4%
Whiting Value	1,945,835	779,109	40.0%	1,631,484	83.8%
Fluke Value	2,185,024	731,655	33.5%	1,658,023	75.9%
Scup Value	607,284	350,698	57.7%	371,814	61.2%

Table 102. Average Annual Pounds and Value of Landings by Season (2004 - 2006)

	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	68,688,243	100,060,801	29,333,642	42.7%	55,423,858	55.4%	39,354,601	57.3%	44,636,943	44.6%
Total Value	28,240,626	41,719,613	13,713,365	48.6%	23,637,244	56.7%	14,527,261	51.4%	18,082,369	43.3%
Number of Trips	2,235	3,234	732	32.7%	1,202	37.2%	1,503	67.3%	2,032	62.8%
Loligo Landings	18,703,902	24,348,946	10,031,648	53.6%	13,895,100	57.1%	8,672,255	46.4%	10,453,846	42.9%
Mackerel Landings	12,657,652	30,232,537	12,016,543	94.9%	29,416,380	97.3%	641,109	5.1%	816,157	2.7%
Whiting Landings	1,011,592	5,629,815	649,615	64.2%	3,362,125	59.7%	361,977	35.8%	2,267,690	40.3%
Fluke Landings	824,350	1,369,865	687,996	83.5%	1,165,779	85.1%	136,354	16.5%	204,086	14.9%
Scup Landings	737,773	1,041,371	603,708	81.8%	850,507	81.7%	134,065	18.2%	190,864	18.3%
Loligo Value	13,889,238	18,012,864	7,059,540	50.8%	9,797,419	54.4%	6,829,698	49.2%	8,215,445	45.6%
Mackerel Value	3,323,348	7,236,385	3,175,122	95.5%	7,043,206	97.3%	148,226	4.5%	193,179	2.7%
Whiting Value	603,206	3,254,596	386,225	64.0%	1,945,835	59.8%	216,981	36.0%	1,308,761	40.2%
Fluke Value	1,540,115	2,595,227	1,263,913	82.1%	2,185,024	84.2%	276,203	17.9%	410,203	15.8%
Scup Value	528,080	760,381	418,138	79.2%	607,284	79.9%	109,942	20.8%	153,097	20.1%

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 10 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 10 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 6). 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 (Figure 7).

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 2008 (i.e., ~2013). 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 103 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 in 1996 and 2007. 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 effective 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 lower the maximum sustainable yield of the managed resources, and negatively affect 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 104 and discussed below. These impacts, in addition to the impacts of the management actions being developed in this document (Table 76 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 105 (Section 8.9).

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Table 103. 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 MSB 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 MSB 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 MSB 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 103 (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 MSB 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 MSB 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 MSB 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 MSB 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 MSB 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 103 (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 9 to the MSB FMP (2007-2008) (note: this will likely be in proposed rule phase in late 2007, so the impacts described reflect the anticipated impacts of the preferred alternatives)	Multiple year specs	**No Impact** Administrative	**No Impact** Administrative	**No Impact** Administrative	**No Impact** Administrative	**No Impact** Administrative
	Extend *Illex* moratorium	**Positive** Would decrease the likelihood that the fishing quota would be exceeded	**Positive** Constrains effort	**No Impact** If current trawling effort is maintained, would not increase habitat disturbances.	**Positive** Constrains effort	**Potentially Positive** Maintains net benefits to fleet and dependent communities by limiting overcapitalization.
	Revise biological reference points for *Loligo*	**Potentially Positive** Increase chance of achieving long term sustainable yield for *Loligo*.	**Potential low negative** May increase effort slightly if it results in a higher quota.	**Potential low negative** May increase effort slightly if it results in a higher quota.	**Potential low negative** May increase effort slightly if it results in a higher quota.	**Potential low positive** May increase benefits slightly if it results in a higher quota.
	Designate EFH for *Loligo* eggs based on documented observations of egg mops	**Potentially positive** if used as basis for future management.	**Potentially positive** if used as basis for future management.	**Potentially positive** if used as basis for future management.	**Potentially positive** if used as basis for future management.	**Potentially negative short term** if used as basis for future management. **Potentially positive long term** if used as basis for future management to improve long-term sustainability of resource.
	Area closures to reduce gear impacts on EFH	**Low positive** Small area with low effort impacted	**Low positive** Small area with low effort impacted	**Low positive** Protects deep-sea corals in small area.	**Low positive** Small area with low effort impacted	**No impact** Small area with low effort impacted
	Increase *Loligo* possession limit for directed *Illex* fishery during *Loligo* closures. Preferred alternative was no action.	**Loligo negative.** Maintains current levels of regulatory discarding. **Other SMB no impact**	**No impact**	**No impact**	**No impact**	**No impact**

Amendment 9 continued.	Institute Daily reporting requirement in directed *Illex* fishery. Preferred alternative was no action.	**No impact**	**No impact**	**No impact**	**No impact**	**No impact**
[RFFA]Amendment 11 to the MSB 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]Amendment 12 to the MSB FMP (~ 2009/2010)	Authorize sector allocations	**Low positive** Already quota controlled but sectors may reduce discarding.	**Low positive** Lower effort associated with increased efficiency	**Low positive** Lower effort associated with increased efficiency	**Low positive** Lower effort associated with increased efficiency	**Positive** Increased efficiency
	Reauthorized Magnuson-Stevens compliance.	**Positive** Increased conservation, primarily due to ACL/AM compliance	**Low Positive** Constrain fishing effort due to ACL/AM compliance	**Low Positive** Constrain fishing effort due to ACL/AM compliance	**Low Positive** Constrain fishing effort due to ACL/AM compliance	**Potentially negative short term** due to AM. **Potentially positive long term** due to AM and increased long-term sustainability.
[Pr] Atlantic Trawl Gear Take Reduction Team (2006-2008)	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] Implement Standardized Bycatch Reporting Methodology in 2008	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 2007 (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	May recommend	**Indirect Positive**	**Indirect Positive**	**Indirect Positive**	**Indirect Positive**	**Indirect Negative**

Sea Turtle Conservation for the Atlantic Ocean and the Gulf of Mexico Fisheries (w/in next 5 years)	strategies to prevent the bycatch of sea turtles in commercial fisheries operations	Will improve data quality for monitoring total removals	Reducing availability of gear could reduce bycatch	Reducing availability of gear could reduce gear impacts	Reducing availability of gear could reduce encounters	Reducing availability of gear could reduce revenues

(Table 103, which continues above and below)

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Table 103 (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 103 (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 (low probability 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 105.

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. Thus the baseline for determining that the summary effects of past, present, and reasonably foreseeable future actions on butterfish have been negative is "what could have been with better management," and not "what would have been with no management." While this is contrary to standard accepted practice in cost-benefit analysis, it is useful for highlighting where management has been insufficient. 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 103**) 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. 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 to better manage bycatch. The summary effects of past and present actions on non-target species are considered to be a mixed set of partially 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 103**) 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. Altogether, the resultant impact of past and present actions on non-target species is a likely 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 103**) 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 MSB 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 103**), 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 103**. Additionally, the same general trends will be noted with regard to the expected outcomes of fishery-related actions and non-fishing actions; 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 103**, 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 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 104. Summary effects of past, present and reasonably foreseeable future actions on the VECs identified for Amendment 10 (based on actions listed in Table 103).

VEC	Past Actions (P)	Present Actions (Pr)	Reasonably Foreseeable Future Actions (RFFA)	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,	**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 reduction of revenue per unit of effort	**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 105. It is suggested that the reader refer to the appropriate subsections to obtain details regarding this information.

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Table 105. 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 of Amendment 9, 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 87**. 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 88** 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.

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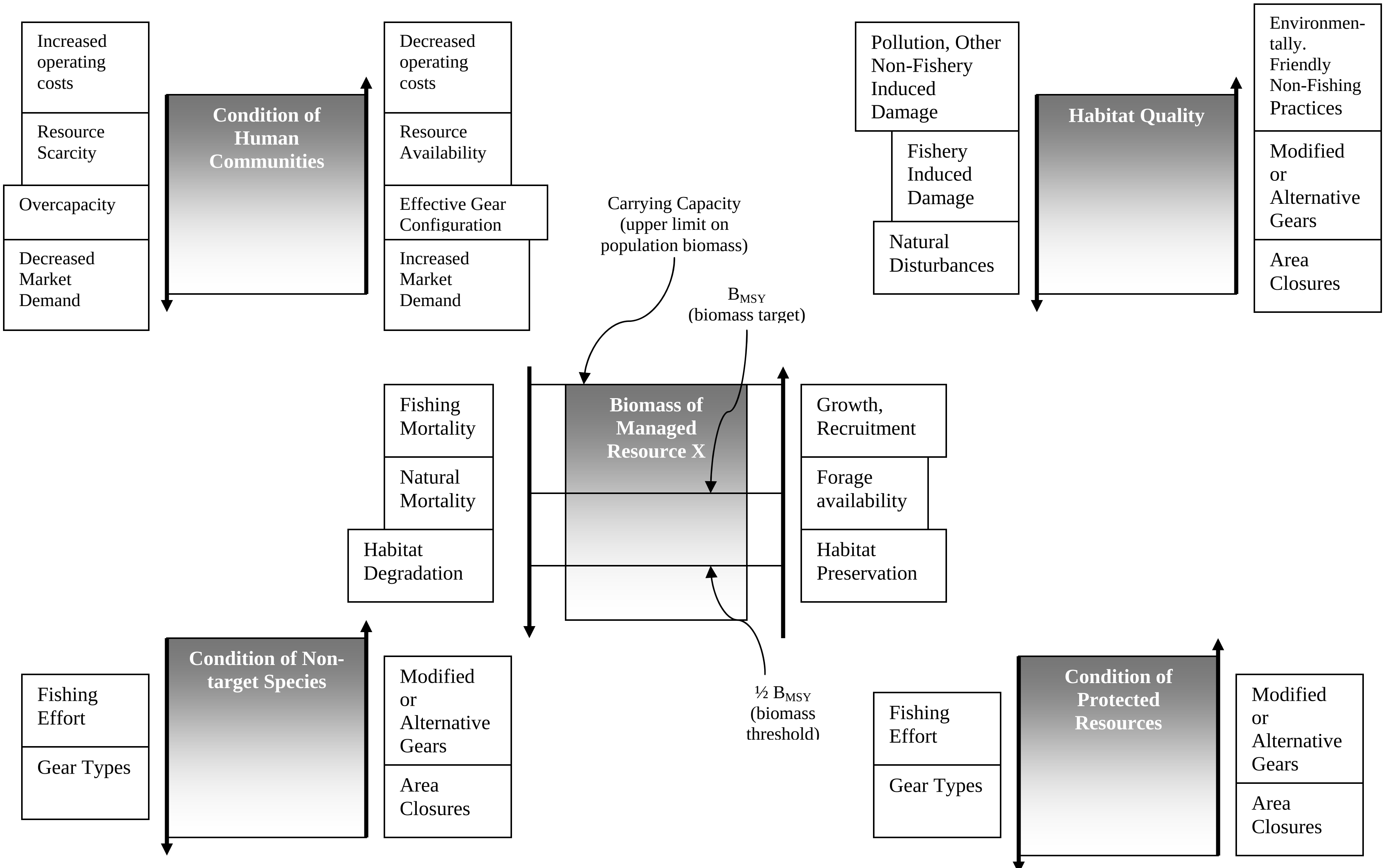

Figure 87. Examples of environmental sources of positive impacts (up arrows) and negative impacts (down arrows) for the five VECs.

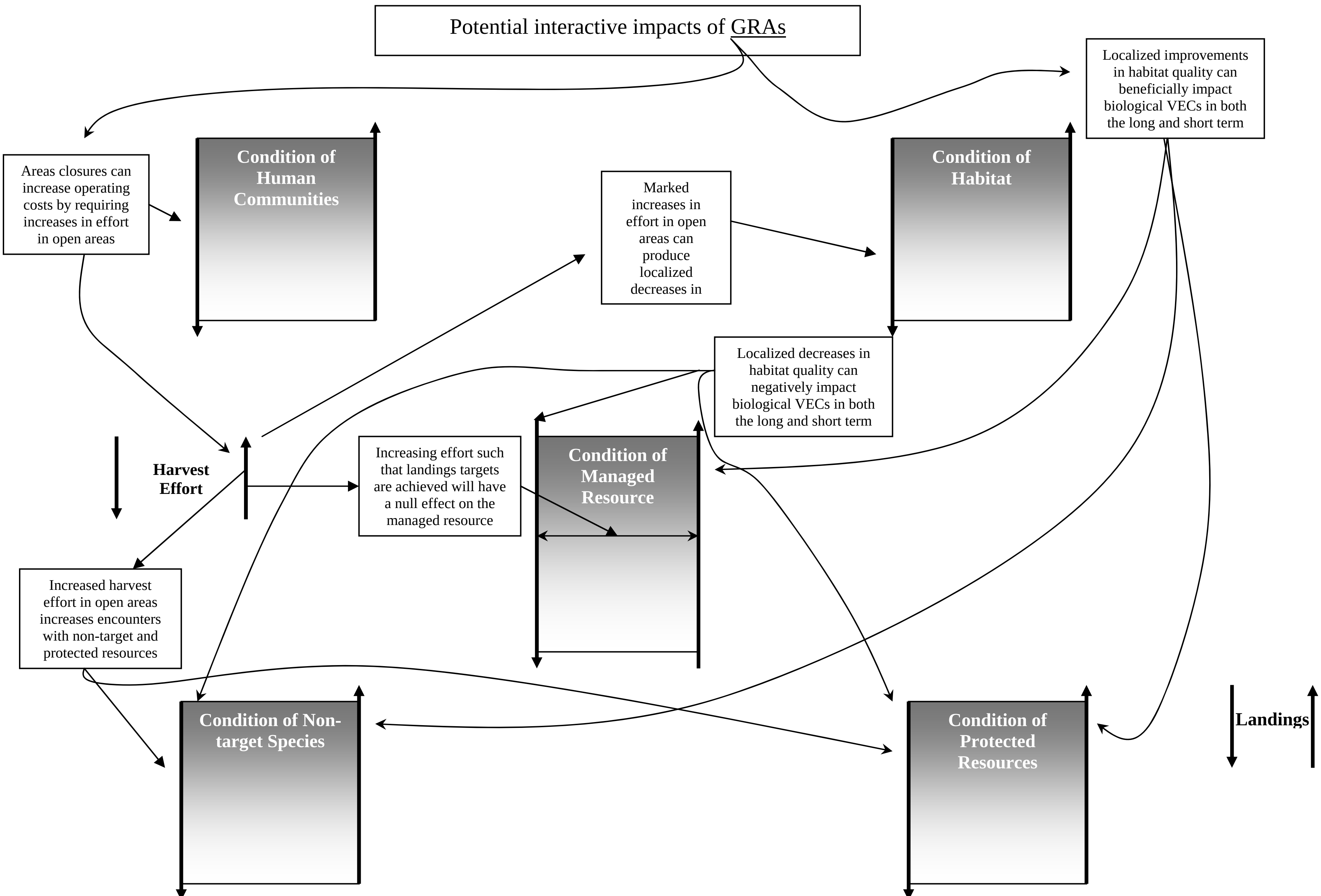

Figure 88. Examples of environmental sources of positive impacts (up arrows) and negative impacts (down arrows) for the five VECs.

