FRAMEWORK ADJUSTMENT 2

TO THE

ATLANTIC MACKEREL, SQUID, AND BUTTERFISH FISHERY MANAGEMENT PLAN

Environmental Assessment
Regulatory Impact Review
Final Regulatory Flexibility Analysis
EFH Assessment

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Mid-Atlantic Fishery Management Council

in cooperation with

the National Marine Fisheries Service,

the New England Fishery Management Council,

and

the South Atlantic Fishery Management Council

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Executive Summary

Framework 2 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management (FMP), prepared by the Mid-Atlantic Fishery Management Council, is intended to manage the Atlantic mackerel, squid, and butterfish fisheries pursuant to the Magnuson-Stevens Fishery Conservation Act (MSFCMA) of 1976, as amended by the Sustainable Fisheries Act (SFA). The purpose of this action is to address a number of issues and problems which have developed relative to the management of the Atlantic mackerel, squid, and butterfish Fisheries since the development and implementation of Amendment 8. Specifically, Framework 2 would extend the moratorium on entry to the *Illex* fishery for an additional year, include a provision that in the event the annual specifications for Atlantic mackerel, squid and butterfish are not published by NMFS prior to the start of the fishing year, that the previous year's specifications will apply (excluding total allowable landings of foreign fishing (TALFF specifications)), modify the control rule and quota setting procedure for *Loligo,* and would allow for an exemption from the 2500 pound *Loligo* trip limit for vessels in the *Illex* fishery during a closure of the directed *Loligo* fishery during the months of August or September.

The FMP modified by this Amendment was implemented on 1 April 1983. The current management unit is all Atlantic mackerel, *Loligo pealei*, *Illex illecebrosus*, and butterfish under US jurisdiction.

The objectives of the FMP are:

1. Enhance the probability of successful (i.e., the historical average) recruitment to the fisheries.

2. Promote the growth of the US commercial fishery, including the fishery for export.

3. Provide the greatest degree of freedom and flexibility to all harvesters of these resources consistent with the attainment of the other objectives of this FMP.

4. Provide marine recreational fishing opportunities, recognizing the contribution of recreational fishing to the national economy.

5. Increase understanding of the conditions of the stocks and fisheries.

6. Minimize harvesting conflicts among US commercial, US recreational, and foreign fishermen.

The fishing year for Atlantic mackerel, *Illex* and *Loligo* squid, and butterfish is the twelve (12) month period beginning 1 January.

The preferred management measures proposed in this framework action are:

1. Extend the moratorium on entry to the *Illex* fishery for an additional year.

2. If annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, the previous year's specifications shall apply until the final rule for new specifications is implemented (excluding TALFF specifications).

3. For *Loligo*, an annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} consistent with requirements of Section 304 (e) of the Magnuson-Stevens Act. In addition, Max OY, ABC, OY, and DAH may be specified for a period of up to three years.

4. Vessels possessing *Illex* squid moratorium permits would be permitted to possess *Loligo* taken seaward of the 50 fathom curve in an amount not to exceed 10% of the total weight of *Illex* on board during a period of closure of the *Loligo* fishery during the months of August or September.

The alternative measures considered for this Framework Action include:

1. Extend the moratorium on entry to the *Illex* fishery for an additional five years (moratorium on entry to the *Illex* fishery would expire in 2007 unless extended in future Amendment).

2. Allow the moratorium on entry to the *Illex* fishery to expire in 2002 (no action).

3. If annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, the Atlantic mackerel, *Loligo* and *Illex* squid and butterfish fisheries operate without specifications and Joint Ventures cannot be conducted until the final rule for new specifications is implemented (no action/status quo).

4. If annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, a set of default specifications shall apply for the Atlantic mackerel, *Loligo* and *Illex* squid and butterfish fisheries until the final rule for new specifications is implemented.

5. If annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, the fisheries for these species will be closed until the final rule for new specifications is implemented.

6. If annual specifications for Atlantic mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications shall apply, until the final rule for new specifications is implemented (excluding TALFF specifications).

7. If annual specifications for Atlantic mackerel are not published by the NMFS prior to the start of the fishing year, a set of default specifications shall apply for Atlantic mackerel, until the final rule for new specifications is implemented (excluding TALFF specifications).

8. For *Loligo*, an annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} in a time period of at least three years but not greater than five years.

9. For *Loligo*, an annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} in a time period of at least five years but not greater than ten years.

10. Maintain current control rule and quota setting procedure for *Loligo* (no action/status quo).

11. Vessels possessing *Illex* squid moratorium permits would be permitted to possess *Loligo* in an amount not to exceed 20% of the total weight of *Illex* on board during a period of closure of the *Loligo* fishery during the months of June-September.

12. No exemption from the 2,500 lb *Loligo* trip limit during a period of closure of the *Loligo* fishery permitted (no action/status quo).

1.0 INTRODUCTION

Framework 2 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management (FMP), prepared by the Mid-Atlantic Fishery Management Council, is intended to revise the management plan for the Atlantic mackerel, squid, and butterfish fisheries pursuant to the Magnuson-Stevens Fishery Conservation Act (MSFCMA) of 1976, as amended by the Sustainable Fisheries Act (SFA). The purpose of the last amendment (8), was to bring the Atlantic Mackerel, Squid, and Butterfish Fishery Management plan into compliance with the new and revised National Standards and other required provisions of the Sustainable Fisheries Act. The The SFA, which reauthorized and amended the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), made a number of changes to the existing National Standards, as well as to definitions and other provisions in the Magnuson-Stevens Act, that caused the Guidelines to be significantly revised. Specifically, Amendment 8 revised the overfishing definitions for Atlantic mackerel, *Loligo* and *Illex* squid, and butterfish and addressed the new and revised National Standards relative to the existing management measures. In addition, Amendment 8 added a framework adjustment procedure that allows the Council to add or modify management measures through a streamlined public review process. A number of issues related to the management of Atlantic Mackerel, Squid, and Butterfish have developed since Amendment 8 was developed and implemented and are addressed in this Framework Adjustment.

2.0 PURPOSE AND NEED FOR ACTION

The purpose of this action is to address a number of issues and problems which have developed relative to the management of the Atlantic Mackerel, Squid, and Butterfish Fisheries since the development and implementation of Amendment 8. Specifically, Framework 2 would extend the moratorium on entry to the *Illex* fishery for an additional year, include a provision that in the event the annual specifications for Atlantic mackerel, squid and butterfish are not published by the NMFS prior to the start of the fishing year, that the previous year’s specifications will apply (excluding TALFF specifications), modify the overfishing definition control rule and quota setting procedure for *Loligo,* and would allow for an exemption from the 2500 pound *Loligo* trip limit for vessels in the *Illex* fishery during a closure of the directed *Loligo* fishery during the months of August or September.

2.1 History of FMP Development

In March 1977, the Council initiated development of the Mackerel and Squid FMPs. The Council adopted the Mackerel FMP for hearings in September 1977 and the Squid FMP for hearings in October 1977. Hearings on Mackerel and Squid FMPs were held in December, 1977. The Mackerel and Squid FMPs were adopted by the Council in March 1978. The Mackerel FMP was submitted for NMFS approval in May 1978. The Squid FMP was submitted for NMFS approval in June 1978. However, based on NMFS comments, the Council requested that the Mackerel and Squid FMPs be returned.

The FMPs were revised, the revisions being identified as Mackerel FMP

Supplement 1 and Squid FMP Supplement 1. These two Supplements, along with the original Butterfish FMP, were adopted for public hearings by the Council in July of 1978. Hearings on all three documents were held during September and October 1978 and all three FMPs were adopted in final form by the Council in November 1978. The Butterfish FMP was submitted for NMFS approval in December 1978. Mackerel FMP Supplement 1 and Squid FMP Supplement 1 were submitted for NMFS approval in January 1979. NMFS approved Squid FMP Supplement 1 in June 1979 and Mackerel FMP Supplement 1 in July 1979. Both FMPs were for fishing year (1 April - 31 March) 1979-80.

The Butterfish FMP was disapproved by NMFS in April 1979 because of a need for additional justification of the reasons for reducing OY below MSY. The Butterfish FMP was revised, adopted by the Council, and resubmitted for NMFS approval in June 1979. It was approved by NMFS in November 1979 for fishing year 1979-80.

The Council adopted Amendments 1 to both the Mackerel and Squid FMPs for hearings in August 1979. Hearings were held during October 1979. The Amendments were adopted by the Council and submitted for NMFS approval in November 1979. Both Amendments were approved by NMFS in March 1980. This extended the Squid FMP for an indefinite time beyond the end of fishing year 1979-80 and extended the Mackerel FMP through fishing year 1980-81. Butterfish FMP Amendment 1, extending the FMP through fishing year 1980-81, was adopted by the Council for hearings in December 1979 with hearings held during January 1980. During January 1980 the Amendment was adopted in final form by the Council and submitted for NMFS approval and was approved in March 1980.

The Council began work on an amendment to merge the Mackerel, Squid, and Butterfish FMPs in March 1980 the document being identified as Amendment 2 to the Mackerel, Squid, and Butterfish FMP. The Amendment was adopted by the Council for public hearings in August 1980. However, NMFS commented that there were significant problems with the Amendment that could not be resolved prior to the end of the fishing year (31 March 1981). The Council then prepared separate Amendments 2 to both the Mackerel and Butterfish FMPs to extend those FMPs through fishing year 1981-82. Since Amendment 1 to the Squid FMP extended that FMP indefinitely, there was no need to take this action for the Squid FMP. Those drafts were adopted for public hearing by the Council in October 1980 with hearings held in November. The Amendments were adopted in final form by the Council and submitted for NMFS approval in November 1980. Amendment 2 to the Mackerel FMP was approved by NMFS in January 1981 and Amendment 2 to the Butterfish FMP was approved by NMFS in February 1981.

In October 1980 the merger amendment, previously designated as Amendment 2, was redesignated Amendment 3. The Council adopted draft Amendment 3 to the Squid, Mackerel, and Butterfish FMP in July 1981 and hearings were held during September. The Council adopted Amendment 3 in October 1981 and submitted it for NMFS approval. NMFS review identified the need for additional explanation of certain provisions of the Amendment. The revisions were made and the revised Amendment 3 was submitted for NMFS approval in February 1982.

The Amendment was approved by NMFS in October 1982. However, problems developed with the implementation regulations, particularly with the Office of Management and Budget through that agency's review under Executive Order 12291. In an effort to have the FMP in place by the beginning of the fishing year (1 April 1983), the FMP, without the squid OY adjustment mechanism, or a revised Atlantic mackerel mortality rate, and retitled as the Atlantic Mackerel, Squid, and Butterfish FMP, was implemented by emergency interim regulations on 1 April 1983. By agreement of the Secretary of Commerce (Secretary) and the Council, the effective date of those emergency regulations was extended through 27 September 1983. The differences between the FMP and the implementing regulations resulted in a hearing before the House Subcommittee on Fisheries and Wildlife Conservation and the Environment on 10 May 1983.

Amendment 1 to the Atlantic Mackerel, Squid, and Butterfish FMP was prepared to implement the squid OY adjustment mechanism and the revised mackerel mortality rate. That Amendment was adopted by the Council on 15 September 1983, approved by NMFS on 19 December 1983, and implemented by regulations published in the *Federal Register* on 1 April 1984.

Amendment 2 was adopted by the Council on 19 September 1985 and approved by NOAA 6 March 1986. Amendment 2 changed the fishing year to the calendar year, revised the squid bycatch TALFF allowances, put all four species on a framework basis, and changed the fishing vessel permits from permanent to annual.

Amendment 3 was adopted by the Council in two actions. The Atlantic mackerel overfishing definition was adopted by the Council at its October 1990 meeting. The *Loligo*, *Illex*, and butterfish overfishing definitions were adopted at the December 1990 meeting. This was done because the Northeast Fisheries Center proposed changes to the overfishing definitions proposed in the hearing draft for the squids and butterfish. The Center's concerns were incorporated in the version adopted at the December 1990 meeting.

Amendment 4, approved by NMFS 8 November 1991, authorized the Regional Director, Northeast Region, NMFS (Regional Director) to limit the areas where directed foreign fishing and joint venture transfers from US to foreign vessels may take place. Directed foreign fishing must be conducted seaward of at least 20 miles from the shore. Operations of foreign vessels in support of US vessels (that is, joint ventures) may operate anywhere in the Exclusive Economic Zone (EEZ) throughout the management unit unless specific areas are closed to them. The catch limitations were changed by requiring that, if the preliminary initial or final amounts differ from those recommended by the Council, the *Federal Register* notice must clearly state the reason(s) for the difference(s) and specify how the revised specifications satisfy the 9 criteria set forth for the species affected. Additionally, for Atlantic mackerel, the specification of OYs and other values may be specified for three years at one time. These annual values may be adjusted within any year and prior to the second and third years as set forth above. However, projecting specifications over several years should allow more orderly development of the fishery since the revisions to the specifications

for the second and third years would be done by notice, rather than by regulatory measures. The joint ventures section was changed to allow the Regional Director may impose special conditions on joint ventures and directed foreign fishing activities. Such special conditions may include a ratio between the tonnage that may be caught in a directed foreign fishery relative to the tonnage that may be purchased over-the-side from US vessels and relative to the tonnage of US processed fish that must be purchased by the venture.

Amendment 5 was approved by NMFS 9 February 1996. It lowered the *Loligo* MSY, eliminated the possibility of 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 US jurisdiction. Amendment 6 revised the definitions of overfishing for *Loligo*, *Illex,* and butterfish and allowed for seasonal management of the *Illex* fishery.

Amendment 7 was developed to achieve consistency among FMP's in the NE region of the US relative vessel permitting, replacement and upgrade criteria. Amendment 8 was developed to bring the FMP into compliance with new and revised National Standards and other required provisions of the Sustainable Fisheries Act. Specifically, Amendment 8 revised the overfishing definitions for Atlantic mackerel, *Loligo* and *Illex* squid, and butterfish and addressed the new and revised National Standards relative to the existing management measures. In addition, Amendment 8 added a framework adjustment procedure that allows the Council to add or modify management measures through a streamlined public review process.

2.2 Problems for Resolution

2.2.1 Moratorium on entry to *Illex* fishery expires in 2002

Prior to the 1980's, the fishery for *Illex* in the US EEZ was prosecuted primarily by the foreign distant water fleets. With the implementation of the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan and it's subsequent Amendments, the fishery has become fully Americanized. At the same time that the domestic fishery was undergoing development, new biological data became available which indicated that *Illex* is an annual species. This resulted in downwardly revised estimates of the potential yield from this fishery. The simultaneous growth of the domestic fishery and reduction in estimates of sustainable yields resulted in the fishery moving towards a fully capitalized and exploited state. Hence a limited entry program became necessary and was implemented in Amendment 5. However, due to concerns that capacity might be insufficient to fully exploit the annual quota, a five year sunset provision was placed on the *Illex* moratorium when it was implemented as part of Amendment 5. The sunset provision for the moratorium entry into the *Illex* fishery, implemented in 1997, is set to expire in July 2002.

2.2.2 Timeliness of Quota Specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish affects fishing activity

In recent years, publication of the final rule implementing the annual specifications for Atlantic mackerel has not occurred until after the start of the fishing year. Industry members have recently testified that this situation has had a negative impact on possible Joint Venture activities for Atlantic mackerel, due to timing of the winter Atlantic mackerel fishery and the uncertainty about that the upcoming year's JV specifications. To help alleviate this situation, the Council is considering that, in the event the annual specifications for mackerel are not published by the NMFS prior to the start of the fishing year, that the previous year's specifications will apply until the final rule for new specifications is implemented (excluding TALFF specifications).

2.2.3 *Loligo* control rule is too conservative

The Council recognized during the development of Amendment 6 that optimal management of the *Loligo* resource would involve in-season assessment of the resource and adjustment of harvest levels according to fluctuations in stock size. In addition, the control rule relative to the definition of overfishing for *Loligo* was found to be too conservative during the most recent stock assessment. During the development of quota specifications for 2000, the Council concluded that the new requirements of the SFA required remedial action to rebuild the stock to a level which will produce MSY (B_{msy}) given the status determination at that time that *Loligo* was approaching an overfished state. The fishing mortality rate control rule adopted in Amendment 8 specifies that the target fishing mortality rate must be reduced to zero if biomass falls below 50% of B_{msy}. The target fishing mortality rate increases linearly to 75% of F_{msy} as biomass increases to B_{msy}. However, projections made in SAW 29 indicate that the control rule appears to be overly conservative. In fact, projections from SAW 29 indicated that the *Loligo* biomass could be rebuilt from ½ B_{msy} to levels approximating B_{msy} in three years if fishing mortality is reduced to the target mortality rate specified in Amendment 8 of 75% of F_{msy}. As a result, the Council concluded that the control rule adopted in Amendment 8 was too conservative. Model projections presented in the Atlantic Mackerel, Squid and Butterfish Monitoring Committee demonstrated that the stock could be rebuilt in a relatively short period of time, even at fishing mortality rates approaching F_{msy}. Based on this conclusion, the Council chose an *ad hoc* approach and specified ABC in 2000 as the yield associated with 90% F_{msy} (or 13,000 mt based on stock size estimates at that time). The control rule adopted in Amendment 8 needs to be modified to incorporate recommendations from SAW-29 relative to *Loligo* stock rebuilding potential.

2.2.4 Compliance with *Loligo* trip limit for vessels in the *Illex* fishery during closures of directed *Loligo* fishery problematic

The 2,500 pound trip limit for *Loligo* during directed *Loligo* fishery closures creates a compliance problem for *Illex* squid fishery vessels which occasionally take higher levels of *Loligo* incidental to the pursuit of *Illex* squid. The *Illex* fishery is a limited access, intensive fishery which occurs primarily seaward of the 50 fathom contour during the months of June - September. During the months of June, July, August, and September otter trawl

vessels participating in the directed fishery for *Illex* are currently exempt from the *Loligo* minimum mesh requirements if they possess *Loligo*. For the purposes of this exemption, the directed *Illex* fishery for this time period is defined as an otter trawl vessel fishing for *Illex* seaward of the 50 fathom depth contour. In addition, any vessel possessing *Loligo* which fished under the *Illex* exemption must not have available for immediate use any net with mesh sizes less than specified above for *Loligo* when the vessel moves landward of the 50 fathom contour. This exemption was included Amendment 5 because of concerns raised by fishermen that a small bycatch of *Loligo* can be expected in the *Illex* fishery.

Members of the directed *Illex* industry testified at Council meetings that there has been a recent shift of *Loligo* to offshore waters in certain years at or near the end of the period when the directed *Illex* fishery is prosecuted (i.e., August or September). They testified that the 2,500 *Loligo* trip limit during periods of closure of the directed *Loligo* fishery has caused compliance problems for vessels operating in the directed *Illex* fishery since the recent implementation of restrictive quotas in the *Loligo* fishery (which coincided with the offshore shift in *Loligo* distribution). This framework action was proposed, in part, to address these compliance issues.

2.3 Management Objectives

The objectives of the FMP are:

1. Enhance the probability of successful (i.e., the historical average) recruitment to the fisheries.

2. Promote the growth of the US commercial fishery, including the fishery for export.

3. Provide the greatest degree of freedom and flexibility to all harvesters of these resources consistent with the attainment of the other objectives of this FMP.

4. Provide marine recreational fishing opportunities, recognizing the contribution of recreational fishing to the national economy.

5. Increase understanding of the conditions of the stocks and fisheries.

6. Minimize harvesting conflicts among US commercial, US recreational, and foreign fishermen.

2.4 Management Unit

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

2.5 Management Strategy

Effective federal fishery management of Atlantic mackerel, *Loligo* and *Illex* squid, and butterfish has occurred for the past two decades. The management strategy during the first phase of the Atlantic Mackerel, Squid, and Butterfish FMP was to provide for the orderly development of the domestic fisheries for these resources under the purview of the Magnuson Act. This process involved the sequential phasing out of foreign fishing for these species in US waters and the gradual transfer of offshore fishing methods and technology to the domestic fishing fleet. For both squid species, the domestic fisheries have been fully developed.