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 106** summarizes the added effects of the condition of the VECs (i.e., status/trends/stresses from Section 6 and **Table 105**) and the sum effect of the past, present and reasonably foreseeable future actions (from Table 105). 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 107.

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Table 106. CEA baseline conditions of the VECs.

VEC		Status/Trends/Stresses	Combined Effects of Past, Present Reasonably Foreseeable Future Actions (Table 104)	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; most recent stock assessment estimated that stock size to be below ½ Bmsy threshold. SSC-approved AR model predicts biomass at or above B_{MSY} target in 2007.	**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 13 for each fishery)		Quantitative characterization of bycatch in SMB fisheries is poor to unknown, with the exception of butterfish; *Loligo* fishery continues to account for large proportion of Observer Program discards for several 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	**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 6.3.4.1of Amendment 9; 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 White-sided dolphin	Unknown status, but takes are below PBR; taken by *Loligo*, mackerel and other fisheries; Unknown status, but takes are below PBR; historically taken by foreign mackerel vessels;	**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
	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 106 (continued)

VEC	Status/Trends/Stresses	Combined Effects of Past, Present Reasonably Foreseeable Future Actions (Table 104)	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 103**, and the relationships between the VECs illustrated in **Figure 87** 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 distribution. **Table 103** 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 106** lists the summary effects of the past, present and future actions on the VECs and Table 107 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 10) Actions</u> The summary effects of the proposed actions are dependent on which combinations of actions are ultimately implemented. All of the alternatives have been described repeatedly throughout this document. The individual impacts of each of the alternatives is presented in detail in Section 7.0 and summarized in the executive summary. 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 alternatives recommended by the

Council in this amendment additively result in decreased harvest of 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 107 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 76. Table 107 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 106** added with the direct/indirect effects conditional on implementation of alternatives with positive or negative directionality on a given VEC. If no 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 106** would apply (1st shaded column). Note that the summary cumulative effects apply to individual proposed actions. If there are no additive effects on human communities from an 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 which actions are ultimately implemented through this amendment, it is expected that the overall long-term cumulative effects should be positive for all VECs (see **Table 107**). 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 MSA 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 107 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, reducing 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 107 in the 2nd and 3rd shaded columns, respectively. The preferred alternatives (if any) 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 108.

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, and recent poor recruitment. The discarding problem is not a direct result of past or present management actions, but instead, management inaction, which will be addressed through this amendment. 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, including this amendment, are anticipated to rebuild the stock, notwithstanding the difficult to measure 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 103**) 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: Alternatives which do not adopt a butterfish mortality cap (1A), modify *Loligo* minimum mesh size (2A-E) and exempt *Loligo* minimum mesh size requirements for *Illex* vessels (3A-D) and do not adopt Gear Restricted Areas (GRAs) (4A) would not likely impact fishing mortality on the three managed species other than butterfish and therefore would not have cumulative impacts on these species. (It should be noted that without alternatives 2B-E, 3B-D and 4B-E, the resultant positive impact on butterfish would be reduced, since these alternatives would have a more positive effect on this species -- see below).

Table 107. Summary cumulative effects for the management actions proposed in Amendment 10.
The cumulative effects (shaded columns) are the sum of the Refer to Table 76 for the rationale behind the positive, negative, or neutral impacts from the proposed actions.

VEC	Management actions with neutral or no impacts		Management actions with positive impacts		Management actions with negative impacts	
	Alternatives with No Direct/ Indirect Effects (see Table 76)	**Combined Baseline Effects (independent of proposed actions - see table 107) Cumulative effects of No Action or Proposed Action with neutral or no impacts**	**Alternatives with Positive Direct/Indirect Effects (see Table 76)**	**Resultant Cumulative Effects (conditioned on implementation of Proposed Actions with positive effects)**	**Alternatives with Negative Direct/Indirect Effects (see Table 76)**	**Resultant Cumulative Effects (conditioned on implementation of Proposed Actions with negative effects)**
Managed Resources	2A-E[A] 3A[A], 3B[A], 3C[A], 3D[A] 4A[A], 4B[A], 4C[A], 4D[A], 4E[A]	**Negative**	1B-E [B] 2B[B<], 2C[B<], 2D [B], 2E[B>] 3B[B<], 3C[B<], 3D[B<] [<] 4B[B], 4C[B], 4D[B], 4E[B]	**More Positive than baseline** – measures to control fishing effort would further stabilize stocks for SMB species	1A[B] 2A[B] 3A[B <], 3C[I <], 3D [I <] 4A[B]	**Negative** - decreased stock biomass, increased risk of overfishing
Non-Target Species	2A 4A	**Negative** - Increased bycatch rates would continue until reduction measures are implemented	1B-D[<], 1E 2B-D[<], 2E 3B[<], 3C[<], 3D[<] 4B[+], 4C[+], 4D[+], 4E[+]	**Positive** – measures to control fishing effort would reduce bycatch mortality	1A[<] **3A**[<]	**Negative** - decreased stock biomass, increased risk of overfishing

Table 107 (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 76 for the rationale behind the positive, negative, or neutral impacts from the proposed actions.

Habitat	1A 2A 3A, 3B 4A	**Positive** - reduced habitat disturbance by fishing gear and non-fishing actions	1B-D$^{<}$ 4B$^{<+}$, 4C$^{<+}$, 4D$^{<+}$, 4E$^{<+}$	**Positive** - measures to control fishing effort and closed areas would further reduce habitat disturbance by fishing gear	1E 2B$^{<}$, 2C$^{<}$, 2D$^{<}$, 2E$^{<}$ 3C$^{<}$, 3D$^{<}$ 4B$^{<--}$, 4C$^{<--}$, 4D$^{<--}$, 4E$^{<--}$	**Negative** - increased habitat disturbance by fishing gear and non-fishing actions
Protected Resources	1A 2A 3A, 3B 4A	**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	1B-D$^{<}$ 4B$^{<+}$, 4C$^{<+}$, 4D$^{<+}$, 4E$^{<+}$	**Positive** - measures to control fishing effort and closed areas would reduce gear encounters, improve habitat quality; anticipated Trawl PRP should further reduce takes	1E 2B$^{<}$, 2C$^{<}$, 2D$^{<}$, 2E$^{<}$ 3C$^{<}$, 3D$^{<}$ 4B$^{<--}$, 4C$^{<--}$, 4D$^{<--}$, 4E$^{<--}$	**Negative in short term** - increased gear encounters would continue **Positive in long term** – anticipated Trawl TRP should reduce the negative impact of encounters
Human Communities	1A 2A 3A 4A	**Short-term negative** lower revenues would continue until stocks are fully rebuilt **Long-term positive** sustainable resources should support viable communities and economies		**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	1B-E 2B$^{<}$, 2C$^{<}$, 2D$^{<}$, 2E 3B$^{<}$, 3C, 3D 4B, 4C, 4D$^{>}$, 4E$^{>}$	**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 107 (footnotes)

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 76)**

The effects of implementing the GRAs (4B-E) on the three other managed species (exclusive of butterfish) are 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: implement a butterfish mortality cap (1B-D) would have positive effects of reducing fishing mortality of butterfish. As mentioned above, measures to modify *Loligo* minimum mesh size (2B-E), eliminate exemptions from *Loligo* minimum mesh size requirements for *Illex* vessels (3B-D) and GRAs (4B-E) would have positive cumulative impacts on butterfish due to the reduced catches, but not for the other three species. It is noteworthy here to mention that the positive cumulative effects of the GRAs on butterfish apply to inside the GRAs. It is anticipated that this might translate to a negative effect on butterfish, if the fishing effort is shifted to outside areas and the ratio of *Loligo* to butterfish is lower outside the GRA . It is anticipated that this might translate to a negative effect on habitat and protected resources outside the GRAs if the fishing effort is shifted in those areas and the abundance of *Loligo* is lower outside the GRA .

Summary of Alternatives with Negative Effects: Negative cumulative effects on butterfish would result from adopting at least one of following: not adopting a butterfish mortality cap (1A), not modifying *Loligo* minimum mesh size (2A), continuing all exemptions from minimum mesh size for *Illex* vessels (3A), and not implementing any GRAs (4A). In addition, Alternatives 3C and 3D would potentially have low negative effects on *Illex* due to slightly increased mortality of the larger mesh sizes.

Of the four species managed through this FMP, butterfish is the only one presently designated to be overfished. Amendment 10 to the FMP is being developed in order to directly address recovery of the butterfish stock. Recovery of the butterfish stock is currently being compromised 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. As such, a combination of any of the management measures in this amendment should promote improvement and long-term sustainability of the butterfish stock and result in positive cumulative impacts.

Management measures in this amendment are unlikely to substantially affect the status of the *Loligo* and *Illex* stocks. Likewise, 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.

Non-target Species Impacts

Summary of CEA Baseline: Fishery encounters with non-target species (listed in **Table 15** A-B), and the subsequent bycatch mortality remains a substantial 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 action Alternatives on non-target species, as described above, will likely be positive if the action Alternatives in this Amendment are adopted. 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: It is also likely that not implementing the following: butterfish mortality cap (1A), modifying *Loligo* minimum mesh size (2A), and GRAs (4A) 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: Alternatives that have positive on non-target species include: modifying *Loligo* minimum mesh size (2B-E), eliminating exemptions for *Loligo* minimum mesh size requirements for *Illex* vessels (3B-D), and developing GRAs (4B-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 would apply inside the GRAs since fishing effort would be reduced in these areas. It is anticipated that this might translate to a negative effect outside the GRAs if the fishing effort is shifted to areas outside the GRA.

Summary of Alternatives with Negative Effects: Other alternatives that would have negative cumulative effects include: not limiting the current exemption for *Loligo* mesh size requirements for *Illex* vessels (3A) as it would have a minor negative effect on these species since it would not allow for increased escapement of butterfish or other bycatch species.

The implementation 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 103**) 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. Not implementing: a butterfish mortality cap (1A), an increased *Loligo* minimum mesh size (2A), eliminating exemptions from *Loligo* minimum mesh size requirements for *Illex* vessels (3A), and the GRAs (4A) would not have any effects since not acting would not change fishing effort (and thus disturbance to the bottom). Thus, implementation of the above alternatives (which really mean not implementing anything) would not likely have positive or negative cumulative effects on habitat. The elimination of September from the exemptions for *Loligo* minimum mesh size requirements for *Illex* vessels (3B) should have no impact on habitat because *Illex* are large enough in September so no increase in fishing effort to catch a given amount of *Illex* is predicted.

Summary of Alternatives with Positive Effects: Implementing a butterfish mortality cap (1B-D) may reduce impacts on habitat because a cap could reduce effort. The butterfish GRAs (4 B-E) would have the effect of decreasing fishing effort inside the GRAs and thus reduce bottom disturbance in these areas (areas outside the GRAs are discussed under negative effects).

Summary of Alternatives with Negative Effects: The alternatives that implement an increased *Loligo* minimum mesh size (2B-E) likely have a low negative habitat impact since a larger mesh would reduce *Loligo* retention and may, in turn, increase harvest efforts (and area trawled) to make up for that reduction. Likewise, alternatives to reduce exemptions for *Loligo* minimum mesh size requirements for *Illex* vessels (3C-D) may also result in slightly increased effort and therefore habitat disturbance.

The implementation of the GRAs (4B-E) may have low negative impacts to habitat outside the GRAs since gear restrictions may shift effort there. If this increase is minor it would have a minor effect and thus pose only a minor negative contribution to cumulative effects. These outside areas are already being fished by other fisheries. It remains unclear how much additional effort would be expended outside of any potential GRAs. However, the negative economic impacts of GRA area closures may provide a significant incentive to fish more intensively in open areas. If this amendment generates positive impacts, some habitat types will likely require a long time to recover.

Overall, the incremental cumulative impacts on habitat provided with this Amendment, are uncertain, though they may be slightly negative due to the "forced inefficiency" nature of certain proposed Alternatives that result in greater effort to catch the same amount of fish.

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 (gear modifications lessen the negative impact of a given level of effort). Future actions that would directly reduce the mortality of protected resources from encounters with SMB fisheries include the implementation of the Atlantic Trawl Gear Take Reduction Plan 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: Not implementing: a butterfish mortality cap (1A), an increased *Loligo* minimum mesh size (2A), eliminate exemptions from *Loligo* minimum mesh size requirements for *Illex* vessels (3A), and the GRAs (4A) would not have any effects since not acting would not change fishing effort (and thus interactions with protected resources). Thus, implementation of the above alternatives (which really mean not implementing anything) would not likely have positive or negative cumulative effects on protected resources. The elimination of September from the exemptions for *Loligo* minimum mesh size requirements for *Illex* vessels (3B) should have no impact on protected resources because *Illex* are large enough in September so no increase in fishing effort to catch a given amount of *Illex* is predicted.

Summary of Alternatives with Positive Effects: Implementing a butterfish mortality cap (1B-D) may reduce impacts on protected resources because a cap could reduce effort. The butterfish GRAs (3 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 could 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. The alternatives that implement increased *Loligo* minimum mesh size (1E, 2B-E) 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 and potentially increase protected species interactions. In addition, some alternatives to eliminate exemptions from *Loligo* minimum mesh size requirements for *Illex* vessels (3 C-D) may also increase effort and interactions for protected species.

In opposition to the positive effects inside the GRAs (10B-E) described above, implementation of the GRAs could have low negative impacts to protected species outside the GRAs since gear restrictions may shift effort there. The negative economic impacts of area closures may provide a significant incentive to fish more intensively in open areas and thus potentially increase interactions. It remains unclear how much additional effort would be expended outside of any potential area closures if they were to be implemented. The overall impact of the GRAs would also depend on the ratio of protected resources to *Loligo* inside the GRAs compared to the ratio of protected resources to *Loligo* in areas where effort shifts to outside of the GRAs. If the latter is higher then there might be negative effects, and if lower then positive overall effects could be observed, depending on the total effort.

<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 MSB 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 103**), 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: a butterfish mortality cap (1A), a modification of *Loligo* minimum mesh size (2A), limitations on exemptions from *Loligo* minimum mesh size requirements for *Illex* vessels (3A), or butterfish GRAs (4A) also would not contribute any cumulative effects, since it would not impact the intensity or distribution of fishing effort and hence revenues.

Summary of Alternatives with Positive Effects: None in the short term. See next section for discussion of possible longer-term positive effects.

Summary of Alternatives with Negative Effects: There are a number of alternative that exhibit negative cumulative effects. Alternatives to modifying *Loligo* minimum mesh size (2B-E), limiting exemptions from minimum mesh size for *Illex* vessels 2B-D, and the butterfish GRAs (4B-E) would, in effect, reduce revenues and contribute to negative effects on human communities. The loss of revenue impacts of 2E, 3C, 3D, 4D, and 4E are generally more severe than their respective counterparts (for example 2E would have a more severe impact than 2B).