All four species in the management unit are managed primarily via annual quotas to control fishing mortality. In addition, to the annual review and modifications to management measures specified in the FMP, the Council added a framework adjustment procedure in Amendment 8 which allows the Council to add or modify management measures through a streamlined public review process. As such, management measures that have been identified in the plan can be implemented or adjusted at any time during the year. This is the second framework action taken under the Atlantic Mackerel, Squid and Butterfish FMP since the framework procedure was implemented under Amendment 8. This framework action addresses the problems and issues described in section 2.2.

3.0 PREFERRED AND ALTERNATIVE MANAGEMENT MEASURES

3.1 Moratorium on entry to *Illex* fishery expires in 2002

3.1.1 Extend the moratorium on entry to the *Illex* fishery for an additional year (Preferred Alternative).

Amendment 5 established a moratorium on new entry into the commercial fishery for *Illex* squid. The Council placed a five year sunset provision on the moratorium which is set to expire in July 2002. This measure would extend the *Illex* moratorium for an additional year. Under this measure, only vessels which possess *Illex* moratorium permits during calendar year 2002 would be eligible for *Illex* moratorium permits under the moratorium extension. Under this alternative, the moratorium on entry to the *Illex* fishery would expire in 2003 unless extended in the next Amendment.

The extension of the moratorium under this framework option would maintain the status quo in the fishery at least until 2003. This will allow the Council more time to consider longer term measures for the *Illex* moratorium in Amendment 9 to the FMP. Vessels which took small quantities in the past will be able to continue to do so under the incidental catch provision of the FMP. However, further expansion of entry into the directed *Illex* fisheries will be controlled for at least an additional year, thus additional capitalization will be avoided.

3.1.2 Extend the moratorium on entry to the *Illex* fishery for an additional five years (moratorium on entry to the *Illex* fishery would expire in 2007 unless extended in future Amendment)

Amendment 5 established a moratorium on new entry into the commercial fishery

for *Illex* squid. The Council placed a five year sunset provision on the moratorium which is set to expire in July 2002. This measure would extend the *Illex* moratorium for an additional five years. Under this measure, only vessels which possess *Illex* moratorium permits during calendar year 2002 would be eligible for *Illex* moratorium permits under the moratorium extension. Under this alternative, the moratorium on entry to the *Illex* fishery would expire in 2007 unless extended in a future Amendment.

3.1.3 Allow the moratorium on entry to the *Illex* fishery to expire in 2002 (no action)

Under this option, the *Illex* moratorium would expire in July of 2002 and the fishery would revert to open access conditions.

3.2 Timeliness of Quota Specifications for Atlantic mackerel, *Loligo* and *Illex* squid and Butterfish

3.2.1 If annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, the previous year's specifications shall apply until the final rule for new specifications is implemented (excluding TALFF specifications) (Preferred Alternative)

Under this measure, if annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid are not published by the NMFS prior to the start of the fishing year, the previous year's specifications shall apply until the final rule implementing the new quota specifications is implemented. As noted above, this measure does not apply to TALFF specifications.

3.2.2 If annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, the Atlantic mackerel, *Loligo* and *Illex* squid and Butterfish fisheries operate without specifications and Joint Ventures cannot be conducted until the final rule for new specifications is implemented (no action/status quo)

This alternative maintains the current status quo conditions. Under this measure, if annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid are not published by the NMFS prior to the start of the fishing year, the fishery opens without quota specifications. Under these conditions, no JV is specified for Atlantic mackerel for the new fishing year and therefore no mackerel JV operations can be conducted until the final rule implementing the new quota specifications is published. In addition, the *Loligo* fishery is essentially unregulated during the first quarter.

3.2.3 If annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, a set of default specifications shall apply for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish fisheries until the final rule for new specifications is implemented

Under this measure, if annual specifications for Atlantic mackerel, *Loligo* and

Illex squid are not published by the NMFS prior to the start of the fishing year, the fishery opens under a set of default quota specifications. Under this option quotas would be specified which correspond to the three year average of quota specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish for the period 1998-2000, except for TALFF which be set equal to zero under the default measures.

3.2.4 If annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, the fisheries for these species will be closed until the final rule for new specifications is implemented

Under this measure, if the annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, the fisheries for these species will be closed until the final rule for new specifications is published. In other words, the landing of all four species in the management unit would be prohibited until the final rule for new specifications is published.

3.2.5 If annual specifications for Atlantic mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications shall apply, until the final rule for new specifications is implemented (excluding TALFF specifications)

Under this measure, if annual specifications for Atlantic mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications shall apply until the final rule implementing the new quota specifications is published. As noted above, this measure does not apply to TALFF specifications. This alternative is included because one of the primary concerns that has arisen when annual specifications are not in place is the inability to conduct JV operations in the Atlantic mackerel fishery.

3.2.6 If annual specifications for Atlantic mackerel are not published by the NMFS prior to the start of the fishing year, a set of default specifications shall apply for Atlantic mackerel, until the final rule for new specifications is implemented (excluding TALFF specifications)

Under this measure, if annual specifications for Atlantic mackerel are not published by the NMFS prior to the start of the fishing year, the fishery opens under a set of default quota specifications. Under this option quotas would be specified which correspond to the three year average of quota specifications for Atlantic mackerel for the period 1998-2000, except for TALFF which be set equal to zero under the default measures. This alternative is included because one of the primary concerns that has arisen when annual specifications are not in place is the inability to conduct JV operations in the Atlantic mackerel fishery.

3.3 *Loligo* control rule

3.3.1 Annual quota associated with a target fishing mortality rate of up to

90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} consistent with requirements of Section 304e of the Magnuson-Stevens Act. In addition, Max OY, ABC, OY, and DAH may be specified for a period of up to three years. (Preferred Alternative)

This measure modifies the control rule for *Loligo* squid and allows for the in-season adjustment of the annual *Loligo* quota. The primary components of the overfishing definition that were required under the SFA and implemented under Amendment 8 (i.e,, the maximum fishing mortality rate threshold (F_{msy}) and the minimum biomass threshold (½ B_{msy})), remain unchanged. Under this measure, an annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} in a time period consistent with Section 304 e of the Magnuson-Stevens Act. This section of the Act specifies that an overfished stock shall be rebuilt in a time period as short as possible, but not to exceed ten years.

The Atlantic Mackerel Squid and Butterfish Monitoring Committee will meet in late spring to review available NEFSC survey data and develop recommendations about in-season adjustments to the annual *Loligo* specifications for consideration by the Atlantic Mackerel Squid and Butterfish Committee and the Council. Based on an evaluation of the most recent NEFSC spring and fall trawl survey data, the OY, DAH and ABC specifications may be adjusted to be consistent with the control rule. Based on the recommendations of the Council, the Regional Administrator may make in-season adjustments, as appropriate, through publication of a notice in the Federal Register of an in-season adjustment action. In-season adjustment actions may include increases or decreases in the OY, DAH and ABC specifications and may be implemented by opening or closing the directed fishery for *Loligo*, as necessary.

3.3.2 Annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} in a time period of at least three years but not greater than five years

This measure modifies the control rule for *Loligo* squid and allows for the in-season adjustment of the annual *Loligo* quota. The primary components of the overfishing definition that were required under the SFA and implemented under Amendment 8 (i.e,, the maximum fishing mortality rate threshold (F_{msy}) and the minimum biomass threshold (½ B_{msy})), remain unchanged. Under this measure, an annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality

shall be implemented to insure that stock is rebuilt to B_{msy} in a time period of at least three years but not greater than five years.

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3.3.3 Annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} in a time period of at least five years but not greater than ten years

This measure modifies the control rule *Loligo* squid and allows for the in-season adjustment of the *Loligo* quota. The primary components of the overfishing definition that were required under the SFA and implemented under Amendment 8 (i.e,, the maximum fishing mortality rate threshold (F_{msy}) and the minimum biomass threshold (½ B_{msy})), remain unchanged. Under this measure, an annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} in a time period of at least five years but not greater than ten years.

The Atlantic Mackerel Squid and Butterfish Monitoring Committee will meet in late spring to review available NEFSC survey data and develop recommendations about in-season adjustments to the annual *Loligo* specifications for consideration by the Atlantic Mackerel Squid and Butterfish Committee and the Council. Based on an evaluation of the most recent NEFSC spring and fall trawl survey data, the OY, DAH and ABC specifications may be adjusted to be consistent with the control rule. Based on the recommendations of the Council, the Regional Administrator may make in-season adjustments, as appropriate, through publication of a notice in the Federal Register of an in-season adjustment action. In-season adjustment actions may include increases or decreases in the OY, DAH and ABC specifications and may be implemented by opening or closing the directed fishery for *Loligo*, as necessary.

3.3.4 Maintain current control rule for *Loligo* (no action/status quo).

This alternative maintains the current status quo conditions Under this

option, the *Loligo* control rule adopted in Amendment 8 would remain unchanged. Under Amendment 8, annual quotas are specified which correspond to a target fishing mortality rate of 75 % of F_{msy}. Target F is defined as 75% of the F_{msy} when biomass is greater than 80,000 mt, and decreases linearly to zero at 40,000 mt (½ of the B_{MSY} proxy).

3.4 Allow for an exemption from the *Loligo* trip limit during periods of closure of the directed *Loligo* fishery for vessels engaged in the *Illex* fishery

3.4.1 Vessels possessing *Illex* squid moratorium permits would be permitted to possess *Loligo* taken seaward of the 50 fathom curve in an amount not to exceed 10% of the total weight of *Illex* on board during a period of closure of the *Loligo* fishery during the months of August or September (Preferred Alternative)

Under this measure, vessels which possess *Illex* squid moratorium permits fishing east of the 50 fathom contour would be permitted to possess *Loligo* in an amount not to exceed 10% of the total weight of *Illex* on board during a period of closure of the *Loligo* fishery during the months of August or September. This framework measure would be subject to an annual review by the Council. The Atlantic Mackerel, Squid and Butterfish Monitoring Committee will meet in the late fall of each year and evaluate available landings data to determine the effect of this measure. If the *Loligo* landings taken under the *Illex* exemption program substantially exceed a level which could be reasonably expected given historical estimates of *Loligo* bycatch in the directed *Illex* fishery, the Monitoring Committee may recommend to the Atlantic Mackerel, Squid and Butterfish Committee and Council that the exemption be terminated. Based on the recommendation of the Council, the Regional Administrator may issue a Notice Action which would remove this measure from the regulations. If no action is taken by the Regional Administrator, the measure would remain effect. In addition, the Council may place an overall cap on the amount of *Loligo* that may be landed under this exemption program as part of the annual quota specification process.

3.4.2 Vessels possessing *Illex* squid moratorium permits would be permitted to possess *Loligo* in an amount not to exceed 20% of the total weight of *Illex* on board during a period of closure of the *Loligo* fishery during the months of June-September.

Under this measure, vessels which possess *Illex* squid moratorium permits would be permitted to possess *Loligo* in an amount not to exceed 20% of the total weight of *Illex* on board during a period of closure of the *Loligo* fishery during the months of June-September. This framework measure would be subject to an annual review by the Council. At the end of the fishing year, the Atlantic Mackerel, Squid and Butterfish Monitoring Committee will evaluate the effect of this measure and make recommendations to the Atlantic Mackerel, Squid and Butterfish Committee and Council relative to it’s termination. Based on the recommendation of the Council, the Regional Administrator may issue a Notice Action which would remove this measure from the regulations.

If no action is taken by the Regional Administrator, the measure would remain effect. In addition, the Council may place an overall cap on the amount of *Loligo* that may be landed under this exemption program as part of the annual quota specification process.

3.4.3 No exemption from the 2,500 lb *Loligo* trip limit during a period of closure of the *Loligo* fishery (no action/status quo).

This alternative maintains the current status quo conditions. Under the no action alternative vessels fishing in the *Illex* fishery would not be exempt from the *Loligo* trip limit during periods when the directed *Loligo* fishery is closed and would be restricted to 2,500 lbs per trip.

4.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT

4.1 DESCRIPTION OF THE STOCK

4.1.1 *Loligo pealei*

4.1.1.1 Species Description and Distribution

Long-finned squid (*Loligo pealei*), also known as the common, bone or winter squid, are distributed in continental shelf and slope waters of the Western Atlantic Ocean from Newfoundland, Canada to the Gulf of Venezuela (Summers, 1983; Dawe et al. 1990). *Loligo* undergo seasonal migrations moving to shallow inshore waters in spring and summer to spawn and feed. In late autumn they move offshore to overwinter along the edge of the continental shelf (Summers, 1969; Serchuk and Rathjen, 1974).

Previous studies of the life history and population dynamics of this species assumed that *Loligo* died after spawning at an age of 18-36 months based on the analysis of length frequency data (which suggested a "crossover" life cycle (Mesnil 1977; Lange and Sissenwine 1980). However, recent advances in the aging of squid have been made utilizing counts of daily statolith growth increments (Dawe et al. 1985; Jackson and Choat 1992). Preliminary statolith ageing of *Loligo* indicated a life span of less than one year (Macy 1992). Consequently, the last two stock assessments for *Loligo* were conducted assuming that the species has an annual life-cycle and has the capacity to spawn throughout the year (NMFS 1994a, NMFS 1996), as now appears typical of pelagic squid species studied throughout the world (Jereb *et al.* 1991).

4.1.1.2 Status of the Stock

Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management (FMP) was developed to bring the FMP into compliance with the Sustainable Fisheries Act (SFA). The SFA, which reauthorized and amended the Magnuson-Stevens Act, made a number of changes to the existing National Standards, as well as to definitions and other provisions in the Magnuson-Stevens Act, that caused the Guidelines to be significantly revised. The most significant changes were made to National Standard 1, which imposed new requirements concerning definitions of overfishing in fishery management

plans. The overfishing definition for Loligo was revised in Amendment 8 to comply with the SFA as follows: overfishing for *Loligo* will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{max} is exceeded (F_{max} is a proxy for F_{msy}). When an estimate of F_{msy} becomes available, it will replace the current overfishing proxy of F_{max}. Annual quotas will be specified which correspond to a target fishing mortality rate. Target F is defined as 75% of the F_{msy} when biomass is greater than B_{msy}, and decreases linearly to zero 50% of B_{MSY}. Maximum OY is specified as the catch associated with a fishing mortality rate of F_{max}. In addition, the biomass target is specified to equal B_{MSY}.

The most recent assessment of the Loligo stock (SAW 29) concluded that the stock was approaching an overfished condition and that overfishing was occurring (NMFS 1999). A production model indicated that current biomass was less than B_{msy}, and near the biomass threshold of 50% B_{MSY}. There was high probability that fishing mortality exceeded F_{msy} in 1998. The average F from the winter fishery (October to March) over the last five years averaged 180% of F_{MSY}, and F from the summer fishery equaled F_{MSY}. However, the production model also indicated that the stock has the ability to quickly rebuild from low stock sizes. Length based analyses indicated that fully-recruited fishing mortality is greater than F_{max} and stock biomass was among the lowest in the assessment time series (1987-1998). Recent survey indices of recruitment were well below average.

The new requirements of the SFA required the Council to take remedial action for 2000 to rebuild the stock to a level which will produce MSY (B_{msy}) given the status determination that *Loligo* was approaching an overfished state. The control rule in Amendment 8 specifies that the target fishing mortality rate must be reduced to zero if biomass falls below 50% of B_{msy}. The target fishing mortality rate increases linearly to 75% of F_{msy} as biomass increases to B_{msy}. However, projections made in SAW 29 indicate that the control rule appears to be overly conservative. Projections from SAW 29 indicated that the Loligo biomass could be rebuilt to levels approximating B_{msy} in three years if fishing mortality was reduced to the target mortality rate specified in Amendment 8 of 75% of F_{msy}. The yield associated with this fishing mortality rate (75% of F_{msy}) in 2000, assuming status quo F in 1999, was estimated to be 11,732 mt in SAW 29. The current regulations still specify Max OY as the yield associated F_{max} or 26,000 mt. In determining the specification of ABC for the year 2000, the Council considered advice offered by SAW 29 which indicated that the control rule adopted in Amendment 8 was too conservative. The Council chose to specify ABC as the yield associated with 90% F_{msy} or 13,000 mt in 2000.

The most recent survey data for *Loligo* squid indicate that abundance of this species has increased significantly since the most recent assessment was conducted (i.e, SAW-29). Estimates of biomass based on NEFSC fall 1999 and spring 2000 survey indices for *Loligo* indicate that the stock is currently at or near B_{msy}. In fact, the 1999 fall survey index was the sixth highest value observed in the time series since 1967 and the second highest since 1987. The 2000 spring survey index for *Loligo* was the tenth highest in the time series since 1968 and the fifth highest since 1987 (Lai, pers.comm). Based on the assumption that the stock will be at or near B_{msy} in 2001, the Council

recommended that the 2001 quota be specified as the yield associated with 75% of F_{msy} . The yield associated with 75% of F_{msy} at B_{msy} is 17,000 mt based on projections in SAW-29 (NMFS 1999).

4.1.1.3 Ecological relationships and stock characteristics

Previous studies of the life history and population dynamics of this species assumed that *Loligo* died after spawning at an age of 18-36 months based on the analysis of length frequency data (which suggested a "crossover" life cycle (Mesnil 1977, Lange and Sissenwine 1980)). However, recent advances in the aging of squid have been made utilizing counts of daily statolith growth increments (Dawe *et al.* 1985, Jackson and Choat 1992). Preliminary statolith ageing of *Loligo* indicates a life span of less than one year (Macy 1992, Brodziak and Macy 1994). Consequently, the most recent stock assessment for *Loligo* was conducted assuming that the species has an annual life-cycle and has the capacity to spawn throughout the year (NMFS 1994), as now appears typical of pelagic squid species studied throughout the world (Jereb *et a*l. 1991).

Eggs are collected in gelatinous capsules as they pass through the female's oviduct during mating. Each capsule is about 3" long and 0.4" in diameter. Mating activity among captive *Loligo* was initiated when clusters of newly spawned egg capsules were placed in the tank. During spawning the male cements bundles of spermatophores into the mantle cavity of the female, and as the capsule of eggs passes out through the oviduct its jelly is penetrated by the sperm. The female then removes the egg capsule and attaches it to a preexisting cluster of newly spawned eggs. The female lays between 20 and 30 of these capsules, each containing 150 to 200 large (about 0.05"), oval eggs, for a total of 3,000 to 6,000 eggs. These clusters of demersal eggs, with as

many as 175 capsules per cluster, are found in shallow waters (10-100') and may often be found washed ashore on beaches (Grosslein and Azarovitz 1982).

Loligo eggs in captivity develop in 11 to 27 days at temperatures ranging from 73 to 54 F; in nature, they may develop over a 40 F span of seawater temperature, beginning at 46 F. Little is known about the larval stages of *Loligo*; larvae are about 0.1" at hatching. They are not often found in the spawning areas and are assumed to be washed away by currents. A few 0.8" and many 1 to 2" juveniles appear in autumn research vessel catches in shallow waters. Significant numbers of these juveniles have also been found around Hudson Shelf Valley in late winter when adults are mostly found offshore. These are presumably October spawned individuals just beginning to move offshore (Grosslein and Azarovitz 1982).

The diet of *Loligo* changes with increasing size; small immature individuals feed on planktonic organisms (Vovk 1972a, Tibbetts 1977) while larger individuals feed on crustaceans and small fish (Vinogradov and Noskov 1979). Cannibalism is observed in individuals larger than 2 in (5 cm) (Whitacker 1978). Juveniles 1.6-2.4 in (4.1-6 cm) long fed on euphausiids and arrow worms, while those 2.4-4 in (6.1-10 cm) fed mostly on small crabs, but also on polychaetes and shrimp (Vovk and Khvichiya 1980, Vovk 1985). Adults 4.8-6.4 in (12.1-16 cm) long fed on fish (Clupeids, Myctophids) and squid larvae/juveniles, and those >6.4 in (16 cm) fed on fish and squid (Vovk and Khvichiya 1980, Vovk 1985). Fish species preyed on by *Loligo* include silver hake, mackerel, herring, menhaden (Langton and Bowman 1977), sand lance, bay anchovy, menhaden, weakfish, and silversides (Kier 1982). Maurer and Bowman (1985) demonstrated seasonal and inshore/offshore differences in diet: in the spring in offshore waters, the diet was composed of crustaceans (mainly euphausiids) and fish; in the fall in inshore waters, the diet was composed almost exclusively of fish; and in the fall in offshore waters, the diet was composed of fish and squid.

The NEFSC bottom trawl survey data on food habits demonstrates a similar ontogenetic shift in the diet of *Loligo*. During 1973-1980, the diet of 0.4-4 in (1-10 cm) long squid was composed primarily of crustaceans (23%), while fish were the most important prey item in the diet of 4.4-16 in (11-40 cm) long squid. During 1981-90, the diet of squid 0.4-4 in (1-10 cm) in length was composed of 42% cephalopods (i.e., squid), 26% fish, and 21% crustaceans, while the diet of larger squid, 4.4-16 in (11-40 cm) in length, was dominated by fish (39%) and cephalopods (22%).

Juvenile and adult *Loligo* are preyed upon by many pelagic and demersal fish species, as well as marine mammals and diving birds (Lange and Sissenwine 1980, Vovk and Khvichiya 1980, Summers 1983). Marine mammal predators include long-finned pilot whale, *Globicephala melas*, and common dolphin, *Delphinus delphis* (Waring *et al.* 1990, Overholtz and Waring 1991, Gannon *et al.* 1997). Fish predators include bluefish, sea bass, mackerel, cod, haddock, pollock, silver hake, red hake, sea raven, spiny dogfish, angel shark, goosefish, dogfish and flounder (Maurer 1975, Langton and Bowman 1977, Gosner 1978, Lange 1980).

4.1.2 Atlantic mackerel

4.1.2.1 Species Description and Distribution

Atlantic mackerel (*Scomber scombrus*) is a fast swimming, pelagic, schooling species distributed between Labrador (Parsons 1970) and North Carolina (Anderson 1976a). The existence of separate northern and southern spawning contingents was first proposed by Sette (1950). The southern group spawns primarily in the Mid-Atlantic Bight during April-May while the northern group spawns in the Gulf of St. Lawrence in June-July. Both groups overwinter between Sable Island (off Nova Scotia; Figure 3) and Cape Hatteras in water generally warmer than 45 F (USDC 1984a).

Both groups make extensive northerly (spring) and southerly (autumn) migrations to and from spawning and summer feeding grounds (Figure 3). The southern contingent begins its spring migration from waters off North Carolina and Virginia in March- April, and moves steadily northward, reaching New Jersey and Long Island usually by April-May, where spawning occurs. These fish may spend the summer as far north as the Maine coast. In autumn this contingent moves southward and returns to deep offshore water near Block Island after October (Hoy and Clark 1967).

The northern contingent arrives off southern New England in late May, and moves north to Nova Scotia and the Gulf of St. Lawrence where spawning occurs usually by July (Hoy and Clark 1967, Bigelow and Schroeder 1953). This contingent begins its southerly autumn migration in November and December and disappears into deep water off Cape Cod.

Even though there are two spawning groups of mackerel in the Northwest Atlantic, biochemical studies (Mackay 1967) have not established that genetic differences exist between them. These two contingents intermingle off southern New England in spring and autumn (Sette 1950). Tagging studies reported by Beckett *et al.* (1974), Parsons and Moores (1974) and Moores *et al.* (1975) indicate that some mackerel that summer at the northern extremity of the range overwinter south of Long Island. Precise estimates of the relative contributions of the two contingents cannot be made (ICNAF 1975). Both contingents have been fished by the foreign winter fishery and no attempt was made to separate these populations for assessment purposes by the International Commission for the Northwest Atlantic Fisheries (ICNAF), although separate Total Allowable Catches (TAC) were in effect for Subareas 5

and 6 and for areas to the north from 1973- 1977. Since 1975 all mackerel in the northwest Atlantic have been assessed as a unit stock (Anderson 1982). Thus, Atlantic mackerel are considered one stock for fishery management purposes.

4.1.2.2 Status of the Stock

The Northwest Atlantic mackerel stock was most recently assessed at SAW-30 (NMFS 2000). The assessment concluded that the Atlantic mackerel stock is currently at a high level of abundance and is under-exploited. Based on trends in survey indices, recruitment has been well above average throughout most of the 1990's. However, estimates of fishing mortality and stock sizes based on virtual population analyses conducted in SAW 29 were considered unreliable.

The previous assessment of the Northwest Atlantic mackerel stock was conducted at SAW-20 and provided estimates of fishing mortality and stock sizes (NMFS 1995). In 1994, F was estimated to be 0.02 with an 80% confidence interval of 0.00-0.03, while SSB was estimated to be 2.1 million mt (with an associated 80% confidence interval of 1.2 - 8.2 million mt).

A recent Canadian assessment confirmed the conclusion that the Atlantic mackerel stock is currently at a high level of abundance (Gregoire 1996). Results of spawning stock size projections based on egg production in Canadian waters indicated that the northern (i.e., Canadian) portion of the adult stock remained constant at around 800,000 mt between 1992 and 1994. The Canadian assessment concluded that Atlantic mackerel stock biomass remains high and further that the
appearance of one and two year old fish (the 1993 and 1994 year classes) in the 1995 Canadian catch indicates that two very large year classes are entering the fishery.

4.1.2.3 Ecological relationships and stock characteristics

Atlantic mackerel (*Scomber scombrus*) is a fast swimming, pelagic, schooling species distributed between Labrador (Parsons 1970) and North Carolina (Anderson 1976a). The existence of separate northern and southern spawning contingents was first proposed by Sette (1950). The southern group spawns primarily in the Mid-Atlantic Bight during April-May while the northern group spawns in the Gulf of St. Lawrence in June-July. Both groups overwinter between Sable Island (off Nova Scotia; Figure 3) and Cape Hatteras in water generally warmer than 45 F (USDC 1984a).

Both groups make extensive northerly (spring) and southerly (autumn) migrations to and from spawning and summer feeding grounds (Figure 3). The southern contingent begins its spring migration from waters off North Carolina and Virginia in March- April, and moves steadily northward, reaching New Jersey and Long Island usually by April-May, where spawning occurs. These fish may spend the summer as far north as the Maine coast. In autumn this contingent moves southward and returns to deep offshore water near Block Island after October (Hoy and Clark 1967).

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Even though there are two spawning groups of mackerel in the Northwest Atlantic, biochemical studies (Mackay 1967) have not established that genetic differences exist between them. These two contingents intermingle off southern New England in spring and autumn (Sette 1950). Tagging studies reported by Beckett *et al.* (1974), Parsons and Moores (1974) and Moores *et al.* (1975) indicate that some mackerel that summer at the northern extremity of the range overwinter south of Long Island. Precise estimates of the relative contributions of the two contingents cannot be made (ICNAF 1975). Both contingents have been fished by the foreign winter fishery and no attempt was made to separate these populations for assessment purposes by the International Commission for the Northwest Atlantic Fisheries (ICNAF), although separate Total Allowable Catches (TAC) were in effect for Subareas 5 and 6 and for areas to the north from 1973- 1977. Since 1975 all mackerel in the northwest Atlantic have been assessed as a unit stock (Anderson 1982). Thus, Atlantic mackerel are considered one stock for fishery management purposes.

Mackerel spawning occurs during spring and summer and progresses from south to north. The southern contingent spawns from mid-April to June in the Mid-Atlantic Bight and the Gulf of Maine and the northern contingent spawns in the southern Gulf of St. Lawrence from the end of May to mid-August (Morse 1978). Most spawn in the shoreward half of continental shelf waters, although some spawning extends to the shelf edge and beyond. Spawning occurs in surface water temperatures of 45-57 ^{o}F, with a peak around 50-54 ^{o}F (Grosslein and Azarovitz 1982).

All Atlantic mackerel are sexually mature by age 3, while about 50% of the age 2 fish are mature. Average size at maturity is about 10.5-11" FL (Grosslein and Azarovitz 1982). Growth is very rapid with fish reaching 7.9 in (20 cm) by their first autumn (Anderson and Paciorkowski 1978). The maximum age observed is 17 years (Pentilla and Anderson 1976).

Fecundity estimates ranged from 285,000 to 1.98 million eggs for southern contingent mackerel between 12-17" FL. Analysis of egg diameter frequencies indicated that mackerel spawn between 5 and 7 batches of eggs per year. The eggs are 0.04-0.05" in diameter, have one 0.1" oil globule, and generally float in the surface water layer above the thermocline or in the upper 30-50'. Incubation depends primarily on temperature; it takes 7.5 days at 52 ^{o}F, 5.5 days at 55 ^{o}F, and 4 days at 61^{o}F (Grosslein and Azarovitz 1982).

Mackerel are 0.1" long at hatching, grow to about 2" in two months, and reach a length of 8" in December, near the end of their first year of growth. During their second year of growth they reach about 10" in December, and by the end of their fifth year they grow to an average length of 13" FL. Fish that are 10-13 years old reach a length of 15-16" (Grosslein and Azarovitz

1982). MacKay (1973) and Dery and Anderson (1983) have found an inverse relationship between growth and year class size.

Atlantic mackerel are opportunistic feeders that can ingest prey either by individual selection of organisms or by passive filter feeding (Pepin *et al.* 1988). Filter feeding occurs when small plankton are abundant and mackerel swim through patches with mouth slightly agape, filtering food through their gill rakers (MacKay 1979). According to MacKay (1979) particulate feeding is the principal feeding mode in the spring and fall while filter feeding predominates in the summer in the Gulf of St Lawrence. Moores *et al.* (1975) maintains that the diet of fish from Newfoundland suggests that particulate feeding occurs there throughout the season.

Larvae feed primarily of zooplankton (Collette in prep.). First-feeding larvae (0.140 in; 3.5 mm) collected from Long Island Sound were found to be phytophagous while slightly larger individuals (greater than 0.176 in; 4.4 mm) fed on copepod nauplii (Peterson and Ausubel 1984; Ware and Lambert 1985). Fish >0.2 in (5 mm) fed on copepodites of *Acartia* and *Temora* while diets of fish >0.24 in (6 mm) contained adult copepods (Peterson and Ausubel 1984). Larvae >0.256 in (6.4 mm) were cannibalistic, feeding on 0.14-.018 in (3.5-4.5 mm) conspecifics (Peterson and Ausubel 1984). Consumption rates of larvae average between 25 and 75% body weight per day. Larvae feed selectively, primarily on the basis of prey visibility (Peterson and Ausubel 1984). Fortier and Villeneuve (1996), studying larval mackerel from the Scotian Shelf, found that with increasing larval length, diet shifted from copepod nauplii to copepod and fish larvae including yellowtail flounder, silver hake, redfish and a large proportion of conspecifics. Predation was stage-specific: only the newly hatched larvae of a given species were ingested. However, piscivory was limited at densities of fish larvae $<0.1/m^3$ and declined with increasing density of nauplii and with increasing number of alternative copepod prey ingested.

Juveniles eat mostly small crustaceans such as copepods, amphipods, mysid shrimp and decapod larvae (Collette in prep.). They also feed on small pelagic molluscs (*Spiratella* and *Clione*) when available (Collette in prep.). Adults feed on the same food as juveniles but diets also include a wider assortment of organisms and larger prey items. For example, euphausid, pandalid and crangonid shrimp are common prey; chaetognaths, larvaceans, pelagic polychaetes and larvae of many marine species have been identified in mackerel stomachs (Collette in prep.). Bigelow and Schroeder (1953) found many Gulf of Maine mackerel feeding on *Calanus* as well as other copepods. Larger prey such as squids (*Loligo*) and fishes (silver hake, sand lance, herring, hakes and sculpins) are not uncommon, especially for large mackerel (Bowman *et al.* 1984). Under laboratory conditions, mackerel also fed on *Aglanta digitale*, a small transparent medusa common in temperate and boreal waters (Runge *et al.* 1987). While there is variability between the two size classes and between the two survey periods, copepods and euphausids and various crustaceans could be considered relative staples in the diet.

Immature mackerel begin feeding in the spring; older fish feed until gonadal development begins, stop feeding until spent and then resume prey consumption

(Berrien 1982; Collette in prep.). Under experimental conditions in which larval fish (0.12-0.4 in; 3-10 mm in length) were presented as part of natural zooplankton assemblages, prey preference by mackerel was positively size selective and predation rates were not influenced by larval fish density (Pepin *et al.* 1987). Subsequent studies indicated that mackerel may achieve a higher rate of energy intake by switching to larger prey and increasing search rate as prey size and total abundance increase (Pepin *et al.* 1988). Filter feeding activity also increased with increasing prey density and Pepin *et al.* (1988) conjecture that feeding rates under natural conditions of prey abundance (0.1g wet weight/m^3) indicate that mackerel would not be satiated if foraging were restricted only to daylight.

Predation has a major influence on the dynamics of Northwest Atlantic mackerel (Overholtz *et al.* 1991b). In fact, predation mortality is probably the largest component of natural mortality on this stock, and based on model predictions, may be higher than previously thought (Overholtz *et al.* 1991b). Atlantic mackerel serve as prey for a wide variety of predators including other mackerel, dogfish, tunas, bonito, striped bass, Atlantic cod (small mackerel), and squid, which feed on fish <4-5.2 in (10 to 13 cm) in length (Collette in prep.). Pilot whales, common dolphins, harbor seals, porpoises and seabirds are also significant predators (Smith and Gaskin 1974; Payne and Selzer 1983; Overholtz and Waring 1991; Montevecchi and Myers 1995). Other predators include swordfish, bigeye thresher, thresher, shortfin mako, tiger shark, blue shark, spiny dogfish, dusky shark, king mackerel, thorny skate, silver hake, red hake, bluefish, pollock, white hake, goosefish and weakfish (Scott and Tibbo 1968; Maurer and Bowman 1975; Stillwell and Kohler 1982, 1985; Bowman and Michaels 1984).

4.1.3 *Illex illecebrosus*

4.1.3.1 Species Description and Distribution

Illex is distributed on the western north Atlantic from the Labrador Sea to Florida Straits (Roper *et al.* 1998). Until recently, *Illex illecebrosus* was believed to be distributed on both sides of the North Atlantic, as was once thought (Roper et al. 1998). This confusion seems to have been a result of misidentifications of the closely related species *I. coindetii* (which does seem to be distributed on both sides of the Atlantic), as *I. illecebrosus*. It is most abundant in the Newfoundland region, moderately abundant between Newfoundland and New Jersey (Wigley 1982), and is commercial exploited from Newfoundland to Cape Hatteras (Brodziak 1995c). There is overlap in the geographic distributions of *Illex* species in the northwest Atlantic Ocean *I. illecebrosus* and *I. oxygonius* (Roper and Mangold 1998; Roper *et al.* 1998). The species are morphologically similar and difficult to distinguish and identify.

Data from the NOAA/Canada DFO East Coast of North America Strategic Assessment Project indicate that during 1975-1994 *Illex* in the northwest Atlantic were distributed from Labrador to Cape Hatteras (Figure 20). The areas of highest abundance of the species are the southern edge of the Grand Bank, the Scotian Shelf, Georges Bank, and the Middle Atlantic Bight.

Illex are highly migratory, capable of long distance migrations of more than 1,000 miles (Brodziak 1995c). They undergo seasonal inshore-offshore migrations which may be related to temperature, food, or both (MAFMC 1995). They spend winters (January to March) in dense aggregations along the outer continental shelf and upper slope where water temperatures are relatively warm, 46-57 ^{o}F (8-14 ^{o}C). In the spring (April-May), when shelf waters begin warming, they migrate shoreward, and during summer and autumn are widespread throughout the entire New England and Middle Atlantic continental shelf (Wigley 1982). In late autumn they begin their return migration to the warmer, offshore waters at the edge of and beyond the continental shelf (MAFMC 1995), where spawning is believed to occur. The hypothetical migration path of *Illex* is summarized in Figure 21 (Black *et al.* 1987).

4.1.3.2 Status of the Stock

Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management (FMP) was developed to bring the FMP into compliance with the Sustainable Fisheries Act (SFA). The SFA, which reauthorized and amended the Magnuson-Stevens Act, made a number of changes to the existing National Standards, as well as to definitions and other provisions in the Magnuson-Stevens Act, that caused the Guidelines to be significantly revised. The most significant changes were made to National Standard 1, which imposed new requirements concerning definitions of overfishing in fishery management plans. The overfishing definition for *Illex* was revised in Amendment 8 to comply with the SFA as follows: overfishing for *Illex* will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{MSY} is exceeded. Annual quotas will be specified which correspond to a target fishing mortality rate of 75% of F_{MSY}. Maximum OY will be specified as the catch associated with a fishing mortality rate of F_{MSY}. In addition, the biomass target is specified to equal B_{MSY}. The minimum biomass threshold is specified as ½ B_{MSY}.

The most recent assessment of the *Illex* stock (SAW 29) concluded that the stock was not in an overfished condition and that overfishing was not occurring (NMFS 1999). However, due to a lack of adequate data, an the estimate of yield at F_{msy} was not updated in SAW 29. However, an upper bound on annual fishing mortality was computed for the US EEZ portion of the stock based on a model which incorporated weekly landings and relative fishing effort and mean squid weights during 1994-1998. These estimates of F were well below the biological reference points. Current absolute stock size is unknown and no stock projections were done in SAW 29 or since then.

4.1.3.3 Ecological relationships and stock characteristics

The age and growth of *Illex* has been well studied relative to other squid species, being one of the few for which the statolith ageing method has been validated (Dawe *et al.* 1985). Research on the age and growth of *Illex* based on counts of daily statolith growth increments indicates an annual life span (Dawe *et al.* 1985).

Illex is a semelparous, terminal spawner with a protracted spawning season.

There have been no direct observations of spawning in nature, but in speculation about the timing and location is based on squid size and timing of advanced male maturity stages (O'Dor and Dawe 1998), back-calculated hatch dates from aging studies, and the collection of hatchling (Hendrickson pers. comm). *Illex* spawning takes place in the deep waters of the continental slope during winter (MAFMC 1995). Spawning likely occurs throughout the year (O'Dor and Dawe 1998) with most intense spawning generally occurring from December to March (Lange and Sissenwine 1980), but this varies among years and locations. Between Cape Canaveral, Florida and Charleston, North Carolina, spawning occurs during December to January (Rowell *et al.* 1985a, MAFMC 1995), while off Newfoundland, spawning has been reported from January through June (Squires 1967).

The principal spawning area is believed to be south of Cape Hatteras over the Blake Plateau (Black *et al.* 1987, MAFMC 1995), but other spawning occurs between the Florida Peninsula and central New Jersey at depths down to 990 ft (300 m; Fedulov and Froerman 1980, MAFMC 1995). Spawning probably occurs in the northern part of the Gulf Stream/Slope Water frontal zone (Dawe and Beck 1985, O'Dor and Balch 1985, Rowell et al 1985a).

4.1.4 Atlantic butterfish

4.1.4.1 Species Description and Distribution

Atlantic butterfish, *Peprilus triacanthus*, are distributed along the Atlantic coast of North America from Newfoundland to Florida (Bigelow and Schroeder 1953), and are found in commercially exploitable concentrations from Southern New England south to Cape Hatteras (Murawski and Waring 1979). Butterfish north of Cape Hatteras exhibit migratory patterns typical of temperate fishes of the Mid-Atlantic Bight. During the winter months, butterfish are found in deep waters (ca. 200 m) along the edge of the continental shelf. During late spring and summer, butterfish move inshore and northward. Butterfish begin to move offshore again as northern inshore waters begin to cool (Murawski and Waring 1979).