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 revenues generated from the fishery are inextricably connected to the biological conservation of the resource. 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 is likely 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 step will be considered during the Public Hearing Process, NMFS review, and subsequent Council review.

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 108. 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**				
Implement butterfish rebuilding program						
1A	**No Action**	**--**	**0 to** < **--**	**0**	**0**	**0**
1B	**Mortality Cap; butterfish allocation = current Loligo allocation**	**+B** < +L; 0A	< +	< +	**0 to +**	**0 to** < **--** short term, + long term
1C	**Mortality Cap; butterfish allocation = recent Loligo landings distribution**	**+B** < +L; 0A	< +	< +	**0 to +**	**0 to** < **--** short term, + long term
1D	**Mortality Cap; butterfish allocation = weighted to trimester II**	**+B** < +L; 0A	< +	< +	**0 to +**	**0 to** < **--** short term, + long term

1E	**No Cap; 3" mesh to possess any Loligo**	**+B** < +L; 0A	+	< --	**potentially --**	**0 to** < -- short term, + long term
Modify *Loligo* Minimum Mesh Size						
2A*	**No Action**	--B 0 A	0	0	0	0
2B	Increase minimum codend mesh size to $2^{1/8}$ inches	< + B 0 A	< +	< --	< --	< --
2C	Increase minimum codend mesh size to $2^{3/8}$ inches	< + B 0 A	< +	< --	< --	< --
2D	Increase minimum codend mesh size to $2^{1/2}$ inches	< + B 0 A	< +	< --	< --	< --
2E	Increase minimum codend mesh size to 3 inches	>+B 0 A	+	< --	< --	--
Exemptions from *Loligo* Minimum Mesh Size Requirements for *Illex* Vessels						
3A*	**No Action**	< -- B 0 A	< --	0	0	0
3B	Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding September from current mesh exemption	< + B 0 A	< +	0	0	< --
3C	Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding August and September from current mesh exemption	< + B 0 A < -- I	< +	< --	< --	--
3D	Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels	< + B 0 A < -- I	< +	< --	< --	--
Implementation of Seasonal Gear Restricted Areas (GRA) to Reduce Butterfish Discards						
4A*	**No action**	-- B	0	0	0	0

		0 A				
4B	Minimum of 3 inch codend mesh size in Butterfish GRA 1 (50% of discards)	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	--
4C (=4E)	Minimum of 3 inch codend mesh size in Butterfish GRA 2 (90% of discards)	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	> --
4D	Minimum of $3^{3/4}$ inch codend mesh size in Butterfish GRA 3 (50% of discards)	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	--
4E (=4C)	Minimum of $3^{3/4}$ inch codend mesh size in Butterfish GRA 4 (90% of discards)	+B 0 A	+	+ inside GRA -- outside GRA	+ inside GRA -- outside GRA	> --

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/population size
Negative: actions that decrease stock/population size

Habitat:
Positive: actions that improve the quality or reduce disturbance of habitat
Negative: actions that degrade the quality 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

Impact Qualifiers:
Low (as in *low* positive or *low* negative): to a lesser degree
High (as in *high* positive or *high* negative) to a greater degree
Potentially: a relatively higher degree of uncertainty is associated with the impact

9.0 CONSISTENCY WITH THE MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

9.1 NATIONAL STANDARDS

Section 301 of the MSA requires that 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.

Unless otherwise mentioned below, the alternatives identified in this amendment do not address any of the management measures previously implemented under the FMP which were found to be fully in compliance with all national standards of the Magnuson-Stevens Act.

(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.

In 2005, the Council was notified by NMFS that the Atlantic butterfish stock was designated as being over fished because the most recent stock assessment for the species indicated that average stock biomass had fallen below the threshold of ½ B_{msy}, triggering the need for development and implementation of a stock rebuilding program for the species in this Amendment. Alternative 1B-1D would implement measures which are expected to allow the butterfish stock to recover to and remain at the B_{msy} level within a five year planning horizon. As such, these measures were designed to be in compliance with National Standard 1.

(2) Conservation and management measures shall be based upon the best scientific information available.

The analyses used to predict the impacts of all of the alternatives in this amendment were based on 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.

No alternative in this document addresses this national standard.

(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.

No alternative in this document addresses this national standard.

(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.

No alternative in this document addresses this national standard.

(6) Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.

No alternative in this document addresses this national standard.

(7) Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

No alternative in this document addresses this national standard.

(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.

An extensive review of the ports and communities affected by the FMP is included in this document (Section 6.5).

(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.

Alternatives 1A, 2A, 3A, and 4A all propose no action on the issue of finfish discarding, especially as it relates to the discarding of butterfish. If the Council adopted these alternatives as a result of this Amendment, then the FMP would most likely remain out of compliance with this National Standard.

However, each of the action alternatives identified under alternatives 1, 2, 3, and 4 would result in reductions in discards in the *Loligo* fishery (and potentially other small mesh fisheries regulated under this FMP). Alternatives 1B-1D would establish a mixed species management system for the *Loligo* and butterfish fisheries that would place a cap on the mortality of butterfish on an annual basis. These alternatives will achieve butterfish stock rebuilding while minimizing to the extent practical discards of butterfish. Alternatives 2B-2E would require the use of larger codend mesh sizes in the *Loligo* fishery which are intended to reduce the retention and, therefore, the level of discards of non-target species, including butterfish, in the small mesh *Loligo* fishery. Finally, alternatives 4B-4E would impose seasonal mesh size restrictions in bottom otter trawls in pre-specified areas designed to reduce butterfish discards. All of these measures address, to some degree, National Standard 9.

(10) Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

No alternative in this document addresses this national standard.

9.2 OTHER REQUIRED PROVISIONS OF THE MAGNUSON-STEVENS ACT

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;

Alternatives 1A-1D propose to directly rebuilding the butterfish stock over a five year recovery window through the implementation of a butterfish mortality cap which could be adjusted annually in an adaptive management framework. Alternative 1E would achieve stock rebuilding indirectly through an increase in the minimum codend mesh size to 3 inches in the *Loligo* fishery.

(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;

Sections 6.1 and 6.5 in this document include a description o the fisheries managed under this FMP.

(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;

The specification of annual management measures under this FMP includes the identification of MSY and OY for all SMB fisheries. With the exception of butterfish, all the species managed under this FMP are above their pre-defined biomass thresholds and/or are not experiencing overfishing. In the case of butterfish, the stock was defined as being overfished in 2005 based on the fact that average biomass had fallen below the threshold biomass threshold defined in the FMP (i.e., ½ B_{msy}). Recent NEFSC survey and biomass and recruitment projections developed for this amendment suggest that biomass of the butterfish stock could have increased to slightly above the B_{msy} level in 2007 as a result of improved year class strength in 2006. The projections do not represent stock status. Like the stock size estimates, the projection estimates are likely highly imprecise. Also, if butterfish abundance levels increase after higher recruitment events, the expected level of discard mortality would also increase under the no action alternative. Therefore, while temporary stock recovery could theoretically occur relatively quickly, the stock could quickly return to an overfished status in the absence of measures to control fishing mortality due to discarding.

(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;

The specification of annual management measures under this FMP includes analyses of the fisheries' ability to harvest OY. The most recent analyses for the 2008 proposed specifications indicate that fishing vessels of the United States have the ability and intent to harvest all of the OY specified for each species. In addition, the processing sector has the capacity and intent to process all of the OY specified for 2008 for each species.

(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;

Section 6 in this document includes an extensive presentation of pertinent data for the SMB fisheries, and as such, satisfies this provision.

(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;

No alternative in this amendment addresses this provision.

(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;

Section 6.3 of this document describes and identifies EFH in order to satisfy this provision.

(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;

The preparation of this amendment included a review of the scientific data that were available to assess the impacts of all alternatives in this amendment.

(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;

Section 7.5 of this document provides an extensive assessment of the likely effects of the actions proposed in this amendment on fishery participants and communities.

(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;

Each of the species managed under this FMP has threshold criteria for identifying when the stocks are overfished. These are presented in Section 6.1 of this document. The primary purpose of this amendment is develop conservation and management measures to rebuild the overfished butterfish stock. These measures are fully described in section 5.1 of this document.

(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;

This FMP is in compliance with this provision as established through the implementation of the Standardized Bycatch Reporting Methodology (SBRM) Amendment for fisheries in the Northeast Region.

(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;

No alternative in this amendment addresses this provision.

(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;

Recreational fishing for Atlantic mackerel is addressed in Section 6.1 of this document. The other species managed under this FMP have no significant recreational component.

(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.

No alternative in this amendment addresses this provision.

9.3 ESSENTIAL FISH HABITAT ASSESSMENT

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

The purpose of the proposed action and the principal management measures included in it are described in Section 5.0 of this document.

9.3.2 Determination of Habitat Impacts for Selected Measures

Non-habitat measures

The suite of proposed non-habitat measures in this Amendment are described in section 5.0. A summary of the potential habitat benefits of the non-habitat measures considered in this Amendment are listed below in Box 9.3.2.

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Table 109. Summary of non-habitat measures and their expected impacts on EFH.

Management Measure	Impact	Explanation
Butterfish rebuilding program - no action (Alt 1A)	0	No change in effort or distribution of effort expected.
Butterfish rebuilding program - (Alt 1B-1E)	0 to slightly -	If butterfish cap is reached prior to *Loligo* quota being reached, effort will be reduced.
Loligo minimum mesh size - no action (**Alt 2A***)	0	No change in mesh size should result in no change in effort.
Loligo minimum mesh size increase (Alts 2B - 2E)	0 to slightly -	Increase in mesh size could result in no change or slight effort increase.
Illex mesh exemption (Alts **3A*** - 3B)	0	Alternatives 7A, 7B should not affect effort in *Illex* fishery.
Illex mesh exemption (Alts 3C - 3D)	-	Alternatives 7C, 7D may increase effort in *Illex* fishery.
Butterfish gear restricted areas - no action (Alt **4A***)	0	No change in effort in fishery effort.
Butterfish gear restricted areas(Alts 4B - 4E)	+/-	Mixture of decreased effort within GRAs and increased effort outside GRAs. Overall effect depends on abundance of *Loligo* inside and outside GRAs.

9.3.3 Measures to Avoid, Minimize, or Mitigate Adverse Impacts of this Action

Habitat measures

This amendment does not consider any measures specifically to address impacts on habitat.

9.3.4 Determination of Habitat Impacts of this Action

The expected overall effect of the proposed action on habitat is not expected to be great in either a positive or negative direction. Several alternatives may have slight effects (positive or negative).

10.0 RELATIONSHIP TO OTHER APPLICABLE LAW

10.1 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

10.1.1 Introduction

NEPA requires preparation of an Environmental Impact Statement (EIS) for major Federal actions that significantly affect the quality of the environment. The Council published a Notice of Intent (NOI) to prepare this Amendment and the SEIS in the *Federal Register* on February 27, 2007. The underlying EIS for this action was Amendment 5 (61 FR 14456).

The purpose of Amendment 10 to the FMP is to develop a management program consistent with the Magnuson-Stevens Act which would rebuild the butterfish stock to the level associated with B_{MSY}. After a preliminary analysis of the action, the Council believed that an EA would fulfill the requirements of the National Environmental Policy Act (NEPA). However, during the development and preliminary analyses of alternatives for rebuilding strategies and possible management measures, it became apparent that some of the measures being considered could potentially have significant effects on the human environment, particularly the *Loligo* squid fishery. Potential measures being considered are no action, establishment of a mixed species management system with a mortality cap for butterfish, gear modifications, area management, and bycatch/retention requirements. In order to consider the full range of alternatives potentially necessary to rebuild the overfished butterfish stock, the Council determined that the development of a SEIS would be necessary to fulfill the requirements of NEPA and published a supplemental notice of intent to prepare an SEIS on February 17, 2007 which requested comments on this action. No comment from stakeholders were received as a result of that public notice.

However, during the course of development of this amendment the following issues were identified by stakeholders:

1) 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.

2) 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. All of these issues are addressed in this amendment.

3) Accuracy of mesh measurements being used in DSEIS analyses: Industry members testified that fishermen often report mesh size in VTRs and to sea sampling personnel mesh size measurements which include the diameter of one knot of each mesh. Using this convention, if fisherman reports using a "60 mm" mesh size, the actual inside stretch

measure would be considerably less, the difference depending on the twine size being used.

10.1.2 Development of SEIS

The Council began the development of Amendment 10 throughout 2007 following the publication of the supplemental NOI to prepare a SEIS. The Council held a number meetings of its SMB Committee, and Amendment 10 Fishery Management Action Team (FMAT). All of these meetings, as well as several related Council meetings, were open to the public.

10.1.3 Determination of Significance

National Oceanic and Atmospheric Administration Administrative Order 216-6 (NAO 216-6) (May 20, 1999) contains criteria for determining the significance of the impacts of a Proposed Action. In addition, the Council on Environmental Quality regulations at 40 CFR. 1508.27 state that the significance of an action should be analyzed both in terms of "context" and "intensity." Each criterion listed below is relevant in making a determination of significance relative to the Proposed Action and has been considered individually, as well as in combination with the others. The significance of this action is analyzed based on the NAO 216-6 criteria and CEQ's context and intensity criteria. These include:

1) Can the proposed action reasonably be expected to jeopardize the sustainability of any target species that may be affected by the action?

Most of the proposed actions presented in this document are not expected to jeopardize the sustainability of the target species. The proposed alternatives under alternatives 1b-1E are consistent with rebuilding and maintaining the butterfish stock to a long-term sustainable level. Swift implementation of Amendment 10 is expected to minimize threats to the sustainability of the butterfish stock.

2) Can the proposed action reasonably be expected to jeopardize the sustainability of any non-target species?

The proposed actions presented in this document are not expected to jeopardize the sustainability of any non-target species. All of the action alternatives considered in this action should, to some degree, affect the sustainability of non-target stocks in a positive manner due to reduced discards of those species

3) Can the proposed action reasonably be expected to cause substantial damage to the ocean and coastal habitats and/or essential fish habitat as defined under the Magnuson-Stevens Act and identified in FMPs?

The proposed action is not expected to cause damage to the ocean, coastal habitats, and/or EFH as defined under the Magnuson-Stevens Act and identified in the amendment document (Section 6). Among the gear types used by SMB fisheries, bottom-tending mobile gear, primarily otter trawls, have the greatest potential to adversely affect EFH. There are no measures proposed in this action that directly address gear impacts on EFH. All of the no action alternatives in the proposed action are expected to have no impact on habitat. Alternatives 1B-1E (butterfish rebuilding program) and alternatives 2B-2E are expected to have null or slightly negative impacts depending on their effect on fishing effort in the *Loligo* fishery under regulations and butterfish abundance. Alternatives 4B-4E (butterfish GRAs) could have positive or negative habitat impacts, depending on the degree of effort displacement outside of the GRAs and the ratio of *Loligo* abundance inside and outside of the proposed GRAs.

4) Can the proposed action be reasonably expected to have a substantial adverse impact on public health or safety?

No changes in fishing behavior that would affect safety are anticipated. The overall effect of the proposed action on SMB fisheries, including the communities in which they operate, is not expected to affect public health or safety.

5) Can the proposed action reasonably be expected to adversely affect endangered or threatened species, marine mammals, or critical habitat of these species?

All of the no action alternatives in the proposed action are expected to have no impact on endangered or threatened species, marine mammals, or critical habitat of these species. Alternatives 1B-1E (butterfish rebuilding program) and alternatives 2B-2E are expected to have null or slightly increase the chance of interactions with protected species depending on their effect on fishing effort in the *Loligo* fishery under regulations. Alternatives 4B-4E (butterfish GRAs) could increase or decrease the chance of interactions with protected species depending the degree of effort displacement outside of the GRAs and the ratio of *Loligo* abundance inside and outside of the proposed GRAs (which could affect the level of *Loligo* fishing effort).

6) Can the proposed action be expected to have a substantial impact on biodiversity and/or ecosystem function within the affected area (e.g., benthic productivity, predator-prey relationships, etc.)?

This action is not expected to significantly alter fishing methods or activities, nor is it expected to increase fishing effort or the spatial and/or temporal distribution of current fishing effort over the long term to the extent that the proposed action would be expected to have a substantial impact on biodiversity and ecosystem function within the affected area.

7) Are significant social or economic impacts interrelated with natural or physical environmental effects?

As discussed in section 7.5 of this DSEIS, the proposed action is not expected to result in significant social or economic impacts. This includes those interrelated to natural or physical environmental effects.

8) Are the effects on the quality of the human environment likely to be highly controversial?

Measures contained in this DSEIS that are controversial are listed in Section 10.1.2 above. Discarding of non-target species in the small mesh *Loligo* fishery has long been identified as a problem and Amendment 8 to the FMP was found to be deficient relative to National Standard 9 as a result. Traditional measures to reduce discards are considered problematic relative to solving the *Loligo*/butterfish interaction problem. Industry has identified mesh size increases and gear restricted areas as measures which could cause economic hardships because of the impact on their revenues which they expect as a result of anticipated reductions in *Loligo* catch rate efficiencies due to implementation of these measures. The mixed species management model concept introduced in this action is intended to address this issue by allowing the *Loligo* industry the ability to find novel and innovative ways to reduce their bycatch of butterfish as opposed to what they see as management by inefficiency (from their perspective) under traditional discard reduction approaches. However, the mixed species management approach will involve substantial increases in at-sea observer coverage and the associated costs relative to historical levels of coverage.

9) Can the proposed action reasonably be expected to result in substantial impacts to unique areas, such as historic or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers or ecologically critical areas?

The SMB fisheries are not known to be prosecuted in any unique areas such as historic or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers or ecologically critical areas. Therefore, the proposed action is not expected to have a substantial impact on any such areas.

10) Are the effects on the human environment likely to be highly uncertain or involve unique or unknown risks?

The impacts of the proposed measures on the human environment are described in section 7.0 of this document. None of the measures proposed are expected to involve unique or unknown risks to the human environment.

11) Is the proposed action related to other actions with individually insignificant, but cumulatively significant impacts?

As discussed in Section 8.0, the proposed action is expected to have individually insignificant, but cumulatively significant impacts. The proposed action, together with past, present, and future actions is expected to result in significant improvement in the condition of the managed resources (especially butterfish), habitat and long-term social and economic conditions.

12) Is the proposed action likely to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural or historical resources?

The SMB fisheries are not known to be prosecuted in any areas that might affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or cause the loss or destruction of significant scientific, cultural or historical resources. Therefore, the proposed action is not expected to affect any of these areas.

13) Can the proposed action reasonably be expected to result in the introduction or spread of a non-indigenous species?

There is no evidence or indication that the prosecution of the SMB fisheries has ever resulted in the introduction or spread of non-indigenous species. Therefore, it is highly unlikely that the action described in this SEIS would result in the introduction or spread of a non-indigenous species.

14) Is the proposed action likely to establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration?

None of the measures proposed this action are likely to establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration.

15) Can the proposed action reasonably be expected to threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment?

The proposed action is not expected to significantly alter fishing methods or activities such that they threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment. In fact, the proposed measures have been found to be consistent with other applicable laws (see Sections 10.2 - 10.10 below).

16) Can the proposed action reasonably be expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species?

The cumulative effects of the alternatives on the human environment are described in sections 8.0 of this SEIS. Some of the measures proposed in this action could alter fishing methods or activities in the SMB fisheries by altering the spatial and/or temporal distribution of these fisheries. However, the cumulative effects of the proposed action, especially in light of the expected future improvement in the condition of the butterfish stock through the implementation of this amendment, are expected to generate significantly positive cumulative effects overall.

The Council has reviewed the above criteria relative to the action proposed in Amendment 10 to the Atlantic Mackerel, Squid, and Butterfish FMP. Based on these criteria, the Council has determined that the Proposed Action represents a significant action and has prepared an SEIS in accordance with the National Environmental Policy Act. The Draft SEIS for the action proposed in this amendment is included in this integrated document.

10.1.4 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.

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Paul Scarlett, Port Republic, NJ (current Vice-Chair)
Dennis Spitsbergen, Morehead City, NC
Erling Berg, Cape May, NJ
Karen Chytalo, NY
Jeff Deem, Lorton, VA
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10.2 MARINE MAMMAL PROTECTION ACT (MMPA)

The MAFMC has reviewed the impacts of Amendment 10 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 10 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

Section 307(c)(1) of the Federal CZMA of 1972 requires that all Federal activities that directly affect the coastal zone be consistent with approved state coastal zone management programs to the maximum extent practicable. Pursuant to the CZMA regulations at 15 CFR 930.35, a negative determination may be made if there are no coastal effects and the subject action: (1) Is identified by a state agency on its list, as described in § 930.34(b), or through case-by-case monitoring of unlisted activities; or (2) which is the same as or is similar to activities for which consistency determinations have been prepared in the past; or (3) for which the Federal agency undertook a thorough consistency assessment and developed initial findings on the coastal effects of the activity. Accordingly, NMFS has determined that this action would have no effect on any coastal use or resources of any state. Letters documenting the NMFS negative determination, along with this document, will be sent to the coastal zone management program offices of the states of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, and Florida. A list of the specific state contacts and a copy of the letters will be made available upon request.

10.5 ADMINISTRATIVE PROCEDURES ACT

Section 553 of the Administrative Procedure Act establishes procedural requirements applicable to informal rulemaking by Federal agencies. The purpose of these requirements is to ensure public access to the Federal rulemaking process, and to give the public adequate notice and opportunity for comment. At this time, the Council is not requesting any abridgement of the rulemaking process for this action.

10.6 INFORMATION 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 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 will have the to review and comment on management measures after the Council approves the public hearing document/DSEIS at the Council meeting to be held in New Bern, NC on October 18, 2007. The public will have the opportunity to comment on this amendment through the 45-day public hearing process, at least one 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 documents which amend the FMP, 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 was 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 2006, 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 SMB fisheries. Marine Recreational Fisheries Statistical Survey (MRFSS) data were used to characterize the recreational fishery for Atlantic mackerel (the only species managed under this FMP with a significant recreational component).

The policy choices (i.e., management measures) proposed to be implemented by this amendment 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 the opportunity to provide comments on the 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 amendment 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. 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 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 rebuild the overfished Atlantic butterfish stock and to address deficiencies in Amendment 8 relative to minimization of bycatch that were deferred from Amendment 9 to this amendment. 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 rebuild the overfished butterfish stock and minimize to the extent practicable, bycatch and discards in the SMB fisheries.

10.10.5 Description of the Alternatives

These alternatives considered in this amendment are fully described in Section 5.0 of this document, and are also listed below.

Butterfish Stock Rebuilding Program

Alternative 1A: No action

Alternative 1B: Butterfish mortality cap in the *Loligo* fishery with seasonal allocation of the cap based on current seasonal allocation of the *Loligo* quota

Alternative 1C: Butterfish mortality cap in the *Loligo* fishery with seasonal allocation of the cap based on recent distribution of *Loligo* landings

Alternative 1D: Butterfish mortality cap in the *Loligo* fishery with seasonal allocation of the cap based on bycatch rate method

Alternative 1E: Implement 3.0 minimum codend in the *Loligo* fishery (no mortality cap)

***Loligo* minimum mesh size requirements**

Alternative 2A: No Action (Maintain 1 $^{7/8}$ inch minimum codend mesh requirement)

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

Alternative 2C: Increase minimum codend mesh size to $2^{3/8}$ inches

Alternative 2D: Increase minimum codend mesh size to $2^{1/2}$ inches

Alternative 2E: Increase minimum codend mesh size to 3 inches

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

Alternative 3A: No Action (*Illex* vessels are exempt from *Loligo* minimum mesh requirements in the months of June – September)

Alternative 3B: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding month of September from current mesh exemption for *Illex* fishery

Alternative 3C: Modify exemption from *Loligo* mesh requirement for *Illex* vessels by excluding months of August and September from current mesh exemption for *Illex* fishery

Alternative 3D: Discontinue exemption from *Loligo* mesh requirement for *Illex* vessels

Seasonal gear restricted areas (GRAs) to reduce butterfish discards

Alternative 4A: No Action (No butterfish GRAs)

Alternative 4B: Minimum of 3 inch codend mesh size in Butterfish GRA1

Alternative 4C: Minimum of 3 inch codend mesh size in Butterfish GRA2

Alternative 4D: Minimum of $3^{3/4}$ inch codend mesh size in Butterfish GRA3

Alternative 4E: Minimum of $3^{3/4}$ inch codend mesh size in Butterfish GRA4

10.10.6 Economic Analysis

The economic impacts of the alternatives in this amendment are discussed in Section 7.5 of this document. Based simply on actual revenue figures, there is the potential for total losses up to $17 million (observer cost + closure cost) under Alternatives 1B - 1D. Based simply on actual revenue figures there is the potential for total losses up to $11 million under Alternatives 4B - 4E (GRAs/closed areas). These amounts are not additive because it is not envisioned that both an alternative 1B-D option and an alternative 4B-E option would be chosen. In addition, given the availability for fishing vessels to employ a number of mitigation strategies, these losses will most likely not be fully realized. The economic impacts of Alternative 2B, 2C, 2D, 2E, 3B, 3C, and 3D 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 rebuild the overfished Atlantic butterfish stock and to address deficiencies in Amendment 8 relative to minimization of bycatch that were deferred from Amendment 9 to this amendment. 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 rebuild the overfished butterfish stock and minimize to the extent practicable, bycatch and discards in the SMB fisheries.

10.10.10 Objectives and Legal Basis for the Action

Amendment 10 was 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 (MSA), which amended and reauthorized the MSFCMA and included a new emphasis on precautionary fisheries management. New provisions mandated by the MSA 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

The proposed actions do not introduce any new reporting, recordkeeping, or other compliance requirements.

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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12.0 APPENDICES

12.I Appendix i

38th Northeast Regional Stock Assessment Workshop (38th SAW)
Advisory Report

Northeast Fisheries Science Center Reference Document 04-04

38th Northeast Regional Stock Assessment Workshop (38th SAW)

Advisory Report

January 2004

B. ATLANTIC BUTTERFISH

State of Stock: According to the existing status determination criterion for this stock, which is a F_{MSY} proxy ($F_{0.1}$=1.01), overfishing is not occurring. There is no biomass reference point in the Fishery Management Plan. New biological refenence points estimated for Atlantic butterfish are F_{MSY}=0.38 and B_{MSY}=22,798 mt. According to these estimates, fishing mortality in 2002 was near the overfishing definition, and stock biomass in 2002 was 8,700 mt, less than half of B_{MSY}, but the estimates of F and biomass are highly uncertain. Recruitment has declined since 1995 and was poor in 2001 and 2002. The last two NMFS autumn survey biomass per tow indices were among the lowest in the series, and the spring 2003 index was also low. Discards are estimated to be more than twice the landings.

Management Advice: Conservation and management measures should be implemented to reduce discards and discard mortality. The TAL setting-process currently ignores discards and should be revised to take this source of mortality into account.

Forecast for 2003: No forecasts were performed.

Landings and Status Table (weights in'000 mt): Butterfish

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	Max[1]	Min[1]	Mean[1]
US Comm landings	3.6	2.1	3.5	2.8	2.0	2.1	1.4	4.4	0.9	12.0	0.8	3.2
Foreign landings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.7	0.0	3.9
USA Discards	3.7	8.6	6.8	3.9	3.3	4.1	2.4	7.3	1.8	19.0	0.3	4.4
Catch used in Assessment	7.3	10.7	10.4	6.6	5.2	6.2	3.8	11.7	2.7	34.3	2.7	11.5
Spawning Stock Biomass (age 1+)	22.3	31.3	12.4	10.8	8.2	7.8	24.5	24.1	8.7	62.9[2]	7.8[2]	23.2[2]
Average Biomass (mid-year)	41.2	21.4	18.0	13.2	12.0	31.6	31.6	16.7	7.8	77.2	7.8	33.4
Recruitment Biomass (age 0)	31.2	2.8	16.0	9.4	9.6	32.4	16.3	4.7	3.0	61.1	2.8	23.2
Fishing Mortality	0.18	0.50	0.58	0.50	0.43	0.20	0.12	0.7	0.34	0.93	0.09	0.40

[1] 1965-2002
[2] 1968-2002

Catches: From 1965 to 2002, US commercial landings averaged 3,200 mt per year, peaking at 12,000 mt in 1984 (Figure B1). Foreign landings began in the mid-1960s and averaged 6,800 mt during 1965-1986 with a peak of 31,700 mt in 1973. Estimates of discards in the USA fishery increased from a few hundred mt in 1965 to a peak of 19,000 mt in 1984, and ranged between 1,000-8,600 mt thereafter. Total catch peaked in 1973 at 34,300 mt, declined, then increased again to 31,500 mt in 1984 (Figure Bl). Since 1985, catches have averaged 8,100 mt, with discards averaging 5,100 mt. Butterfish catches in 2001 and 2002 were 11,700 mt (7,300 mt discards) and 2,700 mt (1,800 mt), respectively.

Data and Assessment: Atlantic butterfish were last assessed in August 1993 (SAW 17). The current assessment relies on NMFS survey biomass indices (wt/tow) [from NEFSC Winter, Spring, and Autumn research vessel surveys] (Figure B6), USA landings from the NMFS dealer database, USA discard estimates from the NMFS observer program, and foreign catch (Murawski and Waring 1979). The abundance and catch data provide a very noisy signal, due to the variable availability of butterfish to the survey and because 2/3rd of the catch is from imprecisely estimated discards. A delay-difference model was developed as a basis for stock assessment.