Butterfish are partially recruited to the spawning stock by the end of their first year, and essentially all individuals are mature by age two (Hildebrand and Schroeder 1928; Murawski *et al*. 1978). Spawning occurs from May-July in near shore coastal waters, with chief egg production in June. Growth of butterfish is rapid with a maximum size of 30 cm being achieved in six years, however few fish are observed which are greater than 20 cm or three years of age (Murawski and Waring 1977).

4.1.4.2 Status of the Stock

SAW 17 (NMFS 1994a) offered the following management advice:

"Butterfish landings in recent years have been well below historical average yields. Japanese demand for butterfish has waned and this has had a negative impact on harvest levels. Butterfish landings are thus unlikely to increase unless market demand improves. If demand does improve, however, the stock in

its current condition may not be able to sustain landings in excess of the long term historical average (1965-1992) of 7,200 mt because of recent declines in abundance as indicated by survey indices."

"Historical information suggests that discarding of butterfish may be an important source of fishing-induced mortality. The SARC recommends that data be collected that would allow discard levels to be reliably estimated."

"Given that butterfish is a short-lived species, new approaches to the assessment and management of the stock are required. A more adaptive, real-time assessment/management system will be needed to maintain full exploitation of the stock while simultaneously ensuring that adequate spawning stock levels are achieved. This would involve both real-time evaluation of stock status and in-season catch level adjustments." No new assessment information is available.

4.1.4.3 Ecological relationships and stock characteristics

Butterfish spawning takes place chiefly during summer (June- August) in inshore waters generally less than 100' deep. The times and duration of spawning are closely associated with changes in surface water temperature. The minimum spawning temperature is approximately 60 ^{o}F. Peak egg production occurs in Chesapeake Bay in June and July, off Long Island and Block Island in late June and early July, in Narragansett Bay in June and July, and in Massachusetts Bay June to August (Grosslein and Azarovitz 1982).

Butterfish eggs, 0.027-0.031" in diameter, are pelagic, transparent, spherical, and contain a single oil globule. The egg membrane is thin and horny. Incubation at 65 ^{o}F takes less than 48 hours. Newly hatched larvae are 0.08" long and like most fish larvae are longer than they are deep. At 0.2" larval body depth has increased substantially in proportion to length, and at 0.6" the fins are well differentiated and the young fish takes on the general appearance of the adult. Larvae are found at the surface or in the shelter of the tentacles of large jelly fish (Grosslein and Azarovitz 1982).

Butterfish eggs are found throughout the New York Bight and on Georges Bank, and they occur in the Gulf of Maine, but larvae appear to be relatively scarce east and north of Nantucket Shoals. In 1973, from mid-June to early September, larvae were common in the plankton off Shoreham, NY. Post larvae and juveniles were common in plankton net samples taken in August in the vicinity of Little Egg Inlet, NJ. Juveniles 3-4" long have been taken in Rhode Island waters in late October (Grosslein and Azarovitz 1982).

Growth is fastest during the first year and decreases each year thereafter. Young of the year butterfish collected in October trawl surveys (at about 4 months old) average 4.8" long. Fish about 16 months old are 6.6", at about 28 months old fish are 6.8", and at 40 months old they are 7.8". Maximum age is reported as six years. More recent studies showed that the population was composed of four age groups ranging from young of the year to over age three (Grosslein and Azarovitz 1982). Some butterfish are sexually mature at age one, but all are sexually mature by age two (Grosslein and Azarovitz 1982).

4.2 Description of Habitat

4.2.1 Inventory of Environmental and Fisheries Data

According to 50 CFR part 600.815 (a)(2)(i)(A), an initial inventory of available environmental and fisheries data sources relevant to the managed species should be used in describing and identifying essential fish habitat (EFH).

In section 600.815 (a)(2)(i)(B) in order to identify EFH, basic information is needed on current and historic stock size, the geographic range of the managed species, the habitat requirements by life history stage, and the distribution and characteristics of those habitats.

Atlantic mackerel, *Scomber scombrus L.,* is a fast swimming, pelagic schooling species distributed in the Northwest Atlantic from the Gulf of St. Lawrence to Cape Lookout North Carolina (Sette 1943, 1950; Anderson 1976; MAFMC 1994). While there are two separate spawning contingents in the Northwest Atlantic, (Sette 1950), since 1975, all mackerel in this area have been assessed as a single unit stock (Anderson 1982) and are considered one stock for management purposes.

The long-finned squid, *Loligo pealei*, is a pelagic schooling species of the molluscan family Loliginidae. It is distributed in continental shelf and slope waters from Newfoundland to the Gulf of Venezuela, with commercial abundances occurring from southern Georges Bank to Cape Hatteras.

The short-finned squid, *Illex illecebrosus*, is a pelagic species of the family Ommastrephidae, the oceanic squids. *Illex* is distributed on the western north Atlantic from the Labrador Sea to Florida Straits (Roper *et al.* 1998). In the western Atlantic, it ranges from Greenland, Labrador and Newfoundland southward to Florida.

The Atlantic butterfish, *Peprilus triacanthus*, is a fast-growing, short-lived, pelagic fish that forms loose schools, often near the surface (Schreiber 1973, Dery 1988, Brodziak 1995a). Butterfish range from Newfoundland and the Gulf of St. Lawrence to the Atlantic and Gulf coasts of Florida, but they are most abundant from the Gulf of Maine to Cape Hatteras (Bigelow and Schroeder 1953, Haedrich 1967, Horn 1970a, Powell *et al*. 1972, Cooley 1978, Scott and Scott 1988, Brodziak 1995a, Klein-MacPhee, *in review*).

Climate, physiographic, and hydrographic differences separate the Atlantic ocean from the Gulf of Maine to Florida into two distinct areas, the New England-Middle Atlantic Area and the South Atlantic Area, with the natural division occurring at Cape Hatteras. These differences result in major zoogeographic faunal changes at Cape Hatteras (Briggs 1974). The New England region from Nantucket Shoals to the Gulf of Maine includes Georges Bank, one of the worlds most productive fishing grounds. The Gulf of Maine is a deep cold water basin, partially sealed off from the open Atlantic by Georges and Browns Banks, which fall off sharply into the continental shelf.

The New England-Middle Atlantic area is fairly uniform physically and is influenced by many large coastal rivers and estuarine areas including Chesapeake Bay, the largest estuary in the United States, Narragansett Bay, Long Island Sound, the Hudson River, Delaware Bay, and the nearly continuous band of estuaries behind the barrier beaches from southern Long Island to Virginia. The southern edge of the region includes the estuarine complex of Currituck, Albemarle, and Pamlico Sounds, a 2500 square mile system of large interconnecting sounds behind the Outer Banks of North Carolina (Freeman and Walford 1974 a-d, 1976 a and b).

The South Atlantic region is characterized by three long crescent shaped embayments, demarcated by four prominent points of land, Cape Hatteras, Cape Lookout, and Cape Fear in North Carolina, and Cape Romain in South Carolina. Low barrier islands occur along the coast south of Cape Hatteras with concomitant sounds that are only a mile or two wide. These barriers become a series of large irregularly shaped islands along the coast of Georgia and South Carolina separated from the mainland by one of the largest coastal salt-water marsh areas in the world. Similarly, a series of islands border the Atlantic coast of Florida. These barriers are separated in the north by broad estuaries which are usually deep and continuous with large coastal rivers, and in the south by narrow, shallow lagoons (Freeman and Walford 1976 b-d).

The continental shelf (characterized by water less than 650 ft in depth) extends seaward approximately 120 miles off Cape Cod, narrows gradually to 70 miles off New Jersey, and is 20 miles wide at Cape Hatteras. South of Cape Hatteras, the shelf widens to 80 miles near the Georgia-Florida border, narrows to 35 miles off Cape Canaveral, Florida and is 10 miles or less off the southeast coast of Florida and the Florida Keys. The shelf is at its narrowest, reaching seaward only 1.5 miles, off West Palm Beach, Florida.

Surface circulation is generally southwesterly on the continental shelf during all seasons of the year, although this may be interrupted by coastal indrafting and some reversal of flow at the northern and southern extremities of the area. There may be a shoreward component to this drift during the warm half of the year and an offshore component during the cold half. The direction of this drift, fundamentally the result of temperature-salinity distribution, is largely determined by the wind. A persistent bottom drift at speeds of tenths of nautical miles per day extends from beyond mid-shelf toward the coast and eventually into the estuaries.

Water temperatures range from less than 33 ^{o}F in the New York Bight in February to over 80 ^{o}F off Cape Hatteras in August. The vertical thermal gradient is minimized during winter. In late April to early May, a thermocline develops in shelf waters except over Nantucket Shoals where storm surges retard thermocline development. The thermocline persists through the summer until surface waters begin to cool in early autumn. By mid-November surface to bottom temperature along the shelf is nearly homogeneous.

Coastwide, an annual salinity cycle occurs as the result of freshwater stream flow and the intrusion of slope water from offshore. Water salinities nearshore average 32 ppt, increase to 34-35 ppt along the shelf edge, and

exceed 36.5 ppt along the main lines of the Gulf stream..

For a complete inventory of environmental and fisheries data that describes *Illex and Loligo* squid, butterfish and Atlantic mackerel habitat, see Section 2.2.1 of Amendment 8.

4.2.2 Habitat Requirements by Life History Stage

Amendment 8 also provided an extensive literature review and synthesis which provided detailed information on the life history and habitat requirements of Atlantic mackerel, *Loligo* and *Illex* squid and butterfish by life history stage. These reviews are summarized the abundance and distribution in relation to a number of abiotic factors for eggs, larvae, juveniles, and adults for each species. For more detailed information relative to habitat requirements by life history stage, see Section 2.2.1 of Amendment 8.

4.2.3 Description and Identification of Essential Fish Habitat

The following is a summary of the descriptions and identification of essential fish habitat for each species. A complete description and identification for *Illex and Loligo* squid, butterfish and Atlantic mackerel habitat is found in Section 2.2.2 of Amendment 8.

Atlantic mackerel

Eggs: Offshore, EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from Maine through Cape Hatteras, North Carolina in areas that comprise the highest 75% of the catch where Atlantic mackerel eggs were collected in MARMAP ichthyoplankton surveys. Inshore, EFH is the “mixing” and/or “seawater” portions of all the estuaries where Atlantic mackerel eggs are “common,” “abundant,” or “highly abundant” on the Atlantic coast, from Passamaquaddy Bay, Maine to James River, Virginia. Generally, Atlantic mackerel eggs are collected from shore to 50 ft and temperatures between 41 ^{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 Passamaquaddy Bay, Maine to James River, Virginia. Generally, Atlantic mackerel larvae are collected in depths between 33 ft and 425 ft and temperatures between 43 ^{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 Passamaquaddy Bay, Maine to James River, Virginia. Generally, juveniles 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 Passamaquaddy 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.

Loligo

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 used by NEFSC 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.

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 used by NEFSC and correspond roughly to the life history stages juveniles and adults, respectively. *Illex* pre-recruits are less than or equal to 10 cm and recruits are greater than 10 cm.

Butterfish

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

Larvae: Offshore, EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras, North Carolina areas that comprise the highest 75% of the catch where butterfish larvae were collected in the NEFSC trawl surveys. Inshore, EFH is the “mixing” and/or “seawater” portions of all the estuaries where butterfish larvae are “common,” “abundant,” or “highly abundant” on the Atlantic coast, from Passamaquaddy 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 Passamaquaddy 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 Passamaquaddy 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.

4.2.4 Fishing Activities that May Adversely Affect EFH

According to section 600.815 (a)(3), adverse effects from fishing may include physical, chemical, or biological alterations of the substrate, and loss of, or injury to, benthic organisms, prey species and their habitat, and other components of the ecosystem. FMPs must include management measures that minimize adverse effects on EFH from fishing, to the extent practicable, and identify conservation and enhancement measures. Councils must act to prevent, mitigate, or minimize any adverse effects from fishing, to the extent practicable, if there is evidence that a fishing practice is having an identifiable adverse effect on EFH.

The following is a summary of general impacts of mobile fishing gear from the report “Indirect Effects of Fishing” (Auster and Langton 1998).

The discussion of the wide range of effects of fishing on EFH is based on the definition of EFH within the Act and the technical guidance produced by NMFS to implement the Act. The Act defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." For the purpose of interpreting the definition (and for defining the scope of this report), "waters" is interpreted by NMFS as "aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate" and "substrate" is defined to include sediment, hard bottom, structures, and associated biological communities. These definitions provide substantial flexibility in defining EFH based on our knowledge of the different species, but also allows EFH to be interpreted within a broader ecosystem perspective. Disturbance has been defined as "any discrete event in time that disrupts ecosystem, community, or population structure and changes resources, substrate availability, or the physical environment" (Pickett and White 1985). From an ecological perspective, fishing with fixed mobile gear is the most widespread form of direct disturbance in marine systems below depths which are affected by storms (Watling and Norse 1997). Disturbance can be caused by many natural processes such as currents, predation, iceberg scour (Hall 1994). Human caused disturbance can result from activities such as harbor dredging and fishing with mobile gear. Disturbance can be gauged by both intensity (as a measure of the force of disturbance) and severity (as a measure of impact on the biotic community).

One of the most difficult aspects of estimating the extent of impacts on EFH is the lack of high resolution data on the distribution of fishing effort. Fishers are often resistant to reporting effort based on locations of individual tows or sets (for the obvious reason of divulging productive

locations to competitors and regulators). Effort data in many fisheries are apportioned to particular statistical areas for monitoring purposes. Using this type of data it, has been possible to obtain averages of effort, and subsequent extrapolations of area impacted, for larger regions.

Trawling effort in the Middle Atlantic Bight off the northeast U.S. was summarized by Churchill (1989). Trawled area estimates were extrapolated from fishing effort data in 30 minute latitude x 30 minute longitude grids. The range of effort was quite variable, but the percent area impacted in some blocks off southern New England was over 200% with one block reaching 413%. Estimating the spatial impact of fixed gears is even more problematic. For example, during 1996 there were 2,690,856 lobster traps fished in the state of Maine (Maine Department of Marine Resources unpublished data). These traps were hauled on average every 4.5 d, or 81.4 times $year^{-1}$. Assuming a 1 m^2 footprint for each trap, the area impacted was 219 km^2. If each trap was dragged across an area three times the footprint during set and recovery, the area impacted was 657 km^2. A lack of data on the extent of the area actually fished makes analysis of the impacts of fishing on EFH in those fisheries difficult.

Auster and Langton (1998) summarize and interpret the current scientific literature on fishing impacts as they relate to fish habitat. These studies are discussed within three broad subject areas: effects on structural components of habitat, effects on benthic community structure, and effects on ecosystem level processes. The interpretation is based on commonalities and differences between studies. Fishing gear types are discussed as general categories (e.g., trawls, dredges, fixed gear). The necessity for these generalizations is based on two over-riding issues: (1) many studies do not specify the exact type and configuration of fishing gear used, and (2) each study reports on a limited range of habitat types. However, their interpretation of the wide range of studies is based on the type and direction of impacts, not absolute levels of impacts. Auster and Langton (1998) do not address the issues of bycatch (Alverson *et al.* 1994), mortality of gear escapees (Chopin and Arimoto 1995), or ghost fishing gear (Jennings and Kaiser 1998, p. 11-12 and references therein), as these issues do not directly relate to fish habitat, and recent reviews have been published which address these subjects.

Impacts of fishing on fish habitat (Auster and Langton 1998) include the following:

1. Effects on structural components of habitat;

2. Effects on community structure; and

3. Effects of ecosystem processes.

4.2.5 Options for Managing Adverse Effects from Fishing

According to section 600.815 (a)(4), fishery management options may include, but are not limited to: (i) fishing equipment restrictions, (ii) time/area closures, and (iii) harvest limits.

According to section 600.815 (a)(3) Councils must act to prevent, mitigate, or minimize adverse effects from fishing, to the extent practicable, if there is evidence that a fishing practice is having an identifiable adverse effect on EFH. Evidence of various gear impacts on bottom in the Mid-Atlantic Region has been presented to the Council over the past several years. It is because of this anecdotal information that the Council is considering that all mobile gear coming into contact with the seafloor within Atlantic mackerel, *Loligo*, *Illex*, and butterfish EFH is characterized as having a potential impact on their EFH. However, the effort of these bottom tending gears is largely unquantified from data that are presently collected by the NEFSC, as summarized by Auster and Langton (1999) and therefore no management measures will be proposed at this time.

The requirement concerning gear impact management is to the extent practicable given the evidence that the fishing practice is having an identifiable adverse effect. The Council feels strongly that very little evidence was provided in the synthesis document of Auster and Langton (1998) relative to identifiable adverse effects to EFH in FMPs managed by this Council at this time. Fishing gear impacts along with the description and identification of EFH are frameworked management measures which can easily and readily be changed as more information becomes available. The Council's Habitat Monitoring Committee (section 2.2.8) will be meeting annually and can provide recommendations concerning gear impacts that NMFS and the Council can act on in the future. The Council feels it would be premature, given the lack of identifiable adverse effects of gear impacts to these managed species EFH, to propose gear management measures at this time. It is simply not practicable to impose unwarranted management measures that are unjustifiable. The Council will consider implementing management measures to protect EFH if and when adverse gear impacts are identified.

4.2.6 Identification of Non-Fishing Activities and Associated Conservation and Enhancement Recommendations

According to section 600.815 (a)(5), FMPs must identify activities that have the potential to adversely affect EFH quantity or quality, or both. Broad categories of activities which can adversely affect EFH include, but are not limited to: dredging, fill, excavation, mining, impoundment, discharge, water diversions, thermal additions, actions that contribute to non-point source pollution and sedimentation, introduction of potentially hazardous materials, introduction of exotic species, and the conversion of aquatic habitat that may eliminate, diminish, or disrupt the functions of EFH.

Estuarine and coastal lands and waters are used for many purposes that often result in conflicts for space and resources (USDC 1985a). Some may result in the absolute loss or long-term degradation of the general aquatic environment

or specific aquatic habitats, and pose theoretically significant, but as yet unquantified threats to biota and their associated habitats (USDC 1985a).

Multiple-use issues are constantly changing, as are the impacts of certain activities on living marine resources (USDC 1985a). Activities that occur on estuarine and coastal lands and waters and offshore waters may affect living marine resources directly and/or indirectly through habitat loss and/or modification. These effects, combined with cumulative effects from other activities in the ecosystem, may contribute to the decline of some species (USDC 1997a). The following discussion identifies and describes each multiple use issue and the potential threats associated with that issue. The adverse effects to marine organisms and their habitats resulting from any given threat are demonstrable, but usually not completely quantifiable. Environmental and socio-economic issues remain to be satisfactorily resolved with regard to impacts on marine organisms and their habitats.

The threats addressed in this section are germane to the entire Atlantic coast. All Mid-Atlantic Council managed species exist outside the geographic boundaries of Mid-Atlantic Council. Knowledgeable NMFS/Council individuals were asked to identify and prioritize non-fishing "perceived" threats. Once this list was complete, the resulting paper was distributed for review via mail, workshops, and conferences. The list is prioritized in regards to (1) perceived threats of habitat managers and others in the environmental community and (2) potential impact to Atlantic mackerel, *Loligo*, *Illex*, and butterfish habitat. Information from the ASMFC workshop (Stephan and Beidler 1997) for habitat managers, which included a broad spectrum of constituents, was also used to identify threats.

According to section 600.815 (a)(7), FMPs must describe options to avoid, minimize, or compensate for the adverse effects identified in the non-fishing threats section including cumulative impacts (section 2.2.5). The Councils are deeply concerned about the effects of marine and estuarine habitat degradation on fishery resources.