Fishing Mortality: Fishing mortality estimates averaged about 0.5 during 1967-1977 and then declined to an average of about 0.3 thereafter (Figure B2). Fishing mortality increased to 0.58 in 1996 and then declined to 0.12 in 2000. The average F during 2000-2002 was 0.39 and the F in 2002 was 0.34. There is an 80% probability that F in 2002 was between 0.25-1.02 (Figure B8).

Recruitment: Recruitment biomass (Age 0) has been highly variable over a range of spawning biomass between 10,000 mt - 50,000 mt. Average recruitment biomass during 1968-2002 was 23,200 mt. Recruitment for this stock averaged 26,600 mt during 1968-1994 and more recently has declined to 5,000 mt and 3,000 mt in 2001 and 2002, respectively (Figure B3).

Spawning Stock Biomass: Butterfish spawning stock biomass (Age 0) has been variable during 1968-2002 (Figure B3), fluctuating between 7,800-62,900 mt and averaging 23,200 mt. Spawning stock biomass in 2002 was estimated to be 8,700 mt, one of the lowest in the time series.

Average Biomass: Average biomass fluctuated between 7,800 -77,200 mt during 1969-2002 (Figure B4), averaged 34,000 mt, and declined to 7,800 mt in 2002. There is an 80% probability that average biomass in 2002 was between 2,600-10,900 mt (Figure B7).

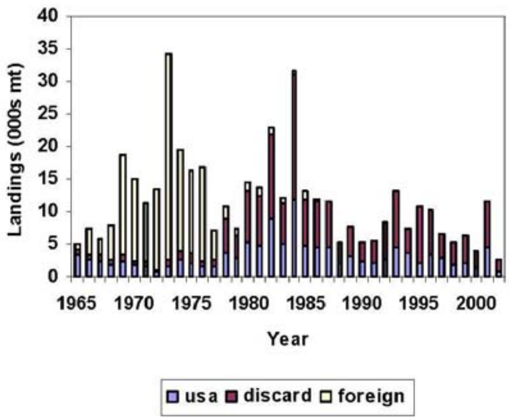
Biological Reference Points: Stock status determination is currently based on a F_{MSY} proxy ($F_{0.1}$=1.01) (Figure B5), and M = 0.8. B_{MSY} has not been previously estimated. New biological reference points were estimated in the delay-difference model for butterfish. A Fox model of surplus production for 1965-2002 produced an MSY=12,200 mt (including discards), B_{MSY}=22,800 mt, and F_{MSY}=0.38. However, there is considerable uncertainty in these estimates.

Special Comments: Further examination of existing the NEFSC Sea Sampling data is needed to evaluate butterfish discards. Other approaches to estimating discards could be explored and alternate sources of information should also be evaluated.

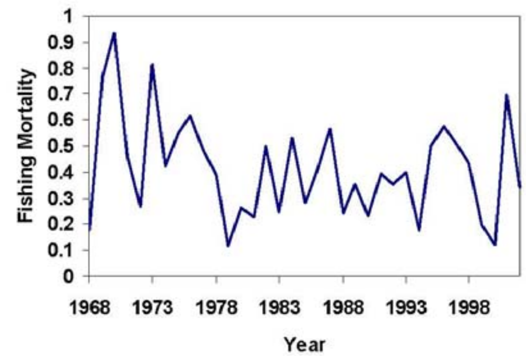
Butterfish are a major prey item for many finfish and marine mammal species. This should be considered for multispecies and ecosystem management.

Sources of Information: Murawski, S. A. and G. T. Waring. 1979. A population assessment of butterfish, *Peprilus triacanthus*, in the northwestern Atlantic Ocean. Trans. Am.Fish. Soc. 108:427-439.

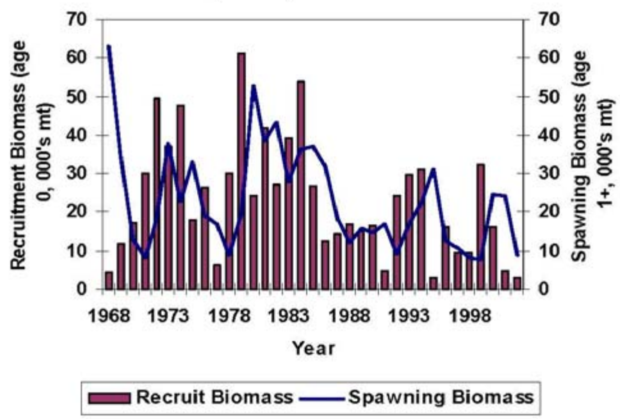
B1. Landings and Discards



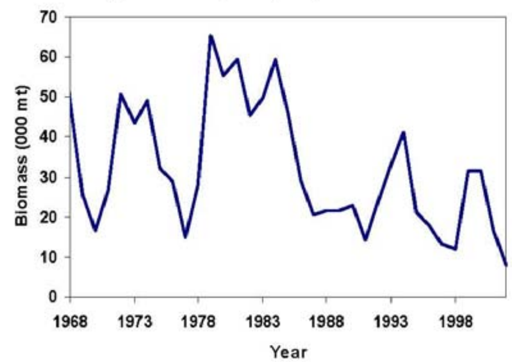
B2. Fishing Mortality



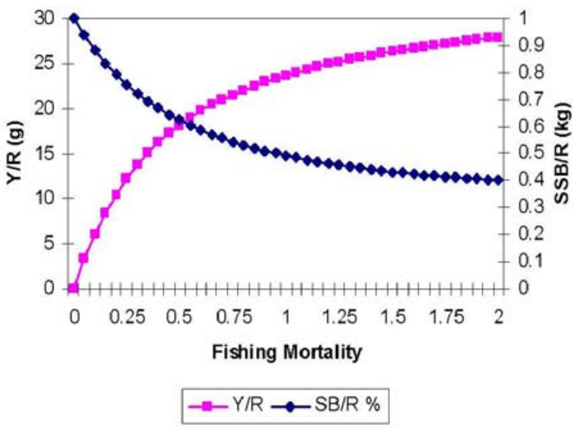
B3. Recruitment and Spawning Biomass



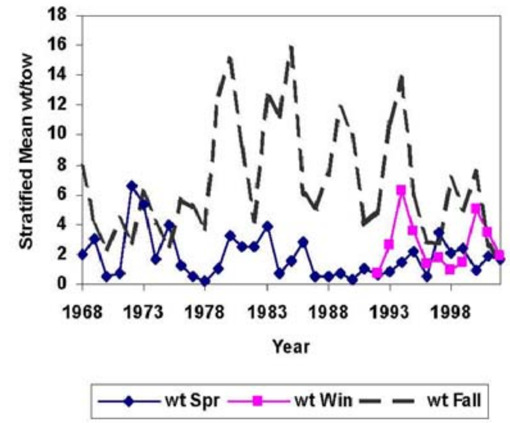
B4. Average Biomass (mid-year)



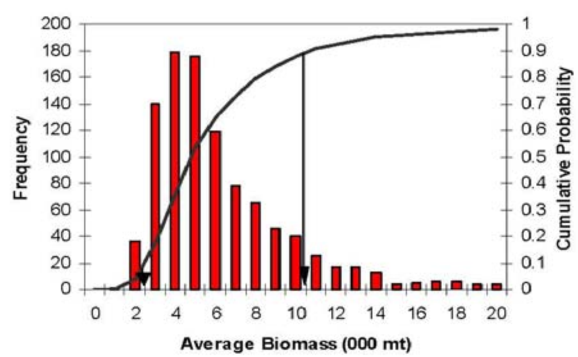
B5. Yield and SSB per Recruit



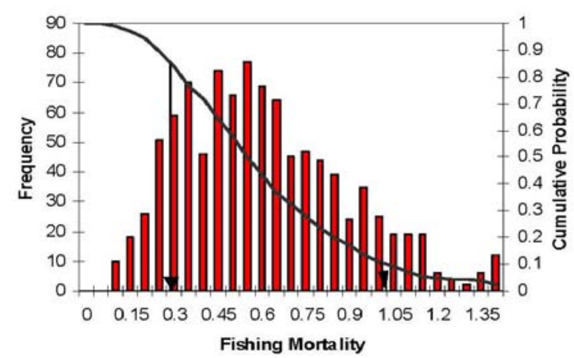
B6. NEFSC Survey wt/tow



B7. Precision of 2002 Average Biomass Estimate



B8. Precision of 2002 Fishing Mortality Estimate



38th SARC Advisory Report

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12.II Appendix ii

Part A: Butterfish Stock Recovery Projections Utilizing AR1 Model:

Several trial methods (low, medium, high), based on various assumptions of the butterfish recruitment time horizon, were used to estimate recruitment and stock recovery time frames for butterfish. Ultimately however, in consultation with the MAFMC SSC, it was decided to use an auto-regressive (AR1) time-series model to forecast recruitment biomass for the stock recovery analysis. Since the recent stock assessment was only current through 2002, recruitment for 2003-2006 was predicted with a linear regression between survey biomass at age 0 and recruit biomass at age 0 for 1991-2002 (Figure C1). Estimates for year-classes during this period ranged from 3.32-17.72 thousand mt (Table C1). These values along with the recruit time-series from the butterfish assessment (1966-2002) were used to investigate the utility of an auto-regressive (AR) time-series model for predicting future recruitment.

There were 41 observations available for modeling the recruitment time-series during 1966-2006 (Figure C2). An AR model was chosen since it is a sensible a priori assumption that recruitment in trailing years is somehow related to recruitment in previous years. The recruit series was differenced to make it stationary (Figure C3). Next the differenced time-series was checked for significant autocorrelation lags (Figure C4). A significant negative correlation was detected at a lag of 1 year (Figure C4), so the modeling proceeded. An AR1 model was fit and used to forecast recruit biomass during

2007-2016, a ten year time frame (Table C2), (Figure C5). The forecasted recruitment ranged from 11.37-14.18 thousand mt for the period (Table C2).

These forecasted recruitment data were used in a projection to determine if and when the stock would rebuild. To simulate a low level of discarding, a fishing rate of F=0.1 was used to project the biomass of butterfish during 2005-2016. Under this scenario the butterfish stock recovers quickly to above Bmsy (22,800 mt) in 2007 and remains above the target level of 22,800 mt during 2007-2016 (Figure C6; Table C3).

Table C1. Estimates of butterfish recruitment (000 mt) from a linear regression of survey biomass at age 0 (kg) and recruit biomass at age 0 (000 mt) (y=3.87 x) during 1991-2002.

Year	Survey 0	Recruit B
2003	1.77	6.8499
2004	1.24	4.7988
2005	0.86	3.3282
2006	4.58	17.7246

Table C2. Forecasted recruitment (biomass 000 mt) for butterfish from an AR1 (auto-regressive) model during 2007-2016 (period 41-51).

Iteration	Sum of Squares	Parameter values
0	0.1860412D+05	0.100
1	0.1676239D+05	-0.013
2	0.1381404D+05	-0.527
3	0.1369174D+05	-0.442
4	0.1369174D+05	-0.442

Final value of MSE is 351.070

Index	Type	Estimate	A.S.E.	Lower <95%>	Upper
1	AR	-0.442	0.145	-0.734	-0.149

Forecast Values

Period	Lower95	Forecast	Upper95
42.	-25.356	11.368	48.092
43.	-27.888	14.175	56.238
44.	-37.412	12.935	63.283
45.	-42.512	13.483	69.478
46.	-48.455	13.241	74.937
47.	-53.329	13.348	80.025
48.	-58.107	13.301	84.709
49.	-62.483	13.321	89.125
50.	-66.663	13.312	93.288
51.	-70.617	13.316	97.249

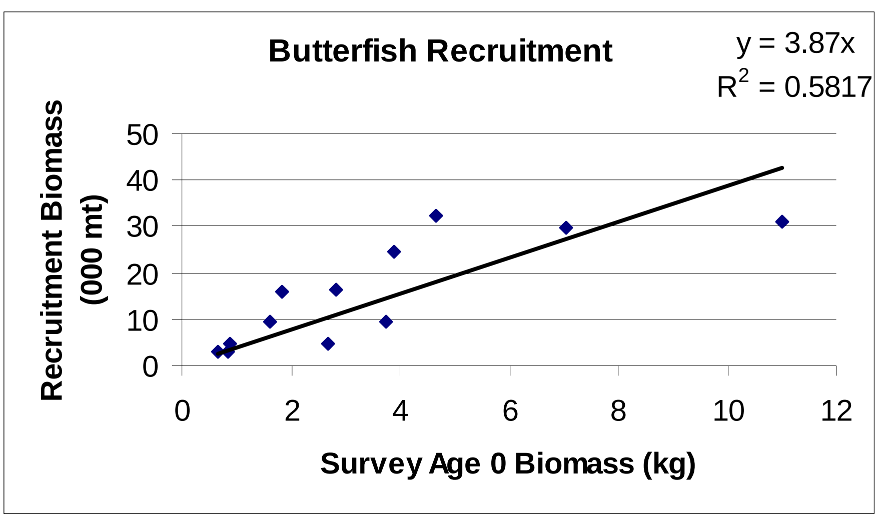

Figure C1. Linear regression of butterfish survey age 0 (kg) and recruitment at age 0 (000 mt) during 1991-2002.

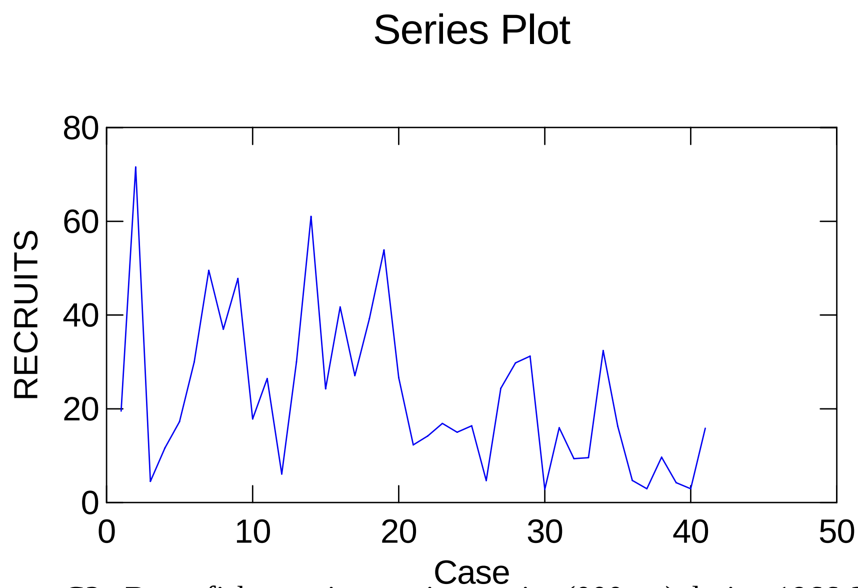

Figure C2. Butterfish recruitment time-series (000 mt) during 1966-2006 (case 1-41)

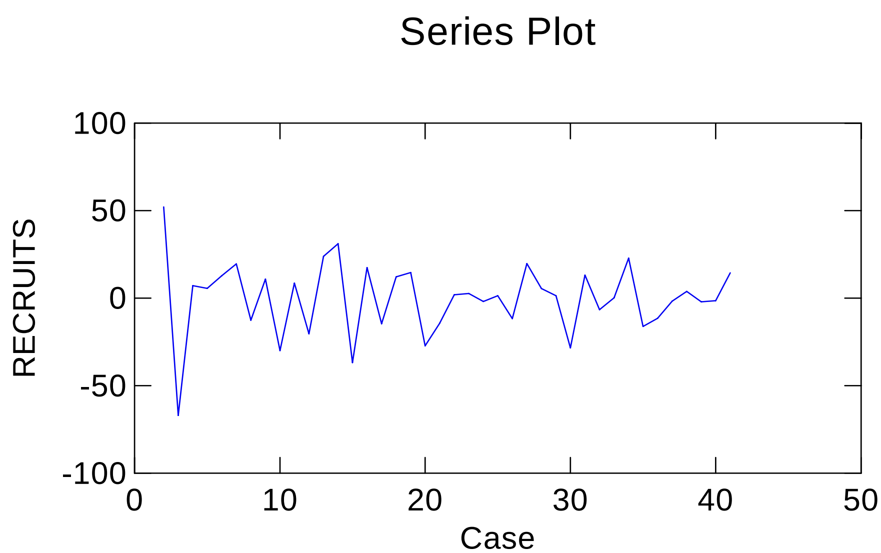

Figure C3. Differenced butterfish recruitment time-series during 1966-2006.

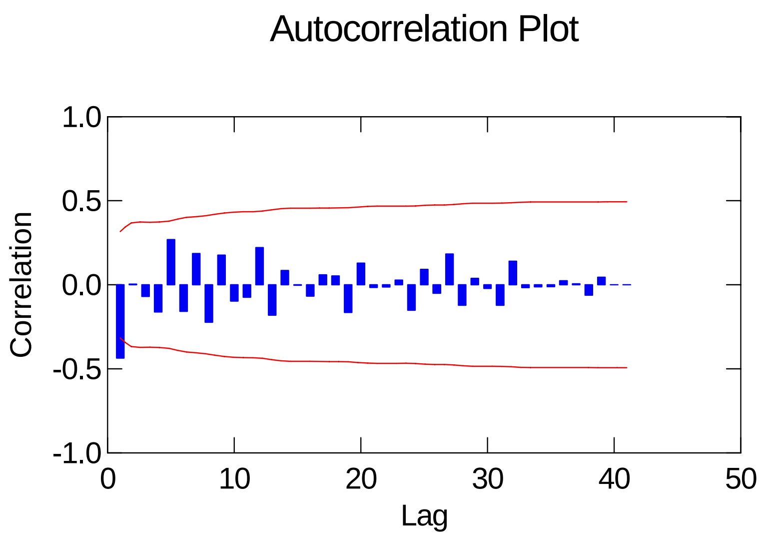

Figure C4. Autocorrelation plot for butterfish recruitment time-series during 1966-2006.

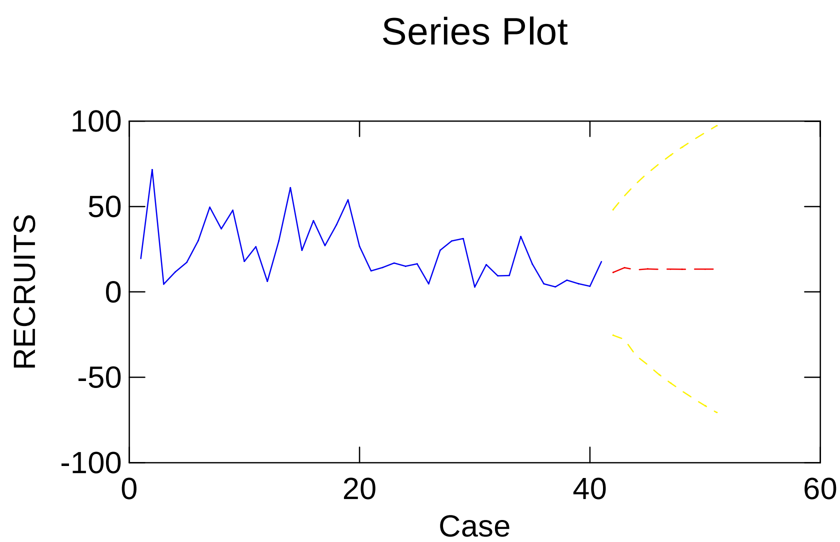

Figure C5. Butterfish recruitment time-series (000 mt) during 1966-2006 (case 1-41) with forecasted recruitment from an AR1 model during 2007-2016 (case 42-51).

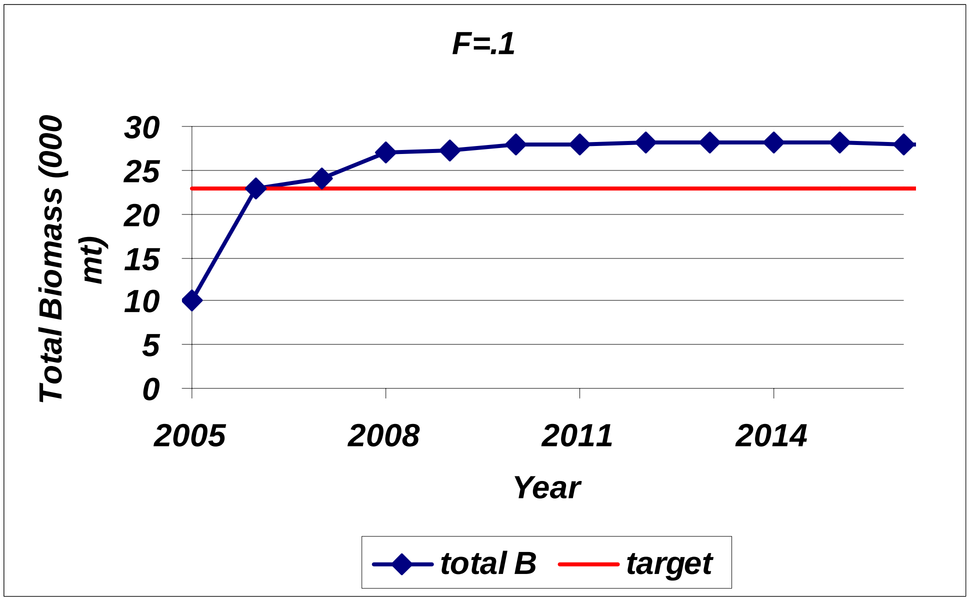

Figure C6. Predicted total biomass (F=0.1) for the butterfish stock during 2005-2016 with target biomass (Bmsy=22,800 mt).

Table C3. Predicted total biomass (F=0.1) for the butterfish stock during 2005-2016..

Year	Total Biomass (mt)
2005	10.1
2006	22.8
2007	24.0
2008	27.0
2009	27.3
2010	27.9
2011	28.0
2012	28.1
2013	28.1
2014	28.1
2015	28.1
2016	28.0

Part B: MAFMC SSC Population Dynamics Subgroup Meeting

March 30, 2007

Baltimore, MD

Summary Notes

The meeting was convened at 1030 by Rich Seagraves (MAFMC staff). SSC members in attendance included Mike Prager, John Hoenig, Ed Houde and Tom Miller. Also attending were Bill Overholtz, Pete Jensen and Greg DiDomenico.

R. Seagraves reviewed the terms of reference for the meeting (see attachment 1). W. Overholtz then gave an overview of the butterfish fishery and recent stock assessment and provided a description of the projection methodology used to develop butterfish stock rebuilding scenarios by the FMAT for the Council.

It was noted that there was an inconsistency in trend between the spring and fall surveys. The spring survey seems to be increasing in recent years while the fall survey has shown a strong negative trend. It was recommended that age 0 fish be removed from the fall time series to see if the spring and fall survey times track each other better.

The SAW 38 assessment model assumes a constant m of 0.8. The question was asked if this is a reasonable assumption for all age classes. It was suggested that a modeling approach which utilizes a decreasing m with age be examined in the next assessment

Questions about accuracy of discards were raised; it was noted that discard rates have been fairly consistent through time

It was noted that recruitment appears to be cyclical throughout the time series, the question as to what environmental factors are driving this periodicity was raised.

The issue of model stability was discussed. Does the FMAT projection at F=0, which does not result in stock rebuilding over a fairly long time scale, imply the model is not any good? It was noted that the stock/recruitment plot is highly scattered (i.e., poor fit). It was also noted that the stock projection used by the FMAT assuming high recruitment resulted in stock recovery in a relatively short period of time. It was suggested that since the revised BRPs are based on the long term time series, then the recruitment assumption in the stock projections should be based on the same time series of information. Under the assumption that future near term recruitment will occur at long term average levels the stock is expected to rebuild quickly. However, if recent poor recruitment levels persist the stock will not recover to B_{msy} under any F scenario.

Regardless of future recruitment events (which are expected to be largely controlled by environmental factors exogenous to control of fishing mortality) management still needs to focus on controlling discard mortality.

W. Overholtz presented results of an approach using the relationship between stock size and recruitment in the form of an auto regressive model to predict future recruitment and make stock projections assuming F=0.1. This model allows the most recent recruitment events to be included and captures the long term recruitment history of the stock. Projections based on this approach were similar to the FMAT approach assuming high recruitment (i.e., long term average) - the stock can recover in a relatively short period of time at low F (i.e., at F=0.1). It was suggested that the auto regressive model could be used but the FMAT should examine projections at other assumed Fs (i.e., up to F=0.2). The projection model chosen to make decisions about butterfish stock rebuilding doesn't necessarily need to be restricted to recruitment events in recent years since the stock has shown resiliency to recover over the long term time series.

The members of the SSC present at the meeting agreed to the following consensus statement:

The SSC notes that analysis based only on recent recruitments may not be stable (i.e., modeling results may change greatly with additional data). Time series auto regressive approach to forecast stock rebuilding trajectory (including 2003-2006 updated recruitments) using range of assumed Fs (i.e., up to F=0.2) appears appropriate. The FMAT analysis assuming long term average recruitment gave similar results. However, probability of stock rebuilding if recent observed recruitments persist (i.e., about last 5 years) is low. The potential to rebuild the stock in ten years increases if discards can be reduced. The SSC noted there is potential for the stock to rebuild quickly under high recruitment (provided discards can be managed). Additional approaches to modeling projections should be considered for future work. The SSC supports the SARC recommendations concerning discard estimation.

Attachment 1

Scientific and Statistical Committee
Population Dynamics Subgroup Meeting
Baltimore, MD
March 30, 2007

Terms of Reference

1. Review population model and analyses used to determine butterfish stock status and evaluate the butterfish stock recruitment times series and projection methodology used to establish stock rebuilding trajectories

2. Determine the most appropriate time series to be used in stock projections and provide advice as to most appropriate butterfish recruitment assumption/stock rebuilding trajectory to achieve stock rebuilding (e.g., near term observed recruitment /10+ years rebuilding plan v. long term observed recruitment /≤ 10 years rebuilding plan)

3. Provide comments and recommendations regarding possible future improvements to the assessment of the butterfish stock including methods to estimate discards

12.III Appendix iii

Methodology and Data for Estimation of Required Sea Days for Butterfish Discard Monitoring in the Loligo Fishery.

The number of trips and sea days required for observer coverage of the *Loligo* fishery for CVs ranging from 10%-50% were estimated with equation 4 and 5 and available data from 2004 for the butterfish fishery (Wigley et al. 2007). Data from (Wigley et al. 2007) were used in equation (4) as:

$$T = \frac{N\left[\frac{nN}{N-n}\right]VR}{CV^2R^2 N + \left[\frac{nN}{N-n}\right]VR}$$

Where (n) is the number of trips sampled in the observer fishery, (N) is the number of trips reported in the VTR, (V) is the variance of the butterfish discard ratio, (R) is the discard ratio for butterfish, and CV is the desired coefficient of variation (Table D2). CV ranging from 10% -50% was substituted into the equation and the corresponding number of trips required was estimated for each quarter and CV (Table D2).

The number of sea days necessary for each level of CV were estimated as:

$$S = T * DA$$

Where DA is the average trip length for trips in the VTR. The number of sea days was estimated for each CV level (Table D2). Since a trimester estimate of sea days was needed, the quarterly data were averaged to produce estimates of the sea days required by trimester (Table D2). Two methods were used to estimate the trimester averages, an average of adjacent quarters, and a weighted average (number of trips) of adjacent quarters (Table D2). Since the National Standard for SBRM monitoring is the 30% CV level, the trimester averages were estimated for this value (Table D2). These estimates ranged from 325-386 days per trimester and totaled 1087 days for the unweighted data and 435-492 and 1369 total sea days for the weighted case (Table D2).

Table D1. Quarter (QTR), number of sampled trips (n), number of VTR trips (N), variance of sampled trips (V), discard ratio (R), and sampling ratio (nN/N-n) for butterfish in 2004.

QTR	n	N	V	R^	nN/N-n
1	41	733	0.000467683	0.0288621	43.42919
2	33	1517	3.54396E-05	0.0125001	33.73383
3	51	1830	6.14E-06	2.98E-03	52.46206
4	69	1142	3.05E-05	0.012912	73.43709

Table D2. Number of trips and sea days required by quarter and CV level for butterfish and number of sea days required by trimester (average of adjacent quarters) and by trimester (weighted by the number of trips in each quarter).

						30%		weighted 30%
						trimester		trimester
	CV	CV^2	# trips	# Sea Days		average		average
Qtr 1	10%	0.01	563.5745377	1816.8167				
	20%	0.04	332.8027025	1072.8687				
	30%	0.09	197.8066484	637.67682				
	40%	0.16	126.1612556	406.71084				
	50%	0.25	86.07667551	277.48866				
tr1						386.2058		492.199624
Qtr 2	CV	CV^2	# trips	# Sea Days				
	10%	0.01	508.5969845	851.2378				
	20%	0.04	169.8604396	284.29509				
	30%	0.09	80.5012086	134.73472				
	40%	0.16	46.35820036	77.589631				
	50%	0.25	29.9992789	50.209736				
tr2						325.0659		440.8127242
Qtr 3	CV	CV^2	# trips	# Sea Days				
	10%	0.01	1216.448	1897.792				
	20%	0.04	606.458	946.141				
	30%	0.09	330.360	515.397				
	40%	0.16	201.762	314.771				
	50%	0.25	134.465	209.780				
tr3						375.9217		435.7972313
Qtr 4	CV	CV^2	# trips	# Sea Days				
	10%	0.01	617.025	1105.998				
	20%	0.04	259.353	464.882				
	30%	0.09	131.911	236.446				
	40%	0.16	78.149	140.080				
	50%	0.25	51.279	91.916				
total						1087.193		1368.80958

12.IV Appendix iv
Draft Description of Proposed *Loligo* Fishery Observer Program

(g) *Loligo pealei* observer program.