The MSFCMA provides for the conservation and management of living marine resources (which by definition includes habitat), principally within the EEZ, although there is concern for management throughout the range of the resource. Additionally, the MSFCMA provides [305(b)(3)(A)] that "Each Council may comment on, and make recommendations to the Secretary and any federal agency concerning, any activity authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by any federal or state agency that, in the view of the Council, may affect the habitat, including essential fish habitat, of a fishery resource under its authority." [305(b)(4)(B)] "Within 30 days after receiving a comment under subparagraph (A), a federal agency shall provide a detailed response in writing to the Council commenting under paragraph (3)."

The Councils have a responsibility under the MSFCMA to consider the impact of habitat degradation on Atlantic mackerel, *Loligo*, *Illex*, and butterfish. The following recommendations are made in light of that responsibility.

The goal of the Council is to preserve all available or potential natural habitat for Atlantic mackerel, *Loligo*, *Illex*, and butterfish by encouraging management of conflicting uses to assure access by the four species and maintenance of high water quality to protect these species migration, spawning, nursery, overwintering, and feeding areas. Non-water dependent actions should not be authorized in Atlantic mackerel, *Loligo*, *Illex*, and butterfish EFH, if they adversely affect that habitat. Those non-water dependent actions in adjacent upland areas, such as agriculture, should be managed to minimize detrimental effects. Water dependent activities that may adversely affect theses species EFH, should be designed using environmentally sound engineering and best management practices to avoid or minimize those impacts. Regardless, the least environmentally damaging alternatives available should be employed to reduce impacts, both individually and cumulatively to Atlantic mackerel, *Loligo*, *Illex*, and butterfish EFH. Finally, compensatory mitigation should be provided for all unavoidable impacts to these species EFH.

Also, in general, the EPA and States should review their water quality standards relative to Atlantic mackerel, *Loligo*, *Illex*, and butterfish EFH areas and make changes as needed in estuarine and coastal areas. The EPA should establish water quality standards for the EEZ sufficient to maintain edible Atlantic mackerel, *Loligo*, *Illex*, and butterfish. Finally, water quality standards in these species EFH should be enforced rigidly by state or local water quality management agencies, whose actions should be carefully monitored by the EPA. Where state or local management efforts (standards/enforcement) are deemed inadequate, EPA should take steps to assure improvement; if these efforts continue to be inadequate, EPA should assume authority, as necessary.

Specific recommendations for the conservation and enhancement of Atlantic mackerel, *Loligo*, *Illex*, and butterfish EFH are found in Section 2.2.5 of Amendment 8 which provides a detailed discussion of individual habitat threats.

4.2.7 Research and Information Needs

Section 600.815 (a)(10), states that each FMP should contain recommendations for research efforts that the Councils and NMFS view as necessary for carrying out their EFH management mandate. There are five sets of recommendations included in Section 2.2.7 of Amendment 8.

4.2.8 Review and Revision of EFH Components of FMP

A complete description of review and revision of EFH components of the FMP is found in Section 2.2.8 of Amendment 8. The following is a summary from Section 2.2.8 of Amendment 8.

Section 600.815 (a)(11), states that Councils and NMFS should periodically review the EFH components of FMPs, including an update of the fishing equipment assessment. Each EFH FMP amendment should include a provision

requiring review and update of EFH information and preparation of a revised FMP amendment if new information becomes available.

The Council will amend its FMPs at least every five years as called for in this section, but is also including a habitat framework adjustment provision that can be included in each FMP. Due to the very rapid time constraints of meeting the October-MSFMCA deadline mandated by Congress (with very limited additional funds), it was impossible to include much of the state survey data that will be available in the future, as well as, much of the unpublished literature on contaminants etc. It is important to understand that this EFH is a "work in progress" and that the process will evolve. This framework provision is envisioned to work along the existing framework provisions established for the New England Multispecies FMP by the NEFMC. A similar process is proposed in this FMP for other non-EFH management measures.

The FMP contains descriptions and identification of essential fish habitat, estimates of gear impacts on essential fish habitat, and contains recommendations that describe options to avoid, minimize, or compensate for the adverse effects and promote the conservation and enhancement of EFH. In some cases definitions, estimates, and recommendations are made in general terms because the specific content and concentrations of organic and inorganic compounds have not yet been compiled and/or specified by regulatory agencies. The purpose of this framework provision is to incorporate such specifics into the definitions, estimates, and recommendations as specifics are developed via existing data not available when the FMP was adopted. The framework provision is not to be used to add or delete the conservation and enhancement recommendations, but only to adjust designations of EFH (boundaries), habitat areas of particular concern, and revise gear management measures (such as degradable panels and lines).

The Council envisions creating a Habitat Monitoring Committee (HMC) made up of at least staff representatives from the NMFS Northeast Fisheries Science Center, the Northeast Regional Office Management and Habitat Sections, the Atlantic States Marine Fisheries Commission, and Chaired by the Council Executive Director or his/her designee. The HMC will meet at the call of the HMC Chair, to develop options for MAFMC consideration on any adjustment or elaboration of any FMP EFH definition or gear impacts of EFH recommendations necessary to achieve the habitat goals and objectives. Based on this review, the HMC will recommend specific measures to revise EFH definitions, revise gear specifications.

The MAFMC, through its Habitat Committee, will review the recommendations of the HMC and all of the options developed by the HMC and other relevant information, consider public comment, and develop a recommendation to meet the FMP’s habitat goals and objectives. If the MAFMC does not submit a recommendation that meets the FMP’s habitat goals and objectives and is consistent with other applicable law, the Regional Administrator may adopt by regulatory change any option developed by the HMC, unless rejected by the MAFMC or tabled by the MAFMC for additional consideration, provided the option meets the FMP’s habitat goals and objective and is consistent with other applicable law. The frameworked process for developing EFH and/or gear impacts will follow the same overall process as that for other non-EFH

management measures.

4.3 Description of the Human Environment

4.3.2 Description of Fishing Activities and Economic Environment

4.3.1.2 *Loligo*

United States fishermen have been landing squid along the Northeastern coast of the US since the 1880's (Kolator and Long 1978). The early domestic fishery utilized fish traps and otter trawls but was of relatively minor importance to the US fishery due to low market demand. The squid taken were used primarily for bait (Lux et al. 1974). However, squid have long been a popular foodfish in various foreign markets and therefore a target of the foreign fishing fleets throughout the world, including both coasts of North America (Okutani 1977). USSR vessels first reported incidental catches of squid off the Northeastern coast of the United States in 1964. Fishing effort directed at the squids began in 1968 by USSR and Japanese vessels. By 1972, Spain, Portugal and Poland had also entered the fishery. Reported foreign landings of *Loligo* increased from 2000 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. Initially, US regulations restricted foreign vessels fishing for squid (and other species) to certain areas and times (the so-called foreign fishing "windows"), primarily to reduce spatial conflicts with domestic fixed gear fishermen and minimize bycatch of non-target species. 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.

By 1982, foreign *Loligo* catches had again risen above 20,000 mt. At this time, US management of the squid resources focused on the Americanization of these fisheries. This process began with the development of joint ventures between US fishermen and foreign concerns. Domestic annual harvest (DAH) was increased from 7,000 mt in the 1982-83 fishing year to 22,000 mt for 1983-84. Foreign allocations were reduced from 20,350 mt during 1982-83 to 5,550 mt during 1983-84 (Lange 1985). The foreign catch of *Loligo* fell below 5,000 mt by 1986, to 2 mt in 1987 and finally to zero in 1990.

The development and expansion of the US squid fishery was slow to occur for several reasons. First, the domestic market demand for squid in the US has traditionally been limited to the bait market. Secondly, the US fishing industry lacked both the catching and processing technology necessary to exploit squid in offshore waters. In the late 19th and early 20th century, squid were taken primarily by pound nets. Even though bottom otter trawls eventually replaced pound nets as the primary gear used to capture squid during this century, the US industry did not develop the appropriate technology to catch and process squid in deep water until the 1980's.

The annual US domestic squid landings (including *Illex* landings) from Maine to North Carolina averaged roughly 2,000 mt from 1928-1967 (NMFS 1994a). During

the period 1965-1980, US *Loligo* landings ranged from roughly 1,000 mt in 1968 to 4,000 mt in 1980. The US *Loligo* fishery began to increase dramatically beginning in 1983 when reported landings exceeded 15,000 mt. Since the cessation of directed foreign fishing in 1987, the US domestic harvest of *Loligo* averaged 17,800 mt during 1987-1992. The ex-vessel value of US caught *Loligo* increased from 7.8 million dollars in 1983 to 23.3 million in 1992.

In 1992 *Loligo* landings totaled 18,172 mt, 99% of which was taken by otter trawls. Nearly half of the 1992 harvest (8,112 mt) was take from statistical area 616, while six statistical areas (616, 537, 613, 622, 612, and 526) accounted for 87% of the total landings. Seasonally, 81% of the 1992 *Loligo* landings occurred in winter and autumn (Jan-Apr and Oct-Dec)(NMFS 1994a). Total US *Loligo* landings were 22,469 mt in 1993 valued at $29.1 million ($0.59/lb; $762/mt). NMFS data for 1994 indicate that US *Loligo* landings were 22,577 mt valued at $31.9 million. Unpublished NMFS weighout data indicate that *Loligo* landings declined to 17,928 mt in 1995 (dockside value declined to $23.0 million) and increased slightly to 18,008 mt (dockside value of $23.1 million) in 1995. NMFS weighout data indicate that 1996 US *Loligo* landings decreased to 12,459 mt (valued at $18.6 million) and then increased to 16,203 mt in 1997 (valued at $26.5 million). The most recent assessment (NMFS 1999) indicated that landings of Loligo were 18,385 mt in 1998 valued at $32.2 million. Unpublished NMFS dealer data indicate that *Loligo* landings were 18,764 mt valued at $32.2 million in 1999. Unpublished preliminary Dealer Reports to NMFS indicate that *Loligo* landings were 16,561 mt in 2000 (110% of the adjusted annual quota).

4.3.1.3 Atlantic mackerel

4.3.1.3.1 Commercial Fishery

Atlantic mackerel have a long history of exploitation off the northeastern coast of the United States dating back to colonial times. American colonists of the 1600's considered mackerel one of their most important staple commodities (Hoy and Clark 1967). The principal commercial gear was the haul seine prior to 1800. Hook and line then became the primary gear until about 1850 when the purse seine was introduced and largely replaced the traditional hook and line method (Anderson and Paciorkowski 1978).

Formal record keeping for Atlantic mackerel in the US began in 1804. During 1804-1818, the US fishery was confined to near shore waters and annual landings averaged about 3,100 mt. Reported landings then increased sharply when the offshore salt mackerel fishery developed in 1818. As the market for salt mackerel grew, so did the fleet in both size and number of vessels. Within 20 years, more than 900 sailing vessels operated from US ports and landings subsequently reached a pre-1850 peak of 80,300 mt in 1831. Annual US landings averaged 41,700 mt from 1819 to 1885 but varied from 10,500 mt in 1840 to 81,300 in 1884. The Canadian mackerel fishery developed later than in the US, and although catch statistics were first reported in 1876, their fishery was probably significant since 1850. Combined US and Canadian landings peaked in 1889 at 106,000 mt, but declined sharply to 13,300 mt by 1889 (Anderson and Paciorkowski 1978).

Landings remained low during the period 1886-1924, averaging 18,100 mt per year (9,400 mt US, 11,700 mt Canadian). The fishery changed significantly during this period as vessels changed from sail to motor power and market demand shifted from salted to fresh mackerel. Average landings subsequently increased to 35,200 mt (23,500 mt US, 11,700 mt Canadian) for the period 1925-1949 with the highest level of 49,200 mt in 1944. Landings gradually declined during the next decade, falling to 6,100 mt in 1959 (Hoy and Clark 1967; Anderson and Paciorkowski 1978).

The modern northwest Atlantic mackerel fishery underwent dramatic change with the arrival of the European distant-water fleets (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,) peaked at 437,000 mt in 1973 and then declined sharply to 77,000 by 1977 (Overholtz 1989).

The Magnuson Act of 1976 established control of the portion of the mackerel fishery occurring in US waters (NAFO Subareas 5-6) under the auspices of the Mid-Atlantic Fishery Management Council. Reported foreign landings in US waters declined from an unregulated level of 385,000 mt in 1972 to less than 400 mt from 1978-1980 under Magnuson (the foreign mackerel fishery was restricted by NOAA Foreign Fishing regulations to certain areas or "windows"). Under the control of MAFMC mackerel FMP and subsequent amendments, foreign mackerel catches were permitted to increase gradually to 15,000 mt in 1984 and then to a peak of almost 43,000 mt in 1988.

Recent US management policy of no TALFF combined with political and economic changes in Eastern Europe resulted in a decline in foreign landings from 9,000 mt in 1991 to 0 in 1992 and 1993. US commercial landings of mackerel increased steadily from roughly 3000 mt in the early 1980's to greater than 31,000 mt in 1990. However, US mackerel landings declined to 12,418 mt in 1992 and 4,666 mt in 1993. NMFS weighout data indicate that US landings were 8,543 mt in 1994 and 8,442 mt in 1995. NMFS weighout data indicate that US Atlantic mackerel landings increased to 15,712 mt in 1996 (valued at $4.6 million) and then declined slightly to 15,406 mt in 1997 (valued at $9.5 million). NMFS weighout data indicate that US Atlantic mackerel landings were 12,509 mt in 1998 (valued at $4.7 million) and 12,405 mt (valued at $3.6 million) in 1999.

4.3.1.3.2 Recreational Fishery

The Atlantic mackerel is seasonally important to the recreational fisheries of the Mid-Atlantic and New England regions. They are available to recreational anglers in the Mid-Atlantic primarily during the spring migration. Historically, mackerel first appear off Virginia in March and gradually move northward. Christensen *et al.* 1979 found mackerel to be available to the recreational fishery from Delaware to New York for about three weeks (generally from early April to early May). As a result, the annual recreational catch of mackerel appears to be sensitive to changes in their migration and subsequent distribution pattern (Overholtz *et al.* 1989).

Since 1979, recreational mackerel landings have varied from 284 mt in 1992 to 4,032 mt in 1987. In recent years, recreational mackerel landings have increased steadily from 1,249 mt in 1995 to 1,736 mt in 1997. NMFS recreational fisheries data indicate that recreational mackerel landings declined to 690 mt in 1998. Recreational mackerel landings occur from Virginia to Maine, with highest catches from New Jersey to Massachusetts. New Jersey accounted for 37% of the recreational mackerel landings for the period 1979-1991, followed by Massachusetts (25%) with the remaining States landing roughly equal amounts of Atlantic mackerel.

4.3.1.4 *Illex illecebrosus*

As in the case of *Loligo*, *Illex* have been exploited by US fishermen since at least late 1800's, being used primarily as bait. From 1928 to 1967, reported annual US squid landings from Maine to North Carolina (including *Loligo pealei*) ranged from 500-2,000 mt (Lange and Sissenwine 1980). However, foreign fishing fleets became interested in exploitation of the neritic squid stocks of the Northwest Atlantic Ocean when the USSR first reported squid bycatches in the mid-1960's. 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 US waters averaged about 18,000 mt, while US fisherman averaged only slightly more than 1,100 mt per year. Foreign landings from 1983-1986 were part of the US joint venture fishery which ended in 1987 (NMFS 1994a). The domestic fishery for *Illex* increased steadily during the 1980's as foreign fishing was eliminated in the US EEZ. US landings first exceeded 10,000 mt in 1987 and ranged roughly from 11,000 mt in 1990 to 17,800 mt in 1992.

Because their geographical range extends well beyond the US EEZ, *Illex* are subject to heavy exploitation in waters outside of US jurisdiction. During the mid-1970's, a large directed fishery for *Illex* developed in NAFO subareas 2-4. 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 (NMFS 1994a).

In 1992, US *Illex* landings were a then record high 17,827 mt with an ex-vessel value of $9,700,000 (average price=$0.54 per kg/$0.25 per lb). Statistical area 622 accounted for 63% of the total harvest, while three areas (SA 622,626, and 632) accounted for 96% of the total in 1992. Temporally, 94% of the 1992 *Illex* landings were taken during June through October. Otter trawl gear accounted for virtually all (99.9%) of the 1992 landings (NMFS 1994a).

Illex landings reached 18,012 mt in 1993 and then rose slightly to a record high 18,344 mt in 1994. In 1993 prices fell to $473/mt but rose sharply in 1994 to $569/mt. NMFS weighout data indicate that Illex landings declined to 14,049 mt in 1995 (dockside value declined to $8.0 million). NMFS weighout data indicate that 1996 US *Illex* landings increased to 16,969 mt (valued at $9.7 million) and then declined to 13,632 mt (valued at $6.1 million) in 1997.

The most recent assessment (NMFS 1999) indicated that landings of *Illex* were 22,705 mt in 1998 valued at $9.2 million. *Illex* landings for the period 1994-1998 averaged 17,142 mt. Unpublished NMFS weighout data indicate that 7,361 mt of *Illex* valued at $3.9 million was landed in 1999.

4.3.1.5 Butterfish

Atlantic butterfish were landed exclusively by US fishermen from the late 1800's (when formal record keeping began) until 1962 (Murawski and Waring 1979). Reported landings averaged about 3,000 mt from 1920-1962 (Waring 1975). 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 the period 1965-1976, US Atlantic butterfish landings averaged 2,051 mt. From 1977-1987, average US landings doubled to 5,252 mt, a historical peak of slightly less than 12,000 mt landed in 1984. Since then US landings have declined sharply to an average of 2,500 mt since 1988. Recent reductions in Japanese demand for butterfish has probably had a negative effect on butterfish landings.

Butterfish landings totaled 2,700 mt in 1992. Almost half (45%) of the 1992 total came from southern New England waters (Statistical area 53). Two statistical areas, 53 and 61, accounted for over 75% of the 1992 total. About half of the landings occurred during January and February, the remainder being distributed throughout the rest of the year. Butterfish landings were 3,631 mt and 2,013 mt in 1994 and 1995 , respectively. NMFS weighout data indicate that US butterfish landings increased to 3,489 mt in 1996 (valued at $5.1 million) and then decreased to 2,797 mt (valued at $4.7 million) in 1997. NMFS weighout data indicate that butterfish landings were 1,964 mt in 1998 (valued at $2.5 million) and that butterfish landings increased to 2,116 mt in 1999 (valued at $2.7 million).

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4.3.2 Description of participants in Atlantic mackerel, squid and butterfish fisheries

According to unpublished NMFS permit file data, there were 2007 vessels with Atlantic mackerel permits in 1999. The distribution of these vessels by home port state is given in Table 1. Most of these vessels were from the states of Massachusetts (43.6%), New York (12.6%), Maine (10.9%), New Jersey (9.1%), Rhode Island (6.4%), Virginia (5.9%), New Hampshire (3.4%) and North Carolina (3.2%). In addition, there were 340 dealers which possessed Atlantic mackerel, squid and butterfish dealer permits in 1999. The distribution of these dealers is given by state in Table 2. Of the 340 vessels which possessed an Atlantic mackerel, squid and butterfish dealer permits in 1999, there were 115 dealers that reported buying Atlantic mackerel in1999 (Table 3).
Based on NMFS dealer reports, a total of 559 vessels landed 26.5 million pounds of Atlantic mackerel valued at $3.6 million in 1999 (Table 4). Most of the vessels which landed mackerel also possessed *Loligo*/butterfish moratorium permits and *Illex* permits (Table 5). There were 260 vessels which landed 0.8 million pounds of Atlantic mackerel which possessed incidental catch permits. The landings of Atlantic mackerel by port in 1999 are given in Table 6. Cape May, NJ accounted for the majority of mackerel landings in 1999 (74%) , followed by North Kingstown, RI (12.5%), Point Judith, RI (2.4%), and Chatham, MA (2.3%). No ports were dependent on Atlantic mackerel for more than 10% of the value of total fishery landings in 1999 (Table 7).