(1) General. Unless otherwise specified, owners, operators, and/or managers of vessels issued a Federal *Loligo pealei*/butterfish limited access permit under §648.4(a)(2), and specified in paragraph (b) of this section, must comply with this section and are jointly and severally responsible for their vessel's compliance with this section. To facilitate the deployment of at-sea observers, all *Loligo* vessels issued limited access permits fishing when the directed *Loligo* fishery is open are required to comply with the additional notification requirements specified in paragraphs (g)(2) of this section. When NMFS notifies the vessel owner, operator, or the vessel manager of any requirement to carry an observer on a directed *Loligo* trip as specified in paragraph (g)(2) of this section, the vessel may not fish for, take, retain, possess, or land any *Loligo* in excess of 2500 pounds without carrying an observer. Vessels may only embark on a directed *Loligo* trip in without an observer if the owner, operator, or vessel manager has been notified that the vessel has received a waiver of the observer requirement for that trip pursuant to paragraphs (g)(3) and (5) of this section.

(2) Vessel notification procedures. For the purpose of determining if an observer will be deployed on a vessel for a specific trip, a vessel issued a limited access permit fishing is required to comply with the following notification requirements:

(i) 72 hours prior to date on which directed fishing for *Loligo* is to take place, the vessel owner or operator must submit, through the VMS e-mail messaging system, notice of its intention to fish for *Loligo*, along with the following information: Vessel name and permit number, owner and operator's name, owner and operator's phone numbers, and number of trips anticipated for the ensuing month. The e-mail address shall be provided to vessels in a Small Entity Compliance Guide issued by the Regional Administrator. The Regional Administrator may waive this notification period if it is determined that there is insufficient time to provide such notification prior to a trimester opening or beginning of the fishing year. Notification of this waiver of a portion of the notification period shall be provided to the vessel through a permit holder letter issued by the Regional Administrator.

(ii) For each *Loligo* trip, the vessel owner, operator, or vessel manager shall notify NMFS by telephone, using the phone number provided by the Regional Administrator in the Small Entity Compliance Guide, and provide the following information: Vessel Name; contact name and number; date and time of departure; port of departure; area to be fished .

(3) Selection of *Loligo* fishing trips for observer coverage. Based on predetermined coverage levels for various sectors of the *Loligo* fishery that are provided by NMFS in

writing to all observer service provider approved pursuant to paragraph (h) of this section, NMFS shall notify the vessel owner, operator, or vessel manager whether the vessel must carry an observer, or if a waiver has been granted, on the specified trip within 24 hours of the vessel owner's, operator's, or vessel manager's notification of the prospective trip as specified in paragraph (g)(2)(ii) of this section. Any request to carry an observer may be waived by NMFS.

(4) Procurement of observer services by *Loligo* vessels.

(i) An owner of a *Loligo* vessel required to carry an observer under paragraph (g)(3) of this section must arrange for carrying an observer certified through the observer training class operated by the Northeast Fisheries Observer Program (herein after NMFS/NEFOP certified) from an observer service provider approved by NMFS under paragraph (h) of this section. A list of approved observer service providers shall be posted on the NOAA/NEFOP website at http://www.nefsc.noaa.gov/femad/fsb/. The owner, operator, or vessel manager of a vessel selected to carry an observer must contact the observer service provider and must provide at least 72 hours notice in advance of the fishing trip for the provider to arrange for observer deployment for the specified trip.

(ii) An owner, operator, or vessel manager of a vessel that cannot procure a certified observer within 72 hours of the advance notification to the provider due to the unavailability of an observer, may request a waiver from NMFS from the requirement for observer coverage for that trip, but only if the owner, operator, or vessel manager has contacted all of the available observer service providers to secure observer coverage and no observer is available. NMFS shall issue such a waiver within 24 hours, if the conditions of this paragraph (g)(4)(ii) are met.

(5) Unless otherwise notified by the Regional Administrator, owners of *Loligo* vessels shall be responsible for paying the cost of the observer for all *Loligo* fishing trips on which an observer is carried onboard the vessel, regardless of whether the vessel lands or sells *Loligo* on that trip. Observer service providers are responsible for setting the daily rate for observer coverage on a vessel.

(h) Observer service provider approval and responsibilities.

(1) General. An entity seeking to provide observer services to the *Loligo* fishery must apply for and obtain approval from NMFS following submission of a complete application to The Observer Program Branch Chief, 25 Bernard St Jean Drive, East Falmouth, MA 02536. A list of approved observer service providers shall be distributed to *Loligo* vessel owners and shall be posted on NMFS's web page as specified in paragraph (g)(4) of this section.

(2) Existing observer service providers. Observer service providers that currently deploy certified observers in the Northeast must submit an application containing the information specified in paragraph (h)(3) of this section, excluding any information specified in paragraph (h)(3) of this section that has already been submitted to NMFS.

(3) Contents of application. An application to become an approved observer service provider shall contain the following:

(i) Identification of the management, organizational structure, and ownership structure of the applicant's business, including identification by name and general function of all controlling management interests in the company, including but not limited to owners, board members, officers, authorized agents, and staff. If the applicant is a corporation, the articles of incorporation
must be provided. If the applicant is a partnership, the partnership agreement must be provided.

(ii) The permanent mailing address, phone and fax numbers where the owner(s) can be contacted for official correspondence, and the current physical location, business mailing address, business telephone and fax numbers, and business e-mail address for each office.

(iii) A statement, signed under penalty of perjury, from each owner or owners, board members, and officers, if a corporation, that they are free from a conflict of interest as described under paragraph (h)(6) of this section.

(iv) A statement, signed under penalty of perjury, from each owner or owners, board members, and officers, if a corporation, describing any criminal convictions, Federal contracts they have had, and the performance rating they received on the contract, and previous decertification action while working as an observer or observer service provider.

(v) A description of any prior experience the applicant may have in placing individuals in remote field and/or marine work environments. This includes, but is not limited to, recruiting, hiring, deployment, and personnel administration.

(vi) A description of the applicant's ability to carry out the responsibilities and duties of a *Loligo* fishery observer services provider as set out under paragraph (h)(2) of this section, and the arrangements to be used.

(vii) Evidence of holding adequate insurance to cover injury, liability, and accidental death for observers during their period of employment (including during training). Workers' Compensation and Maritime Employer's Liability insurance must be provided to cover the observer, vessel owner, and observer provider. The minimum coverage required is $5 million. Observer service providers shall provide copies of the insurance policies to observers to display to the vessel owner, operator, or vessel manager, when requested.

(viii) Proof that its observers, either contracted or employed by the service provider, are compensated with salaries that meet or exceed the Department of Labor (DOL) guidelines for observers. Observers shall be compensated as a Fair Labor Standards Act (FLSA) non-exempt employees. Observer providers shall provide any other benefits and personnel services in accordance with the terms of each observer's contract or employment status.

(ix) The names of its fully equipped, NMFS/NEFOP certified observers on staff or a list of its training candidates (with resumes) and a request for a NMFS/NEFOP Observer Training class (The NEFOP training has a minimum class size of eight individuals, which may be split among multiple vendors requesting training. Requests for training classes with less than 8 individuals will be delayed until further requests make up the full training class size). Requests
for training classes must be made 30 days in advance of the requested date and must have a complete roster of trainees at that time.

(x) An Emergency Action Plan (EAP) describing its response to an 'at sea' emergency with an observer, including, but not limited to, personal injury, death, harassment, or intimidation.

(4) Application evaluation.

(i) NMFS shall review and evaluate each application submitted under paragraphs (h)(2) and (h)(3) of this section. Issuance of approval as an observer provider shall be based on completeness of the application, and a determination of the applicant's ability to perform the duties and responsibilities of a *Loligo* fishery observer service provider as demonstrated in the application information. A decision to approve or deny an application shall be made by NMFS within 15 days of receipt of the application by NMFS.

(ii) If NMFS approves the application, the observer service provider's name will be added to the list of approved observer service providers found on NMFS website specified in paragraph (g)(4) of this section and in any outreach information to the industry. Approved observer service providers shall be notified in writing and provided with any information pertinent to its participation in the *Loligo* fishery observer program.

(iii) An application shall be denied if NMFS determines that the information provided in the application is not complete or the evaluation criteria are not met. NMFS shall notify the applicant in writing of any deficiencies in the application or information submitted in support of the application. An applicant who receives a denial of his or her application may present additional
information to rectify the deficiencies specified in the written denial, provided such information is submitted to NMFS within 30 days of the applicant's receipt of the denial notification from NMFS. In the absence of additional information, and after 30 days from an applicant's receipt of a denial, an observer provider is required to resubmit an application containing all of the information required under the application process specified in paragraph (h)(3) of this section to be re-considered for being added to the list of approved observer service providers.

(5) Responsibilities of observer service providers.

(i) An observer service provider must provide observers certified by NMFS/NEFOP pursuant to paragraph (i) of this section for deployment in the *Loligo* fishery when contacted and contracted by the owner, operator, or vessel manager of a vessel fishing in the *Loligo* fishery unless the observer service provider refuses to deploy an observer on a requesting vessel for any of the reasons specified at paragraph (viii) of this section. An approved observer service provider must maintain a minimum of 8 NEFOP certified observers in order to remain approved, should a service provider cadre drop below 8 the provider must submit the appropriate number of candidates for the next available training class. Failure to do so shall be cause for suspension of their approved status until rectified.

(ii) An observer service provider must provide to each of its observers:

(A) All necessary transportation, including arrangements and logistics, of observers to the initial location of deployment, to all subsequent vessel assignments, and to any debriefing locations, if necessary;

(B) Lodging, per diem, and any other services necessary for observers assigned to a *Loligo* vessel or to attend a NMFS/NEFOP Observer Training class;

(C) The required observer equipment, in accordance with equipment requirements listed on NMFS website specified in paragraph (g)(4) of this section under the Sea Sampling Program, prior to any deployment and/or prior to NMFS observer certification training; and

(D) Individually assigned communication equipment, in working order, such as a cell phone or pager, for all necessary communication. An observer service provider may alternatively compensate observers for the use of the observer's personal cell phone or pager for communications made in support of, or necessary for, the observer's duties.

(iii) Observer deployment logistics. Each approved observer service provider must assign an available certified observer to a vessel upon request. Each approved observer service provider must provide for access by industry 24 hours per day, 7 days per week, to enable an owner, operator, or manager of a vessel to secure observer coverage when requested. The telephone system must be monitored a minimum of four times daily to ensure rapid response to industry requests. Observer service providers approved under paragraph (h) of this section are required to report observer deployments to NMFS daily for the purpose of determining whether the predetermined coverage levels are being achieved in the *Loligo* fishery.

(iv) Observer deployment limitations. Unless alternative arrangements are approved by NMFS, an observer provider must not deploy any observer on the same vessel for two or more consecutive deployments, and not more than twice in any given month. A certified observer's first deployment and the resulting data shall be immediately edited, and approved, by NMFS prior to any further deployments of that observer.

(v) Communications with observers. An observer service provider must have an employee responsible for observer activities on call 24 hours a day to handle emergencies involving observers or problems concerning observer logistics, whenever observers are at sea, stationed shoreside, in transit, or in port awaiting vessel assignment.

(vi) Observer training requirements. The following information must be submitted to NMFS to request a certified observer training class at least 30 days prior to the beginning of the proposed training class: Date of requested training; a list of observer candidates, with a minimum of eight individuals; observer candidate resumes; and a statement signed by the candidate, under penalty of perjury, that discloses the candidate's criminal convictions, if any. All observer trainees must complete a basic cardiopulmonary resuscitation/first aid course prior to the beginning of a NMFS/NEFOP Observer Training class. NMFS may reject a candidate for training if the candidate does not meet the minimum qualification requirements as outlined by NMFS National Minimum Eligibility Standards for observers as described in paragraph (i)(1) of this section.

(vii) Reports.

(A) Observer deployment reports. The observer service provider must report to NMFS when, where, to whom, and to what fishery (open or closed area) an observer has been deployed, within 24 hours of their departure. The observer service provider must ensure that the observer reports back to NMFS its Observer Contract (OBSCON) data, as described in the certified observer training, within 12 hours of landing. OBSCON data are to be submitted electronically or by other means as specified by NMFS. The observer service provider shall provide the raw (unedited) data collected by the observer to NMFS within 72 hours of the trip landing.

(B) Safety refusals. The observer service provider must report to NMFS any trip that has been refused due to safety issues, e.g., failure to hold a valid USCG Commercial Fishing Vessel Safety Examination Decal or to meet the safety requirements of the observer's pre-trip vessel safety checklist, within 24 hours of the refusal.

(C) Biological samples. The observer service provider must ensure that biological samples, including whole marine mammals, turtles and sea birds, are stored/handled properly and transported to NMFS within 7 days of landing.

(D) Observer debriefing. The observer service provider must ensure that the observer remains available to NMFS, including NMFS Office for Law Enforcement, for debriefing for at least two weeks following any observed trip. An observer that is at sea during the 2-week period must contact NMFS upon his or her return, if requested by NMFS.

(E) Observer availability report. The observer service provider must report to NMFS any occurrence of inability to respond to an industry request for observer coverage due to the lack of available observers on staff by 5 pm, Eastern Standard Time, of any day on which the provider is unable to respond to an industry request for observer coverage.

(F) Other reports. The observer provider must report possible observer harassment, discrimination, concerns about vessel safety or marine casualty, observer illness or injury, and any information, allegations, or reports regarding observer conflict of interest or breach of the standards of behavior must be submitted to NMFS within 24 hours of the event or within 24 of learning of the event.

(viii) Refusal to deploy an observer.

(A) An observer service provider may refuse to deploy an observer on a requesting *Loligo* vessel if the observer service provider does not have an available observer within 72 hours of receiving a request for an observer from a vessel.
(B) An observer service provider may refuse to deploy an observer on a requesting *Loligo* vessel if the observer service provider has determined that the requesting vessel is inadequate or unsafe pursuant to the reasons described at §600.746.

(C) The observer service provider may refuse to deploy an observer on a *Loligo* vessel that is otherwise eligible to carry an observer for any other reason including failure to pay for pervious observer deployments, provided the observer service provider has received prior written confirmation from NMFS authorizing such refusal.

(6) Limitations on conflict of interest. An observer service provider:

(i) Must not have a direct or indirect interest in a fishery managed under Federal regulations, including, but not limited to, a fishing vessel, fish dealer, fishery advocacy group, and/or fishery research;
(ii) Must assign observers without regard to any preference by representatives of vessels other than when an observer will be deployed; and
(iii) Must not solicit or accept, directly or indirectly, any gratuity, gift, favor, entertainment, loan, or anything of monetary value from anyone who conducts fishing or fishing related activities that are regulated by NMFS, or who has interests that may be substantially affected by the performance or nonperformance of the official duties of observer providers.