According to unpublished NMFS permit file data, there were 400 vessels with *Loligo*/butterfish moratorium permits in 1999. The distribution of these vessels by home port state is given in Table 8. Most of these vessels were from the states of Massachusetts (27.6%), New York (24.4%), Rhode Island (16.6%), New Jersey (14.1%), North Carolina (5.3%), and Virginia (4.8%). In addition, there were 340 dealers which possessed Atlantic mackerel, squid and butterfish dealer permits in 1999. The distribution of these dealers is given by state in Table 2. Of the 340 vessels which possessed an Atlantic mackerel,

squid and butterfish dealer permits in 1999, there were 137 dealers that reported buying *Loligo* in 1999 (Table 9). Most of these dealers were from the states of New York (29.2%), Massachusetts (24.8%), Rhode Island (18.2%), North Carolina (12.4%), New Jersey (8.0%), and Virginia (5.1%).

A total of 523 vessels landed 41.4 million pounds of *Loligo* valued at 32.2 million in 1999. Most of these landings were taken by vessels which possessed *Loligo*/Butterfish moratorium permits (Table 5). There were 224 vessels which landed 6.6 million pounds of *Loligo* in 1999 which possessed incidental catch permits. The landings of *Loligo* by port in 1999 are given in Table 10. Five ports accounted for the majority of *Loligo* landings in 1999: Point Judith, RI (36.6%), Cape May, NJ (12.9%), Montauk, NY (9.9%), Hampton Bay, NY (8.4%), and North Kingstown, RI (7.9%). There were numerous ports that were dependent on *Loligo* for more than 10% of the value of total fishery landings in 1999 (see Table 11).

According to unpublished NMFS permit file data, there were 77 vessels with *Illex* moratorium permits in 1999. The distribution of these vessels by home port state is given in Table 12. Most of these vessels were from the states of New Jersey (31.2%), New York (14.3%) Massachusetts (13.0%), Rhode Island (11.7%), and Virginia (10.4%). In addition, there were 340 dealers which possessed Atlantic mackerel, squid and butterfish dealer permits in 1999. The distribution of these dealers is given by state in Table 2. Of the 340 vessels which possessed an Atlantic mackerel, squid and butterfish dealer permits in 1999, there were 28 dealers that reported buying *Illex* in 1999 (Table 13). Most of these dealers were from the states of New Jersey (17.9%), North Carolina (17.9%), Massachusetts (17.9%), Rhode Island (14.3%), Virginia (10.7%), and New York (10.7%).

A total of 86 vessels landed 16.3 million pounds of *Illex* valued at $3.6 million in 1999. Virtually all of these landings were taken by vessels which possessed *Illex* moratorium permits (Table 5). There were 38 vessels which landed *Illex* in 1999 which possessed incidental catch permits. The landings of *Illex* by port in 1999 are given in Table 14. Three ports accounted for the majority of *Illex* landings in 1999: Cape May, NJ (43.2%), Point Judith, RI (33.4%), and North Kingstown, RI (20.8%). North Kingstown, RI (12.7%) was the only port dependent on *Illex* for more than 10% of the value of it’s total fishery landings in 1999 (Table 15).

As noted above, there were 400 vessels with *Loligo*/butterfish moratorium permits in 1999. The distribution of these vessels by home port state is given in Table 8. Most of these vessels were from the states of Massachusetts (27.6%), New York (24.4%), Rhode Island (16.6%), New Jersey (14.1%), North Carolina (5.3%), and Virginia (4.8%). In addition, there were 340 dealers which possessed Atlantic mackerel, squid and butterfish dealer permits in 1999. The distribution of these dealers is given by state in Table 2. Of the 340 vessels which possessed an Atlantic mackerel, squid and butterfish dealer permit in 1999, there were 128 dealers that reported buying butterfish in 1999 (Table 16). Most of these dealers were from the states of Massachusetts (23.4%), New York (22.7%), Rhode Island (18.8%), North Carolina (16.4%), New Jersey (8.6%), and Virginia (7.0%).

A total of 522 vessels landed 4.7 million pounds of butterfish valued at $2.7 million in 1999. Most of these landings were taken by vessels which possessed *Loligo*/butterfish moratorium permits (Table 5). There were 229 vessels which landed 0.5 million pounds of butterfish in 1999 which possessed incidental catch permits. The landings of butterfish by port in 1999 are given in Table 17. Five ports accounted for the majority of butterfish landings in 1999: Point Judith, RI (34.3%), North Kingstown, RI (21.7%), Cape May, NJ (9.6%), Montauk, NY (6.7%), and Hampton Bay, NY (5.3%). No ports were dependent on butterfish for more than 10% of the value of total fishery landings in 1999 (Table 18).

According to unpublished NMFS permit file data, there were 1598 vessels with squid/butterfish incidental catch permits in 1999. The distribution of these vessels by home port state is given in Table 19. Most of these vessels were from the states of Massachusetts (45.6%), New York (11.2%), New Jersey (8.9%), Virginia (6.7%), and Rhode Island. In addition, there were 522 vessels which possessed Atlantic mackerel, squid and butterfish party/charter permits in 1999 (Table 20).

4.3.3 Port and Community Description

In order to identify the ports important to fisheries managed by the Mid-Atlantic Council and to identify the fisheries relatively important to those ports, the Council retained Dr. Bonnie J. McCay of Rutgers University to prepare a background document (McCay *et al*. 1993). This research covered ports from Chatham, Massachusetts, to Wanchese, North Carolina. McCay *et al.*1993 and was largely based on two data sources, 1992 NMFS landing statistics and information about the ports obtained from interviews with key informants. The quality of the port descriptions, therefore, partially depends on the information supplied by the informants. More recently, McCay and Cierei (2000) provided updated port descriptions for the states from New York to North Carolina based on 1998 landings and personal interviews. The port descriptions that follow for Massachusetts to Connecticut were taken from McCay *et al*. 1993. The port descriptions for the states from New York to North Carolina were condensed from McCay and Cierei (2000). Since the port descriptions provided here are brief summaries of the material contained in McCay *et al*. (1993) and McCay and Cierei (2000), readers requiring more detailed information are encouraged to obtain the original reports.

For purposes of orientation, Barnstable County, MA includes all of Cape Cod, including the fishing port of Chatham. New Bedford is located in Bristol County, MA. The port of Newport is located in Newport County, RI. Galilee is located in Washington County, RI. Stonington is located in New London County, CT. Greenport, Shinnecock/Hampton Bays, and Montauk are located in Suffolk County, NY. Freeport is located in Nassau County, NY. Brooklyn is located in Kings County, NY. Ocean City is located in Worcester County, MD. Virginia has a system whereby certain cities exist apart from counties. Within the scope of this analysis, Hampton, Norfolk, Newport News and Virginia Beach all fall into this category. Wanchese is located in Dare County, NC.

Chatham, Massachusetts

The total landed value of fish in Chatham in 1992 was around $11 million. Groundfish and shellfish --bay scallops, quahogs, and mussels-- comprise the majority of the landed value for Chatham, accounting for over 80% of the landed value. *Loligo* accounted for 2.38% of landed value in 1992, harvested by pound-nets (65%) and fish pots (37%).

Atlantic mackerel accounted for 0.45%, caught by fish pots (77%), draggers (5%), and sink gill nets (4.6%). Pound nets and fish pots or traps accounted for only 4.6% of the total landed value of species in Chatham in 1992. However, *Loligo* accounted for 31% of the fish pot value and 86% of the pound net revenue. Atlantic mackerel accounted for 12% of the fish pot value and 3% of the pound net revenue. Butterfish accounted for 0.33% of the fish pot value and 0.20% of the pound net revenue.

New Bedford, Massachusetts

The squids, mackerel, and butterfish are not important to New Bedford. *Loligo* squid made up 0.05% of the total landed value for New Bedford in 1992. The other species covered by this FMP accounted for less than 0.01%.

Loligo is caught during the spring months of April and May by inshore boats in Nantucket Sound, and more boats are now fishing for *Loligo* offshore, reported a New Bedford port agent. Even into late fall, he said, boats are targeting squid offshore. New Bedford's *Loligo* fleet are those that summer flounder during the summer. They target squid during the spring and fall when they are not going for summer flounder. The port agent reported that some of the small boats offload at sea to freezer boats from Rhode Island.

Newport, Rhode Island

Within Newport, there are three commercial fishing packing and distributing businesses. One mainly deals with draggers, gillnetters, and some scallopers, and brings in a great deal of groundfish. Another is a lobster house, but they also handle the trappers. There is also a trap company located in Newport. Species caught in traps are discussed below. The dealer that handles mostly draggers packs and distributes the majority of species of important to this study. The trap company also deals with these species but not in as large of quantities.

Approximately 15 large draggers were tied up at the fish house that deals with draggers during a recent visit (1992) to Newport. The fish house owner, the local port agent, and fishermen spoken with on this day said that having 15 boats in port at the same time was unusual, and had to do with a storm moving through the area. Most of the boats that offload at the Newport fish house are not from Newport. They are from other ports such as New Bedford, various Long Island ports, Cape May, and Pt. Judith. These boats are going primarily for squid at the time of our visit, which was in December. This particular fish house owner does not own any of the boats that offload at his dock.

The fishermen who make up the crews in Newport are not necessarily from Newport, but some local people from the area do work on the boats. Some crew members come from Point Judith, New Jersey, New York, and New Bedford. Typically, the owners of the boats do not work the boats. Often the owners used to fish but do not anymore. As with almost all of the ports, crews are paid on the share system.

The total value of landings in Newport for 1992 was $14.5 million. Lobster ranked first, accounting for 44% of landed value. *Loligo* ranked sixth.

Other Washington County Communities, RI (including Quonset Point)

The value of the landings at Other Washington County communities including Quonset Point in 1992 was around $20 million.

Other Washington County including Quonset Point includes both traditional and innovative fisheries. Processing facilities for squid in the region have resulted in the dominance of both *Loligo* and *Illex* squid in terms of landed value, but lobster and bay quahogging and oystering remain important, as well as other inshore activities such as eel potting, trapping striped bass, and an unusual spear fishery for tautog (blackfish). There is some handlining for bluefin tuna and trolling for inshore species such as striped bass and summer flounder as well as yellowfin tuna.

Atlantic mackerel, butterfish, scup, summer flounder, and angler are among the top ten species landed by value, and they figure importantly in the catch of the otter trawl vessels. The gillnet fishery for cod and tautog includes a small amount of angler and Atlantic mackerel. The fish pots are predominantly for scup, but some black sea bass, summer flounder, bluefish, and *Loligo* squid are caught in them too.

Virtually all of the angler, butterfish, weakfish, Atlantic mackerel, and squid landed here are brought in by draggers.

A major fishing location in Washington County is located at Quonset Point, an abandoned Navy Base which houses several isolated industrial developments, including a major offloading facility for car imports. As for commercial fishing, Quonset Point is port to five factory trawlers, two of which are from Rhode Island and three from Portland, Maine. The five trawlers range in length from 117 ft. to 155 ft., and they can hold 4 to 5 hundred thousand lbs. of frozen product per trip. This contrasts with wet boats which have a 150,00 thousand lb. capacity. The Rhode Island boats are owned by the president of a service and sales facility located at Quonset Point. The other three boats are owned by a man from Portland, Maine.

The service and sales facility located at Quonset Point started out with one boat about seven to eight years ago. The two boats owned by the president of the facility at Quonset Point were built specifically as freezer boats. These boats take one to two week trips. The three boats from Maine are converted supply boats and they may stay out as long as thirty days on some trips.

On occasion, the freezer trawlers engage in joint ventures with American boats. The smaller boats will fish and offload onto the freezer boats. The freezer boats have also in the past participated in joint ventures with Russian, Dutch and Polish boats.

The freezer boats target *Loligo* squid, *Illex* squid, butterfish, mackerel, whiting and sometimes scup. They may target herring but not normally.

The *Illex* squid season lasts from June to October, and the freezer boats

average 12 day trips when they are working *Illex*. November to May is the *Loligo* season, and the trawlers average 30 days out while they are targeting *Loligo*. Mackerel is caught from December to April.

The freezer trawlers do not have any significant landings of butterfish. Butterfish is available year round, but they are only desirable from December to February because of their fat content.

The Quonset Point boats will fish from North Carolina up to the Canadian border although they rarely go that far north. They fish for *Illex* up to 600 ft (100 fathoms) off the coast of New Jersey. *Loligo* fishing is mostly done around Hudson Canyon and Block Canyon.

The fish is packaged on the boats in plastic bags and placed in aluminum trays. Fiberboard boxes are also used. The boxes hold approximately 27 to 28 pounds of fish and one boat can hold approximately 13,000 boxes, or 360,000 pounds of fish.

The freezer trawlers are at sea 280 days per year. October and May are the slow months. During this time, the crew works on boat maintenance and painting.

In 1992, the average cost of operating one of these boats for two years was $2,200,000, which covered fuel, maintenance, repairs and nets.

The Rhode Island boats have from 9 to 11 crew members plus a captain and all of these crew are from the local area. The service and sales facility at Quonset Point employs twenty-two persons apart from the crews. This number includes office personnel and `lumpers' who unload the boats.
Crew size increases during the *Loligo* squid season. During *Loligo* season the crew sorts the squid into six sizes and also sorts through the bycatch. *Illex* squid catches are much cleaner and do not require sorting through bycatch.

The crews are full-time workers and are paid on a share system. Individuals can make from $40,000 to $60,000 annually. Fuel costs comes off the top of the boat's catch. The boat takes about 52 or 58 percent and the crew takes about 42 or 48 percent. Food comes from the crew share.

Point Judith, RI

Point Judith is almost exclusively a fishing community, having a core group of fishermen who fish full-time. During the summers, the streets are filled with tourists coming or going on the Block Island ferry. Yet there is little for tourists to do in Point Judith. The town does not have the condominiums, shops, and hotels that other ports such as Chatham, Newport, and Montauk have. Only one hotel stands out in Point Judith, the Dutch Inn, which is circa 1960. The few restaurants, shops, and tourist venues, such as fudge shops, are enough to take care of the summer onslaught of ferry passengers and the year round working population centered around commercial fishing.

The total value of fish landed in Point Judith in 1992 was $36.5 million. The

top ten species by percent landed value in 1992 were lobster, *Loligo* squid (15%), angler, summer flounder, scup, butterfish (4%), winter flounder, yellowtail, and cod. Mackerel accounted for 1%.

Point Judith has a large fleet of trawlers, gillnetters, and lobster boats. While estimates vary, approximately 200 commercial boats dock in Point Judith, including 80 trawlers, 30 gillnetters, and 100 or so lobster boats.

One informant described Point Judith boats as diverse in their annual round and approach to the fisheries, as opposed to New Bedford boats which only go after groundfish. Point Judith boats which are not diverse are the freezer boats which only target fish for frozen markets -- the squids, butterfish, and mackerel. The diverse approach to fisheries combined with full-time experienced fishermen means the fishermen are fishing year round even if they may switch fisheries and boats during the year.

Stonington, Connecticut

The Long Island sound and its estuaries and rivers are the major foci of Connecticut fisheries. There is a small traditional haul seine fishery for alewives and other fishes (unspecified, for "industrial" uses). Dip-nets are used for blue crabs (and a few alewives). Drift gillnets are used for menhaden, bluefish, weakfish, black sea bass, alewife, Atlantic mackerel, and other species. There is a specialized drift gillnet fishery for American shad. Quahogs (hard clams) are very important, and over 70% of Connecticut's landed value comes from oysters cultivated in Long Island Sound. Second to oysters are lobsters, most of which are caught inshore in the sound. Third in value is a mixed species otter trawl fishery, most of which is based in the port of Stonington.

Stonington is the primary port in Connecticut. The main fishing fleet is out of Stonington. Stonington is the only off-shore port with a fleet consisting of trawlers, lobster boats, and ocean scallopers. People are mostly going for groundfish such as cod, haddock, and flounder.

Atlantic mackerel is seldom targeted because there is no market for it in Stonington. Atlantic mackerel accounts for 0.01% of the landed value of species and these are caught primarily by drift gillnets. One vessel specializes in *Loligo* squid. Other vessels will target squid when they appear in large numbers. *Illex* squid is seldom targeted because the market is limited since the *Illex* squid spoils rapidly. There is a market for butterfish but no vessel is specialized in catching it.

The major species of fish caught in Stonington are flounder, summer flounder, squid, whiting, and some codfish during the winter months. Over the past five years (1988-1993), the fishermen have caught an increasing number of monkfish. The three large scallop boats have landed the majority of the monkfish.

In the past, summer flounder was the most important species caught by fishermen in Stonington. However, squid is increasing in importance as a result of the summer flounder quotas. During the summer of 1993, one boat attempted to specialize in dogfish but he discontinued this.

Freeport, NY

According to NMFS weighout data (Tables NY-FP1, 2), Freeport and neighboring Point Lookout (included in the Freeport port code) are almost entirely dependent on otter trawl landings (over 89% poundage, 87% value), and the major species are loligo squid and silver hake, with smaller amounts of scup, weakfish, bluefish, butterfish, summer flounder, other flounders, Atlantic mackerel. Gill-nets are used for bluefish, angler, and other species, and there are small handline, pot, pound-net and bay shellfisheries associated with these ports.

Table NY-FP1: Landings by Gear, Freeport, NY, 1998

GEAR TYPE, Freeport, NY	Lbs. %	Value %
Common seine, haul seine	0.3%	0.1%
Gill net, sink, other	7.0%	6.1%
Handline, other	2.5%	3.8%
Pot/trap, lobster, insh nk	0.6%	2.8%
Pot/trap, lobster, offsh	0.0%	0.0%
Pots + traps, blue crab	0.0%	0.0%
Pots + traps, conch	0.0%	0.0%
Pots + traps, fish	0.1%	0.1%
Pound net, fish	0.2%	0.2%
Rakes, other	0.2%	0.0%
Tongs & grabs, clam	0.0%	0.0%
Trawl, otter, bottom, fish	89.3%	86.8%

Total landings, rounded 1998: 1,865,800 lbs
Total value, rounded 1998: $1,504,800 dollars
Note: 0.0 = >0.0% but <0.06%

Table NY-FP2: Landings by Major Species, Freeport, NY, 1998

Bluefish	4.6%	2.1%
Butterfish	2.8%	2.6%
Flounder, summer	2.8%	7.9%
Flounder, yellowtail	4.0%	2.3%
Hake, silver	27.4%	16.2%
Mackerel, atlantic	2.5%	0.8%
Scup	4.4%	8.8%
Squid (loligo)	37.3%	39.3%
Weakfish, squeteague	2.7%	2.8%
Lobster	0.6%	2.8%
Sea bass, black	0.8%	1.9%

Number of species: 62

Other species of MAFMC interest by percentage total value 1998: Tilefish (0.1), and Illex squid (0.0). Surf clams are also landed here but are reported as "Other New York."

Other Nassau County

Other Nassau County landings came to about 595,000 pounds, worth about 4 million dollars, in 1998. Over 93% of the landings were of hard clams (quahogs), soft clams, and oysters, taken in the rich "Oyster Bays" of this county. Gill nets, handlines, and lobster pots were also used for striped bass and other species.

Greenport and Mattituck, N.Y.

Although Greenport and Mattituck are very dissimilar ports, we combine landings information from them to protect confidentiality.

Otter trawl landings are by far the most important, over 95%, and the classic Mid-Atlantic complement of species is found, led by silver hake and loligo squid, but including butterfish, summer and winter flounder, scup, striped bass, angler, and other species. There is also pound-net fishing, haul-seining, gill-netting, handlining, pelagic longlining, lobster and conch pot fishing, and raking for clams and dredging for bay scallops. Tables NY-GP1, 2 provide weighout data for Greenport combined with nearby Mattituck.

Over 90% of the weighout landings attributed to Mattituck came from otter trawl fishing, and the full complement of Mid-Atlantic species were major landings (=>2% value in 1998: bluefish (25%), butterfish (12%), summer flounder (14.5%), scup (4.4%), dogfish 3.1%), lobster and striped bass were

also significant, among the 37 species landed. Total landings in 1998 were less than 275,000 pounds. But recall that "Other New York" includes lobster and other landings which probably came from places like Mattituck.

Table NY-GP1: Landings by Gear Type, Mattituck and Greenport, NY, 1998

GEAR TYPE	LBS %	VALUE %
Common seine, haul seine	0.0%	0.0%
Gill net, sink	1.5%	1.4%
Handline	1.1%	2.9%
Longline, pelagic	0.0%	0.1%
Pots + traps, conch	0.0%	0.0%
Pound net, fish	1.8%	3.0%
Trawl, otter, bottom,	95.6%	92.5%

Total landings, rounded 1998: 7,831,400 lbs
Total value, rounded 1998: $4,140,500 dollars
Note: Not including "Other New York" landings; here as elsewhere "0.0%" means more than 0 but less than 0.05%

Table NY-GP2: Landings by Major Species, Mattituck and Greenport, NY, 1998

MAJOR SPECIES >2%	LBS %	VALUE %
Bluefish	4.2%	3.1%
Butterfish	1.6%	1.9%
Flounder, summer	1.1%	5.1%
Flounder, winter	2.9%	1.2%
Hake, Red	2.3%	1.5%
Hake, silver	63.3%	46.1%
Scup	0.8%	2.6%
Squid (loligo)	21.6%	27.2%
Bass, striped	0.6%	3.0%

Number of species: 62

Other species of MAFMC interest by percentage value 1998: Atlantic Mackerel (0.1), Black Sea Bass (0.9), dogfish, other (0.1), Dogfish, Smooth (0.0),

Tilefish (0.3), and Illex Squid (0.0).

"Other Suffolk" and Amagansett, NY

The NMFS data are collected for the port of Amagansett and well as unspecified "Other Suffolk" fishing. "Other Suffolk" probably includes landings from the fishermen at Orient/Orient Point, Shelter and Fisher Islands, Southold, Cutchogue, and many other smaller places in Suffolk County on both the north and the south forks of eastern Long Island including Mount Sinai.

Bay clamming (for hard clams, or quahogs) is the major fishery, representing over 71% of the area's value in 1998. Lobstering is next, 14% of the value. Other important shellfisheries are for oysters, soft clams, horseshoe crabs, blue crabs, and green crabs. Harvesting bay scallops is an important fishery for all east end ports, but landings vary widely from one year to the next. There is tremendous diversity in gears used, bespeaking the mixed bay, sound, and ocean nature of these fisheries. They include handlines, longlines, harpoons, seines, otter trawls, gillnets, pound nets, pots for fish, eels, conch, crabs, and lobster, fyke-nets, cast nets, diving gear, crab and oyster dredges, shovels, rakes, tongs, patent tongs, and "by hand".

Montauk, NY

Montauk, the largest fishing port in New York, is situated near the eastern tip of the South Fork of Long Island. Otter-trawls and longlines are the principal gear-types, in terms of pounds landed and value (Table NY-M1). Loligo squid and silver hake are the two most important fin-fish caught in 1998, but tilefish also stand out, and swordfish and tuna landings are important as well. Montauk is the leading tilefish port in the U.S., but this fishery has declined greatly. For the past two years (1998-1999) some of the Montauk-based tilefish boats have been unloading their catches in Rhode Island. Nonetheless, tilefish accounted for 21% of the value of landings in this port in 1998 (Table NY-M2). The number of species landed at Montauk is staggering: 90. The methods used to harvest fish and shellfish are diverse, including pound nets or fish weirs, box traps, haul seines, and spears, along with the more usual pots, lines, and trawl nets.

Table NY-M1: Landings by Gear Type, Montauk, NY, 1998

GEAR TYPE	LBS %	VALUE %
Box trap	0.0%	0.0%
Common seine, haul	0.0%	0.0%
Gill net, sink	1.2%	1.3%
Handline, other	3.0%	6.6%
Longline, bottom	11.4%	20.9%
Longline, pelagic	3.1%	8.7%
Pot/trap, lobster, insh	0.4%	1.3%
Pot/trap, lobster,	0.1%	0.4%
Pots + traps, conch	0.0%	0.0%
Pots + traps, fish	0.1%	0.3%
Pound net, fish	0.6%	0.6%
Spears	0.0%	0.0%
Trawl, otter, bottom,	80.1%	59.9%

Total landings, rounded 1998: 12,035,700 lbs
Total value, rounded 12,108,800 dollars; 0.0% = <0.06 % rounded

Table NY-M2: Landings by Major Species, Montauk, NY, 1998

MAJOR SPECIES >2%	LBS %	VALUE %
Bass, striped		5.2%
Bluefish	2.1%	0.8%
Butterfish	3.2%	2.0%
Dogfish, nk	2.4%	0.4%
Flounder, summer	2.8%	6.9%
Flounder, winter	3.8%	5.1%
Hake, red	3.2%	1.1%
Hake, silver	31.2%	15.7%
Scup	1.8%	3.6%
Squid (loligo)	24.2%	19.8%
Swordfish	1.0%	3.4%
Tilefish	11.5%	21.2%

Number of species: 90

Other species of MAFMC interest by percentage 1998 value: Atlantic Mackerel (0.3), Black Sea Bass (1.3), Dogfish, NK (0.0), Smooth Dogfish (0.0), and Illex squid (0.0).

Shinnecock/Hampton Bays, NY

Shinnecock/Hampton Bays is second only to Montauk as a commercial fishing center in New York. The offshore fishing industry in this part of Long Island is concentrated to the west of Shinnecock Inlet, on a barrier island that is just to the south of Hampton Bays. "Shinnecock," as it is known, is part of the town of Southampton. There is a large county-owned dock that is run by the town, where most commercial boats tie-up. The pack-out facilities and their associated docks are on private land, including two private unloading docks and one belonging to the Shinnecock Fishermen's Cooperative. The rest of the land to the east and west of the inlet is a county park. The NMFS codes for this fishery are for Shinnecock and Hampton Bays. We have combined them for this analysis because both refer to the same place (bluefin tuna and other large pelagic landings are collected using the Shinnecock port code, the rest using Hampton Bays).

This is primarily a dragger fishing port, otter trawl landings making up 84% of the poundage and 74% of the value in 1998 (Tables NY-HB1,2). Silver hake (whiting) and Loligo squid made up over 70% of these landings; 66 other species were landed by draggers, including bluefish, butterfish, red hake, and summer flounder. Gill-nets are second in importance, accounting for 12% of the value of landings in 1998. They too had diverse landings, totalling 39

species, led by bluefish (31% of lbs.), angler (28%), and skates (23%).

"Table NY-HB1: Landings by Gear, Hampton Bays and Shinnecock, N.Y., 1998

GEAR TYPE:	LBS. %	VALUE %
Longline, Bottom	2.9	7.3
Handline	0.1	0.4
Longline, Pelagic	0.3	1.1
Otter Trawl, Bottom	84.3	74.2
Seines, Common and Haul	0.1	0.1
Gillnet, Sink	10.8	11.8
Pound Net, Fish	1.0	1.3
Pots/Traps, Fish	0.1	0.1
Pots/Traps, Eel	0.0	0.0
Pots/Traps, Conch	0.0	0.0
Pots/Traps, Lobster, Offshore	0.0	0.0
Pots/Traps, Lobster, Inshore	0.1	0.3
Shovels	0.0	0.1
By Hand	0.0	0.0
Rakes	0.0	0.0
Pots/Traps, Crab	0.0	0.0
Fyke-Net, Fish	0.0	0.0
Unknown	0.4	3.3

Total Landings by Weight, 1998: 13,143,401 lbs.
Total Landings by Value, 1998: $9,676,293

Table NY-HB2: Landings by Major Species, Shinnecock/Hampton Bays, NY, 1998

MAJOR SPECIES (>2%)	LBS. %	VALUE %
Angler	3.8	8.3
Bluefish	5.2	3.0
Winter Flounder	1.1	2.2
Summer Flounder	2.1	6.8
Yellowtail Flounder	0.9	2.0
Scup	1.5	3.4
Weakfish	2.5	2.1
Dogfish, NK	7.3	1.5
Skates	3.2	1.4
Tilefish	3.0	7.6
Silver Hake	37.5	23.1
Quahog	0.3	2.9
Loligo Squid	22.9	26.9

Total Number: 93

Other species of MAFMC interest, by percentage value, 1998: Butterfish (1.6), Atlantic Mackerel (0.3), Black Sea Bass (0.9), Smooth Dogfish (0.0), Spiny Dogfish (0.0), and Illex Squid (0.0).

Brooklyn

Commercial fish landings in New York City's boroughs have declined markedly over the years. Today landings in Brooklyn were reported in 1998 as less than 30,000 pounds, from otter-trawls (77%), sink gill nets (16%) and handlines. The principal species, out of 17 landed, were butterfish, bluefish, weakfish, and loligo squid. Sports fishing at Sheepshead Bay and other sites, have become more important than commercial fishing.

Columbia, Duchess, Queens, Greene, Rockland, Ulster, Westchester Counties

NMFS has "other" categories for counties where marine and estuarine fishes are landed. Those for Nassau and Suffolk are treated separately above. We lumped the others together; they largely represent estuarine and riverine fisheries. Most of these fisheries are the riverine ones for American shad (85% of pounds, 94% of value). Small amounts of menhaden, blue back herring, winter flounder, weakfish, scup and other species (totaling 10) were reported. The key gear types were drift and sink gill nets, both used for shad. Other gear types, with minor catches, were otter trawls, fyke nets, handlines, and fish pots/traps. The catches in 1998 were very small, totalling less than 200,000 lbs. or $230,000.

Belford, NJ

The fishing port of Belford is on a tidal creek leading out to Raritan Bay and the New York Bays. Its fishery is oriented both to the bay and to the Atlantic Ocean, which is reached by going out around Sandy Hook, a few miles from Belford. Belford and neighboring Port Monmouth were once a large industrial fishing and processing center for menhaden, but the menhaden factory closed in 1982. Menhaden are still caught with small purse-seine boats and pound-nets, primarily for the bait market, and in 1998 they accounted for over 2/3rd of the landings in Belford (Table NJ-B1) Today Belford's fisheries are small-scale and owner-operated; most of the finfish are handled through a fishermen's cooperative, which sells wholesale but also runs a small retail store and restaurant. Lobsters are sold in other ways, including through a local lobster pound. Otter trawl finfishing is the most important activity, accounting for 50% of the landed value in 1998 (Table NJ-B1). It is a multi-species fishery: 42 species were landed in 1998. Major species caught by otter trawlers landing in Belford, by landed value, were summer flounder, Loligo squid, silver hake, winter flounder, spiny dogfish and skates. Lobster pot fishing is third only to purse seining and dragging; it accounted for 17% of landed value in 1998.

In recent years surf clam and ocean quahog vessels have been offloading at Belford, but in 1998 they accounted for less than 4% of the landed value (in contrast to 1992, when ocean quahogs accounted for over 30% of landed value). Crab dredging, in Raritan Bay, is of equal value. The last of New Jersey's pound-nets are in Raritan and Sandy Hook Bays; they accounted for 3.9% of Belford's total landed value in 1998. Some of that was from menhaden but 27 other species were also landed from the pound-nets, notably bluefish, weakfish, summer flounder, and butterfish; small amounts of tuna, skates, shad, tautog. Other fishing techniques used include crab and fish pots, handlining, and diving.

Table NJ-B1: Landings by Gear Type, Belford, NJ, 1998

GEAR TYPE, BELFORD, NJ	Lbs. %	Value %
Diving Gear	0.0	0.0
Dredge, SCOQ	2.7	3.8
Dredge, Crab	2.3	6.1
Hand Line	0.0	0.1
Pots/Traps, Lobster, Offshore	2.0	17.1
Pots/Traps, Blue Crab	0.0	0.0
Pots/Traps, Fish	0.0	0.2
Pound Nets	3.8	3.9
Purse Seine, Menhaden	65.1	18.6
Trawl, Otter, Bottom, Fish	23.9	50.1
Unknown	0.0	0.1

Note: “0.0" means more than 0 but less than 0.05. The figures for landings from which these percentages are derived are not given because they are confidential.

Other Monmouth County Ports

Highlands (at the mouth of two large tidal rivers coming out into Sandy Hook Bay with access to the Atlantic Ocean) and Neptune (in combination with neighboring municipalities which surround the tidal basin known as Shark River) are primarily small lobstering ports, sequestered within summer resort communities. Data for these ports are confidential. Highlands is also the site of bay clam depuration plants, which serve baymen who clam under state permits in Raritan and Sandy Hook Bays and the Navesink River. A small amount of handlining for finfish and potting for rock crab supplements lobstering. Atlantic Highlands is a center for recreational charter and party boat fishing.

Crabbing constitutes most of the landings for the rest of Monmouth County. The winter dredge fishery for blue crabs in Raritan Bay and its tributaries is significant. Clamming is also important. It takes place in the Sandy Hook and Raritan Bays and tidal rivers and is largely dependent on a "depuration" process, located in Highlands, as well as some "relaying" of clams to cleaner waters in south Jersey. Crabbers and clammers, like those involved in other fisheries, live in and around Belford, Highlands, and various municipalities along the shore of Raritan Bay.

Point Pleasant, NJ

The commercial fisheries of Point Pleasant are third in New Jersey to those of the Cape May-Wildwood area and Atlantic City (Table NJ-1). The weigh-out data include some bayman fisheries (i.e. "by hand" and crab dredge gears), but this is primarily an ocean fishing port, with a long history involving ocean pound-nets and fisheries focusing on the offshore 'canyons' of the region. The fishing port is actually Point Pleasant Beach, a borough within the larger town of Point Pleasant. Like so many ports of the Mid-Atlantic region, it is inlet-dependent. Ocean-going fishers must pass through the often dangerous Manasquan Inlet, a challenge shared with the recreational fishing community including the party and charter boat businesses of Point Pleasant and neighboring Brielle. This is a highly developed coastal region. Currently there is a wholesale finfish packing dock at Point Pleasant, a fishermen's cooperative. Another dock is primarily used for offloading surf clams and ocean quahogs although finfish may be handled there as well.

The fisheries are very diverse, the classic situation in the Mid-Atlantic. Two stand out in terms of volume and value: otter trawls and gillnetting, the latter particularly important for spiny dogfish as well as bluefish, weakfish, and other species (Table NJ-PP1). But sea scallop dredging is very important, as are surf clamming/ocean quahogging and offshore lobstering. Landings by major species for Point Pleasant are confidential but one can generalize that the most valuable species, in 1998, was angler or monkfish, which was partly incident to the scallop fishery but also caught by specialized gill-netters both local and migrating from other ports in the northeast and mid-Atlantic. Sea scallops were next in terms of ex-vessel value in 1998, followed by Loligo squid, a major focus of the local dragger fishery in the last decade, summer flounder, also a traditional fishery of the area but sharply cut back by regulations; lobster; spiny dogfish (like monkfish, caught by gill-netters as well as other fishers), and silver hake, or whiting. Whiting was one of the mainstays of this fishery from the 1970s through the 1980s; its availability and abundance have since declined. In terms of pounds landed, menhaden (purse-seined) and surf clams and ocean quahogs were the leading species in 1998, having come to replace the traditional otter trawl finfish fishery in importance over the past decade. Table NJ-PP1 gives landings by gear type.

Table NJ-PP1: Landings by Gear Type, Point Pleasant, NJ, 1998

GEAR TYPE, POINT PLEASANT, NJ:	Lbs. %	Value %
By Hand	0.0	0.0
	0.0	0.0
Dredge, Sea Scallop	1.2	10.4
Dredge, SCOQ	51.4	49.9
Gill Net, Drift	1.0	0.7
Gill Net, Sink	11.0	13.5
Hand Line	0.1	0.1
Longline, Pelagic	0.1	0.2
Pots/Traps, Lobster Offshore	0.6	3.5
Pots/Traps, Fish	0.0	0.0
Purse Seine, Menhaden	20.9	3.7
Trawl, Otter, Bottom, Fish	13.6	17.7
Troll Line	0.0	0.0
Troll Line, Tuna	0.0	0.0
Unknown	0.2	0.3

Total Landings, rounded, 1998: 31,916,900 lbs.
Total Value, rounded, 1998: $16,715,400 dollars

Point Pleasant Beach, NJ

The town of Point Pleasant (pop. 18,177, 1990) is located at the mouth of the Manasquan Inlet at the northern border of Ocean County. The town's economy is geared toward the summer tourist and recreational business. However, it is more than a "beach town", and has a large resident population. It is close to a larger township, called Brick or Bricktown (pop. 66,473, 1990), and across the Manasquan River from Manasquan (5,369, 1990) and Brielle (4,406). The fisheries are concentrated in an area known as Point Pleasant Beach, along a sandy strip which includes restaurants, a fisherman's supply store, small marinas, charter and party boat docks, and two commercial fishing docks.

One of the Cape May seafood businesses has two fishing properties in Point Pleasant, one of which is now used for offloading and trucking surf clams and ocean quahogs. (Each of these docks had been used for finfish until about 10 years ago). From 6 to 10 boats land clams here, according to company personnel interviewed in Cape May. There are 15 crew at the docks and about 50 on the boats. There is also a new (2000) seafood processing plant, initially

shucking surf clams. One existed here two decades ago, part of the early surf clam industry.

A fishermen's cooperative owns two other properties, one for storing and working on gear and some dockage, the other including the coop's offices, gear storage, ice-making, packing house, and a retail store. The cooperative mostly depends on its fourteen or so members, who have older, wooden-hulled vessels, 45-65' in length. They are geared for bottom otter trawling in a mixed-species, diversified fishery. The vessels usually have a two or three man crew, including the captain, who are paid shares of the profits. They are all hired locally. Although there are families with several generations in the fisheries, in recent years crew members are not often related to the captain or owner. Some members of this cooperative and some crew members have been ethnic minorities (Spanish, Portuguese, Chinese, and others). A few women have crewed on these boats. The boats are all owner-operated. They tend to fish in areas of Hudson Canyon called "the Mudhole" or "the Gully." The Mudhole is closer and has a dredged channel, but poor landings, especially of silver hake ("whiting") have forced most to move north into the Gully, where silver hake seem to be more plentiful. The average trip to the Mudhole is one to three days, but for the Gully can last a week.

Most of the draggermen at the cooperative consider themselves loligo squid and whiting specialists, but different species are targeted at different times, depending on the conditions of the ocean, the market, and the preferences of the captain. Squid landings began to overtake silver hake landings in this fleet in 1992 and now account for over 50% of the landed value of Point Pleasant trawlers. At first it was a by-catch while silver hake fishing in the Gully. Now it is targeted by some of the captains. As one captain stated, "You can't help but target squid sometimes, there is so much out there." Squid is sold to local processors. The cooperative is at a disadvantage in marketing squid because members lack freezer boats or refrigerated sea water boats, and thus do not receive the same price that boats so equipped receive, particularly in Cape May.

Summer flounder has long been a mainstay of this fishery, especially in the Mudhole in September and October, as well as other times in New Jersey and New York waters. Because of sharp quota restrictions, it is now a derby-like fishery. It is marketed in the fresh fish markets of New York and Philadelphia, in local restaurants and fish stores, and in the coop's own retail store.