(7) Removal of observer service provider from the list of approved observer service providers. An observer provider that fails to meet the requirements, conditions, and responsibilities specified in paragraphs (h)(5) and (h)(6) of this section shall be notified by NMFS, in writing, that it is subject to removal from the list of approved observer service providers. Such notification shall specify the reasons for the pending removal. An observer service provider that has received notification that it is subject to removal from the list of approved observer service providers may submit information to rebut the reasons for removal from the list. Such rebuttal must be submitted within 30 days of notification received by the observer service provider that the observer service provider is subject to removal and must be accompanied by written evidence that clearly disproves

the reasons for removal. NMFS shall review information rebutting the pending removal and shall notify the observer service provider within 15 days of receipt of the rebuttal whether or not the removal is warranted. If no response to a pending removal is received by NMFS, the observer service provider shall be automatically removed from the list of approved observer service providers. The decision to remove the observer service provider from the list, either after reviewing a rebuttal, or if no rebuttal is submitted shall be the final decision of NMFS and the Department of Commerce. Removal from the list of approved observer service providers does not necessarily prevent such observer service provider from obtaining an approval in the future if a new application is submitted that demonstrates that the reasons for removal are remedied. Certified observers under contract with an observer service provider that has been removed from the list of approved service providers must complete their assigned duties for any *Loligo* trips on which the observers are deployed at the time the observer service provider is removed from the list of approved observer service providers. An observer service provider removed from the list of approved observer service providers is responsible for providing NMFS with the information required in paragraph (h)(5)(vii) of this section following completion of the trip. NMFS may consider, but is not limited to, the following in determining if an observer service provider may remain on the list of approved observer service providers:

(i) Failure to meet the requirements, conditions, and responsibilities of observer service providers specified in paragraphs (h)(5) and (h)(6) of this section;

(ii) Evidence of conflict of interest as defined under paragraph (h)(3) of this section;
(iii) Evidence of criminal convictions related to:

(A) Embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements or receiving stolen property; or

(B) The commission of any other crimes of dishonesty, as defined by state law or Federal law that would seriously and directly affect the fitness of an applicant in providing observer services under this section;

(iv) UnsatiMSActory performance ratings on any Federal contracts held by the applicant; and

(v) Evidence of any history of decertification as either an observer or observer provider.

(i) Observer certification.

(1) To be certified, employees or sub-contractors operating as observers for observer service providers approved under paragraph (h) of this section must meet NMFS National Minimum Eligibility Standards for observers. NMFS National Minimum Eligibility Standards are available at the National Observer Program website: http://www.st.nmfs.gov/st4/nop/.

(2) Observer training. In order to be deployed on any *Loligo* vessel, a candidate observer must have passed a NMFS/NEFOP Fisheries Observer Training course. If a candidate fails training, the candidate shall be notified in writing on or before the last day of training. The notification will indicate the reasons the candidate failed the training. Observer training shall include an observer training trip, as part of the observer's training, aboard a *Loligo* vessel with a trainer. A certified observer's first deployment and the resulting data shall be immediately edited, and approved, by NMFS prior to any further deployments of that observer.

(3) Observer requirements. All observers must:

(i) Have a valid NMFS/NEFOP fisheries observer certification pursuant to paragraph (i)(1) of this section;

(ii) Be physically and mentally capable of carrying out the responsibilities of an observer on board *Loligo* vessels, pursuant to standards established by NMFS. Such standards are available from NMFS website specified in paragraph (g)(4) of this section and shall be provided to each approved observer service provider; and

(iii) Have successfully completed all NMFS-required training and briefings for observers before deployment, pursuant to paragraph (i)(2) of this section.

(iv) Hold a current Red Cross (or equivalence) CPR/first aid certification.

(4) Probation and decertification. NMFS has the authority to review observer certifications and issue observer certification probation and/or decertification as described in NMFS policy found on the website at: http://www.nefsc.noaa.gov/femad/fsb/.

(5) Issuance of decertification. Upon determination that decertification is warranted under paragraph (i)(3) of this section, NMFS shall issue a written decision to decertify the observer to the observer and approved observer service providers via certified mail at the observer's most current address provided to NMFS. The decision shall identify whether a certification is revoked and shall identify the specific reasons for the action taken. Decertification is effective immediately as of the date of issuance, unless the decertification official notes a compelling reason for maintaining certification for a specified period and under specified conditions. Decertification is the final decision of NMFS and the Department of Commerce and may not be appealed.

12.V Appendix v

Methods for Distributing the Butterfish Mortality Cap in the *Loligo* Fishery

Four methods of allocating the proposed mortality cap by trimester in the *Loligo* fishery were evaluated for inclusion in Amendment 10. These included methods based on **1**) the current allocation of *Loligo* quota (Trimester 1= 43%, Trimester 2=17% and Trimester 3= 40%) **2**) recent (2002-2006) *Loligo* landings (Table E1) , **3**) recent (2002-2006) *Loligo* effort (Table E2), and **4**) a bycatch rate method (which takes into account the both the current *Loligo* seasonal quota allocation and the expected butterfish bycatch rates in the *Loligo* fishery by trimester. The overall percentage of the butterfish mortality cap to be allocated to the *Loligo* fishery was determined by catch (fish brought on deck) analysis of observer data during 2002-2006 for trips which landed greater than 2,500 pounds of *Loligo*. This value, 75% (i.e. 75% of all butterfish brought on deck on observed trips occurred on trips that landed greater than 2,500 pounds of *Loligo*), was applied to a range of possible butterfish total mortality caps (kept and discards) ranging from 500-9000 mt. Applying this percentage produced total landings and discards available for allocation to the *Loligo* fishery that ranged from 375-6750 mt. The four allocation methods were used to allocate this range of butterfish mortality caps among the three available trimesters.

The results for the current seasonal distribution of the *Loligo* quota for the range of mortality caps is given in Table E3. These distributions formed the basis for alternative 1B in section 5.1 of the DSEIS. The results for the recent *Loligo* landings and *Loligo* effort methods (Tables E4-E5), were very similar so the basis for alternative 1C in section 5.1 of the DSEIS was recommended to be based on recent *Loligo* landings (Figure E1). The trimester allocation of the butterfish mortality cap based on the recent landings and effort compared with the actual amounts of *Loligo* allocated *a priori* to the fishery (i.e., alternative 1B) differ because of a recent shift in the percentage of landings (and effort) occurring in the first trimester compared to the historical (1994-1998) percent distribution of landings upon which the quota allocation for *Loligo* by trimester is currently based (note also that within trimester 1, there has been a worsening derby situation developing as boats that had not previously targeted *Loligo* have begun to do so (Personal communication with L. Hendrickson, also see Table 9)).

The bycatch rate mortality cap allocation schedule (Table E6) was computed as a function of the *Loligo* quota allocated to a given trimester and on the assumption that the butterfish bycatch *rate* is will vary according to level of butterfish abundance (i.e., as butterfish abundance increases, the bycatch rate in the *Loligo* fishery is also expected to increase). Butterfish bycatch rates were computed by trimester (expressed as the ratio of butterfish catch /*Loligo* catch) based on 2000-2005 sea sampling data (which is assumed to be a low period of butterfish abundance; i.e., biomass is assumed to equal 7,800 mt). This resulted in the following "low" butterfish abundance bycatch rates in the *Loligo* fishery by trimester: trimester = 10.1%, trimester 2 = 1.3% and trimester 3 = 5.3%. To obtain an estimate of bycatch rate after the stock has recovered, the observed bycatch rates during the low abundance period (2002-2005) were scaled by the ratio of high butterfish biomass/low butterfish biomass (i.e., 22,800mt/7,800mt = 2.92). This resulted in the following “high” butterfish abundance bycatch rates in the *Loligo* fishery by trimester: trimester = 29.5 %, trimester 2 = 5.8 3% and trimester 3 = 15.6%. To obtain an estimate of bycatch rate at a "medium" level of abundance, the mid-point between the low and high abundance rates was used. This resulted in the following “medium” butterfish abundance bycatch rates in the *Loligo* fishery by trimester: trimester = 19.8 %, trimester 2 = 2.5% and trimester 3 = 10.5%. For the various stock abundance levels, the corresponding estimated bycatch rates were then multiplied times the amount of *Loligo* allocated to each trimester based on current regulations and the resultant applied to the total mortality cap to obtain the amount to be allocated to each trimester (alternative 1D).

Table E1. *Loligo* landings (mt), by month and year, for otter trawl trips where the amount of *Loligo* kept was greater than 2,500 lbs based on the NMFS Vessel Trip Report database

Landings Approach 2002-2006													
loligo landings													
	1	2	3	4	5	6	7	8	9	10	11	12	total
2002	1561	1677	1600	1521	1643	455	1765	1844	358	2724	566	997	16711
2003	1188	2031	1844	420	281	88	50	114	1215	933	2112	1663	11939
2004	2479	3643	1148	1262	815	484	222	218	125	581	1464	3011	15452
2005	3191	4370	611	2712	673	285	241	64	297	1005	2043	1286	16779
2006	3477	1728	350	1691	1357	427	806	1411	275	1525	1627	1236	15912
total	11896	13450	5553	7606	4769	1739	3084	3652	2270	6768	7813	8192	76793
trisum	(2002-2006)			38505				13245				25043	
% by trimester				0.5014				0.1725				0.3261	

Table E2. Fishing effort (days fished) for otter trawl trips where the amount of *Loligo* kept was greater than 2,500 lbs, by month and year, based on the NMFS Vessel Trip Report database

Effort Approach 2002-2006													
Effort (days fished) for Loligo trips in VTR where qtykept > 2.500 lbs per trip													
				two years where fishery open most of year									
	Month												
Year	1	2	3	4	5	6	7	8	9	10	11	12	total
2002	300	353	377	315	272	34	340	317	12	430	60	188	2998
2003	269	379	406	146	30	7	13	9	55	250	340	331	2236
2004	350	459	138	281	166	71	48	37	26	134	185	299	2194
2005	411	347	34	359	2	7	43	10	87	198	262	193	1954
2006	507	243	10	315	93	3	151	344	30	458	364	231	2750
sum02-06	1837	1781	965	1417	563	121	595	717	210	1470	1212	1242	12132
trisum				6001				1997				4135	
% by trimester				0.494588				0.164579				0.340833	

Table E3. Allocation of butterfish mortality cap in the *Loligo* fishery based on the *Loligo* quota allocation method (alternative 1B) by trimester over a range of landings and discards from 375-6750 mt.

Total Butterfish	*Loligo* fishery lnd+disc	1	2	3	Total
500	375	161	64	150	375
1000	750	323	128	300	750
1500	1125	484	191	450	1125
2000	1500	645	255	600	1500
4000	3000	1290	510	1200	3000
5000	3750	1613	638	1500	3750
9000	6750	2903	1148	2700	6750

Table E4. Allocation of butterfish mortality cap based on *Loligo* landings by trimester (alternative 1C) during 2002-2006 over a range of landings and discards from 375-6750 mt.

Total Butterfish	*Loligo* lnd+disc	1	2	3	Total
500	375	188	65	122	375
1000	750	376	129	245	750
1500	1125	564	194	367	1125
2000	1500	752	259	489	1500
3000	2250	1128	388	734	2250
5000	3750	1880	647	1223	3750
9000	6750	3384	1164	2201	6750

Table E5. Allocation of butterfish mortality cap based on *Loligo* effort by trimester during 2002-2006 over a range of landings and discards from 375-6750 mt.

Total Butterfish	*Loligo* lnd+disc	1	2	3	Total
500	375	185	62	128	375
1000	750	371	123	256	750
1500	1125	556	185	383	1125
2000	1500	742	247	511	1500
3000	2250	1113	370	767	2250
5000	3750	1855	617	1278	3750
9000	6750	3338	1111	2301	6750

Table E6. Allocation of butterfish mortality cap by trimester based on the bycatch rate method (alternative 1D) over a range of landings and discards from 375-6750 mt.

Total Butterfish	*Loligo* lnd+disc	1	2	3	Total
500	375	185	62	128	375
1000	750	371	123	256	750
1500	1125	731	37	357	1125
2000	1500	742	247	511	1500
3000	2250	1462	743	714	2250
5000	3750	2437	124	1189	3750
9000	6750	3338	1111	2301	6750

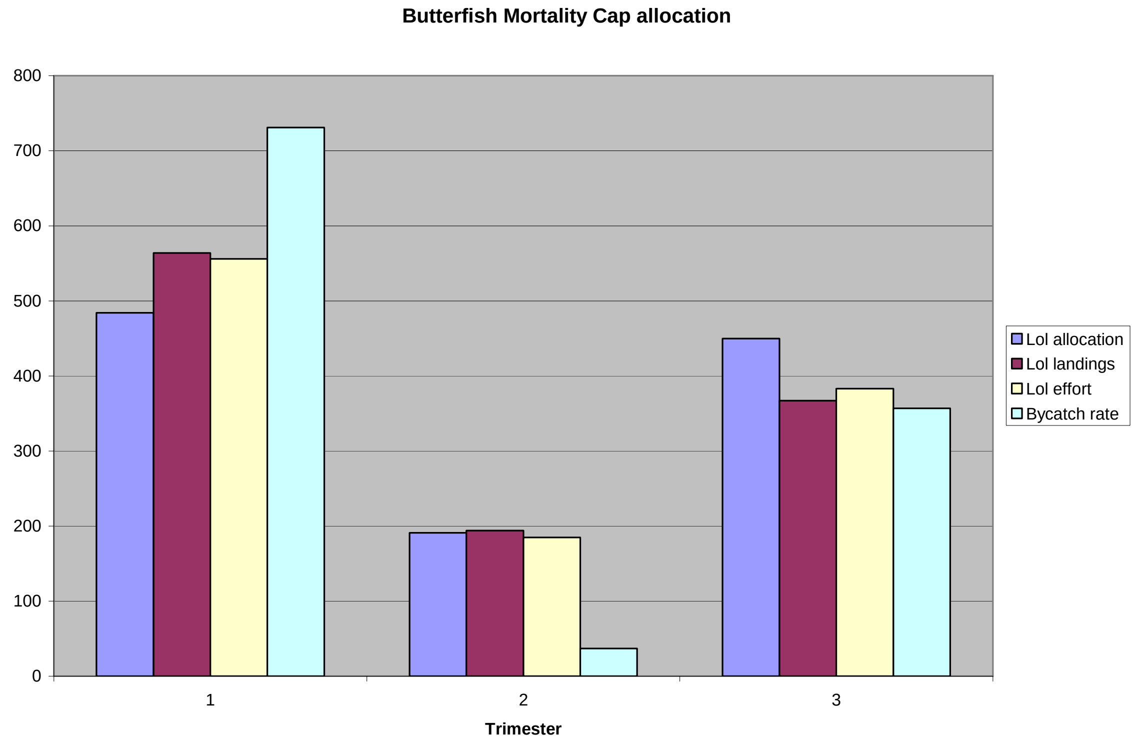

Figure E1. Allocation of butterfish mortality cap by trimester based on 1) current *Loligo* allocation by trimester (alternative 1B), 2) recent *Loligo* landings (alternative 1C), 3) recent *Loligo* effort, and 4) bycatch rate method (alternative 1D)for the case where total butterfish mortality cap is specified at 1500 mt.