At one time a few trawlers targeted scup (also called porgies), partially because doing so took pressure off a supply-burdened whiting market. (There was also a significant offshore summer flounder fishery in the winter months, for a few boats). Today no vessels target scup but may encounter large schools in the winter. Marketing is similar. Spiny dogfish have emerged as a very important fishery for the draggers and even more so for a gill-net fleet, both local and visiting, which has grown in recent years. Gill-netters have used "runaround" nets for species such as bluefish, Spanish mackerel, little tuna, scup, and weakfish, although this gear did not appear in the 1998 NMFS data. They use drift and sink nets for dogfish, angler, bluefish, weakfish, and other species. Angler, or monkfish, are particularly important. In 1998

local fishermen using sink gill nets caught almost 17 million pounds of monkfish as well as over 8 million pounds of spiny dogfish.

Barnegat Light (Long Beach Island), NJ

The fishing port of Long Beach Island is mostly located in the small bayside municipality of Barnegat Light, on this long, densely-developed barrier island on the central New Jersey coast. The commercial fishery has been undergoing a transition from over 20 years of specializing in offshore, deep-water and distant-water longlining. That tradition remains in the importance of bottom and pelagic longline gear (18% of total landed value) and of species such as tilefish, swordfish, and tunas (including big eye, yellowtail, blackfin, and skipjack in 1998) (Table NJ-LBI). (Handlines are also used for big eye tuna as well as for bluefish and other species; troll lines for yellowfin tuna). However, the physical perils of the inlet has kept this a relatively small-boat longliner fleet, and natural and regulatory changes in the species sought have forced people to look for alternatives. An alternative developed over the past decade is sea scalloping and the attendant by-catch of angler. Another is for expansion of the species sought with bottom and pelagic longlines, including sharks and dogfish among others. In 1998 the pelagic longline gear of Long Beach Island caught fully 23 different species, and bottom gear caught 17 species.

Whether transitional adaptation or old stand-by, the gill-net fisheries of Long Beach Island are the most substantial, representing 76% of poundage and 45% of landed value in 1998 (Table NJ-LBI1). The number of species involved is equally impressive: 61 for the drift gill-nets, including mackerel, dogfish, flounders, tunas, weakfish, shad, sharks; 23 for the sink gill-nets. In contrast, otter trawl dragging is minor and only 10 species were landed. Spiny dogfish are a recent focus, representing over one-third of the total landings in 1998.

Table NJ-LBI1: Landings by Gear Type, Long Beach Island, NJ, 1998

GEAR TYPE: LONG BEACH ISLAND, NJ	LBS. (%)	VALUE (%)
Dredge, Sea Scallop	5.7	28.6
Gill Net, Drift	64.0	34.9
Gill Net, sink	11.8	9.8
Handline	0.1	0.1
Longline, Bottom	7.0	6.1
Longline, Pelagic	11.2	19.9
Rakes	0.0	0.2
Otter Trawl	0.2	0.3
Troll Line, Tuna	0.0	0.0
Unknown	0.0	0.0

Total Landings, rounded, 1998: 10,032,800 lbs.
Total Value, rounded, 1998: $10,194,400 dollars

Other Ocean County, NJ

Ocean County, New Jersey, covers a large region, ranging from Point Pleasant Beach in the north to Long Beach Island and beyond to the south. The "Other

Ocean" category encompasses the bayman fisheries in this region, which is made up of barrier islands and a large complex known as Barnegat Bay. It also includes some offshore fisheries from places other than Long Beach Island and Point Pleasant. The bayman fisheries are, as always, for blue crabs and for hard clams (quahogs). Pots are the major way blue crabs are caught; clams are caught with rakes, tongs and "By hand". Fyke nets are minor, for flounders and eels (they are increasingly restricted by regulation). NMFS 1998 weighout data on substantial longline and drift gill-net fisheries and on angler, scallop, tilefish, and bluefin tuna refer to offshore fisheries comparable to and probably associated with those of Long Beach Island.

Atlantic City and Other Atlantic County, N.J.

Atlantic City is better known for casino gambling and its boardwalk than for its status as a fishing port. The fishing port is on the backbay side of the city and is almost entirely given over to surf clam and ocean quahog dredge fishing (Table NJ-AC1). Atlantic City has long been a favored port for this fishery because of ready access to dense beds of clams off the central coast of New Jersey. Ocean quahogging has moved to more northern ports, especially New Bedford, Massachusetts, in recent years; it represented only 11% of the value of Atlantic City's landings in 1998. Other fisheries in Atlantic City are minor. Gears include sink gill-nets, and handlines, and bluefish, black sea bass, weakfish, jonah crab, lobster, and conch predominate.

Table NJ-AC1: Landings by Gear Type, Atlantic City, NJ, 1998

GEAR TYPE: ATLANTIC CITY, NJ	LBS. (%)	VALUE (%)
Dredge, SCOQ	99.9	99.7
Gill Net, Sink	0.0	0.0
Handline	0.0	0.0
Pots & Traps, Conch	0.0	0.0
Pots & Traps, Fish	0.1	0.2

Total Landings, rounded, 1998: 37,338,500 lbs.
Total Value, rounded, 1998: $17,867,000 dollars

Atlantic County, like the other coastal New Jersey counties, has numerous small-scale bay and estuary fisheries as well. By far the most important for this county is the hard clam (quahog) fishery (34% of the landings, 70% of the value for "other Atlantic" in 1998), using rakes, tongs, and "by hand" techniques such as treading. Some of this takes place through clam aquaculture. The other significant species is the blue crab, harvested with pots and dredges (50.5% landings, 25% value). Haul seines, fyke nets, gill nets, handlines, eel pots, and turtle traps are also used for white perch, menhaden, American shad, and many other bay and tidal river species.

Cape May, NJ

Cape May is New Jersey's largest commercial fishing port in terms of landings and value. When combined with neighboring Wildwood (the fishing port is often referred to as "Cape May/Wildwood"), its landings exceeded 93 million lbs., worth over $29 million in 1998.

Draggers, or vessels using bottom otter trawls, account for 69% of Cape May's landings and 70% of its value (Table NJ-CM1). Most are used for a wide variety of finfish species (56). Some are also used for scallops; Cape May has a long history of combined or alternating fin-fishing and scalloping. Squid is very important: In 1998 17% of Cape May's landed value came from Illex squid and another 22% from Loligo squid (Table NJ-CM2). Much of the squid is processed locally as is Atlantic mackerel, caught with draggers and midwater pair trawls. Summer flounder has been a major species but regulations have severely reduced catches (4% landed value in 1998). Scup is another dragger-caught species of historic importance in Cape May; in 1998 it represented 6% of landed value. Cape May is also the home of one of the very few vessels allowed to use purse seines for bluefin tuna in U.S. waters; this vessel lands its catch in Gloucester, MA. The only purse seine landings in Cape May in 1998 were for menhaden, using smaller vessels. Fishing for large pelagics is also done with longlines and troll lines.

Although sea scallop management measures have reduced opportunities for many Cape May fishermen, scalloping remains important. In addition to scalloping with otter trawls, scallop dredges are used, accounting for 15% of the total value of Cape May's landings in 1998. Angler (monkfish) are caught with scallop dredges as well as gill-nets, otter trawls, and scallop otter trawls (1.8% of landed value). Dogfish catches are now relatively small (0.3% of total landings in 1998).

Table NJ-CM1: Landings by Gear Type, Cape May, NJ, 1998

GEAR TYPE: CAPE MAY, NJ	LBS. (%)	VALUE (%)
Handline	0.0	0.0
Longline, Pelagic	0.0	0.3
Otter Trawl, Fish	68.9	61.9
Otter Trawl, Scallop	0.5	7.7
Troll Line, Tuna	0.0	0.0
Gill Net, Sink	0.2	0.5
Gill Net, Drift	0.1	0.1
Purse Seine, Other	0.0	0.0
Purse Seine, Menhaden	23.9	6.7
Dredge, Scallop	0.9	15.4
Menhaden Trawl	3.4	0.6
Pots & Traps, fish	0.1	0.7
Pots & Traps, Conch	0.1	0.4
Pots & Traps, Lobster Offshore	0.2	2.6
Dredge, Crab	0.1	0.3
Dredge, SCOQ	1.4	2.9
Unknown	0.0	0.0

Total Landings, rounded, 1998: 87,244,700 lbs.
Total Value, rounded, 1998: $25,757,200 dollars

Table NJ-CM2: Landings by Major Species, Cape May, NJ, 1998

MAJOR SPECIES: CAPE MAY, NJ	LBS. (%)	VALUE (%)
Atlantic Herring	2.9	1.0
Summer Flounder	0.9	3.9
Lobster	0.2	2.5
Atlantic Mackerel	20.9	8.2
Menhaden	24.1	6.8
Sea Scallop	1.1	21.9
Scup	1.7	6.1
Squid, Illex	34.1	16.9
Squid, Loligo	8.3	22.0
Surf Clam	1.4	2.9
Black Sea Bass	0.4	2.2

Number of Species: 69

Other species of MAFMC interest, by percentage of total value, 1998: Bluefish (0.2), Butterfish (0.5), Smooth dogfish (0.0), Spiny dogfish (0.1), Tilefish (0.0).

Wildwood, NJ

The fishing port of Wildwood is connected to a very popular tourist beach community. Resident and migratory draggers and clam boats are found in Wildwood. The largest landings come from surf clams and ocean quahogs, both harvested offshore with hydraulic dredges. A processing factory is in Wildwood. The otter trawl fleet accounts for 7% of Wildwood's landings, bringing in summer flounder, Loligo squid, butterfish, Atlantic croaker, black sea bass, weakfish, and other species (Table NJ-WW1). Wildwood also has a small pot fishery, including offshore lobster, conch, and fish pots (6% of value). The fish pots are used mainly for black sea bass. Gill-netting is done for weakfish, black sea bass, and other species. Wildwood also had some pelagic longline landings in 1998, notably swordfish and yellowfin tuna. Other species of Mid-Atlantic Fishery Management Council interest landed in 1998, in small quantities (less than 2% landed value) were bluefish, butterfish, Atlantic mackerel, scup, and dogfish.

Table NJ-WW1: Landings by Gear Type, Wildwood, NJ, 1998

GEAR TYPE: WILDWOOD, NJ	LBS. (%)	VALUE (%)
Crab Dredge	0.4	0.5
Surf Clam/Ocean Quahog Dredge	86.5	79.0
Gill Net, Drift	1.9	0.8
Gill Net, Sink	0.5	0.4
Handline	0.1	0.1
Longline, Pelagic	0.9	3.9
Pots & Traps, Offshore Lobster	0.8	1.7
Pots & Traps, Conch	0.5	2.0
Pots & Traps, Fish	1.1	2.8
Otter Trawl	7.2	8.6
Unknown	0.0	0.1

Total Landings, rounded, 1998: 6,193,40
Total Value, rounded, 1998: $3,492,900 dollars

Sea Isle City, NJ

Sea Isle City is north of Wildwood, one of the small fishing ports of the coast that is dependent on a dynamic and often problematic inlet for access to the sea. The fishery here is small. In 1998 fewer than 750,000 pounds, and $1.2 million dollars, were reported in the weighout data. There is a small offshore longliner fishery for tunas (mostly big eye, albacore and yellowfin) and swordfish. Otter trawl fishing includes spiny dogfish, skates, angler, and fluke but only 4% of the landed value. More significant are pot fisheries for offshore lobster (6% of value), conch (12%), and fish (12%, mostly black sea bass). Gill-netting represents 12% of the value, particularly for angler (monkfish). We did not visit Sea Isle City for this report but can report that it is primarily a summer beach town.

Other Cape May County

In the creeks and bays along the Atlantic coast of Cape May and around the cape to the Delaware Bay side are numerous small fisheries, coded as "other Cape May." These are the classic baymen or watermen fisheries, based on crustaceans and shellfish: blue crabs and hard clams dominate (66% and 23.5% of landed value, respectively). Horseshoe crabs are also harvested (12% of the 1998 poundage although only 1.6% of the value). There is a small gill-net fishery for species such as weakfish, American shad, and numerous other estuarine and anadromous species. Very small amounts of bluefish, butterfish, and summer flounder were landed in 1998. This fishery is very similar to and intertwined with the "Other Cumberland County" fishery discussed below.

Table NJ-OCM1: Landings by Gear Type, Other Cape May, 1998

GEAR TYPE: OTHER CAPE MAY, NJ	LBS. (%)	VALUE (%)
By Hand	17.9	23.6
By Hand, Oyster	0.1	0.8
Dredge, Crab	1.1	0.7
Gill Net, Drift	2.6	0.6
Gill Net, sink	0.0	0.0
Handline	0.5	0.5
Longline, Pelagic	0.3	0.3
Pots & Traps, Crab	74.8	65.3
Pots & Traps, Eel	2.2	4.0
Pots & Traps, Fish	0.0	0.0
Rakes	0.4	1.5

Total Landings, rounded, 1998: 1,190,800 lbs.
Total Value, rounded, 1998: $3,492,900 dollars

"Other Cumberland,"NJ

The two big fisheries for this region, the center of New Jersey's Delaware Bay fisheries, are for oysters and blue crabs (Tables NJ-CC1, CC2). 1998 was one of the few years in the past decade when oysters were harvested, due to problems with oyster diseases (there is no harvest in 2000 due to the disease ‘dermo’). Oysters were taken with dredges, and represented 48% of the landed value. Blue crabs are caught with dredges and pots, and represented 46% of the value in 1998. Both horseshoe crabs and menhaden are also taken in large quantities (4.8% and 11.6% of poundage, respectively), and are the focus of controversy in this area due to their alleged roles for migratory birds and as bait for other fishes.

Table NJ-CC1: Landings by Gear Type, Cumberland County, NJ, 1998

Cumberland County Landings by Gear Type	Percent Lbs.	Percent Value
Handline	0.9	0.6
Gill-net, Sink	2.6	0.9
Gill-net, Drift	5.3	1.4
Pots/Traps, Eels	0.8	1.3
By Hand	11.6	1.4
Dredge, Oyster	15.8	48.0
Dredge, Crab	2.4	1.5
Pots/Traps, Blue Crab	60.6	45.0

Total Landings, rounded, 1998: 4,444,900 lbs.
Total Value, rounded, 1998: $5,573,300

Table NJ-OCM2: Landings by Major Species, Pounds and Value, Other Cumberland County, NJ, 1998

Cumberland County, Major Species, 1998	Percent Lbs.	Percent Value
Menhaden	4.6	0.5
Weakfish	2.6	1.5
Blue Crab	62.9	46.4
Horseshoe Crab	11.6	1.4
Oysters	15.8	48

Total Species: 19, including MAFMC-managed Bluefish (0.0% value, 1998), Butterfish (0.0), and Summer Flounder (0.0).

Other New Jersey

Surprisingly, some commercial fishing is reported from the heavily urbanized, industrialized areas of northeastern New Jersey. There is a substantial amount of squid, both *Illex* and *Loligo*, as well as some summer flounder landed in (and trucked into) heavily urbanized Essex County, the site of a packing and processing company. Crab pot fishing is found with small landings in urbanized Bergen and Middlesex Counties. At the other side of the state, commercial fishing extends upbay and upriver from Cumberland County, into rural Salem and Hunterdon counties. Hunterdon is the site of one of the last of the river shad seine fisheries (and an annual shad festival). Salem is the home of small-scale waterman fisheries which involve gill-netting for shad, weakfish and other species, harvesting eels and snapper turtles.

Ocean City, MD (West Ocean City)

Ocean City, on the Atlantic Coast, is the only major port in Maryland engaged in the inshore and EEZ ocean fisheries. It accounts for 18.1% of the pounds landed and only 9.5% of the value landed in 1998 (Table MD1).

The major commercial fishing gears used for landings in Ocean City in 1998 (Table MD-OC1) were:
--gill-netting, heavily dependent on angler and spiny dogfish, but engaged in a very diversified fishery;
--surf clam and ocean quahogging, with small by-catches of angler and scallops;
--bottom dragging with otter trawls, a highly diversified fishery, with strong foci on summer flounder and loligo squid, but also landing 48 other species.

In terms of value, other gear types also emerge as important, namely fish traps and pelagic longlining. Traps are also used for lobster and conch.

Table MD-OC1: Landings by Gear Type, Ocean City, MD 1998

GEAR TYPE: OCEAN CITY, MD	*Lbs. %*	*Value %*
By hand	0.0	0.0
Dredge, SCOQ	56.3	55.8
Gill net, sink	28.1	13.7
Handline	0.0	0.0
Harpoon	0.0	0.0
Longline, pelagic	2.1	11.1
Pots, Lobster Offshore	0.1	0.7
Pots/Traps, Conch	0.9	1.4
Pots/Traps, Fish	2.9	7.4
Otter Trawl, Bottom, Fish	9.5	9.9
Unknown	0.0	0

Total Landings, rounded, 1998: 11,073,123 lbs. (of state total)
Total Value, rounded, 1998: $6,356,802 (of state total)

The major species caught commercially in Ocean City (Table MD-OC2), ranked by 1998 landed value, are:

-surf clams and ocean quahogs
--black sea bass caught mostly with fish traps but also gillnets and draggers;
--angler, caught primarily with sink gillnets but also by the draggers and the clam boats;
--spiny dogfish, caught primarily by the gillnet fleet and also by draggers.
--summer flounder, mostly a dragger fishery
--swordfish, among the species caught with pelagic longlines from this port (tunas are also caught, and big eye and yellowfin tuna each represented over 2% of the total landed value in 1998).

Other species of significance (using the criterion of at least 2% of poundage or value) are:

-- Atlantic croaker and Atlantic mackerel, each caught by draggers and gill-netters
-- striped bass, also caught by draggers and gill-netters
-- lobster, an offshore pot fishery.

Table MD-OC2: Major Species, Landed, Ocean City, MD, 1998

Major Species: Ocean City, MD	Lbs (%)	Value (%)
Dogfish, Spiny	21.6	5.6
Angler	3.8	6.0
Clam, Surf	**	**
Quahog, Ocean	**	**
Sea Bass, Black	2.8	7.1
Flounder, Summer	1.6	5.0
Swordfish	0.7	4.5
Tuna, Big Eye	0.5	2.7
Tuna, Yellowfin	0.5	2.3

Total Species Landed: 69

Note: ** indicates confidential data because fewer than 3 federally permitted dealers involved.
Other species landed of MAFMC relevance (by % value): Bluefish (0.3%), Butterfish (**), Atlantic Mackerel (0.5%), Scup (**), Tilefish (**), Loligo Squid (0.8%), Illex Squid (**).

Chesapeake Bay

Virtually all of the other fishing activity in Maryland centers on the Chesapeake Bay and its tributaries. It is based in numerous small and dispersed landing areas, and focuses on the classic bay fisheries with blue crabs and oysters taking the lead (Table MD-OM1). This is the home of the Chesapeake Bay "watermen." For all ports in Maryland excluding Ocean City, blue crabs represented 71.5% of the value and oysters 12.6% of the value. The only other sizeable fishery in 1998 was for striped bass (5.9% of the value), thanks to the recovery of that species after a long moratorium. True to the tradition of watermen and baymen in the Mid-Atlantic, the diversity of species caught is extremely high: 57 species, ranging from terrapin and snapper turtles, crappies, carp, bullheads, and alewives, to name a few of the brackish water and anadromous species, to soft clams, horseshoe crabs, eels, lobsters, sturgeons, sunfishes, and sharks.

Table MD-OM1: Major Species, Other Maryland Ports, 1998

MAJOR SPECIES (>2%): MARYLAND OTHER THAN OCEAN CITY	Lbs (%)	Value (%)
Bass, Striped	5.6	5.9
Crabs, Blue	61.6	71.5
Croaker, Atlantic	2.4	0.7
Menhaden	8.9	0.7
Oysters	4.9	12.6
Gizzard Shad	3.5	0.9
White Perch	2.9	1.5
Soft Clam	0.4	2.1

Catfish	4.7	1.6

Total Species Landed: 57
Total Landings, 1998: 50,094,300 lbs.
Total Value, 1998: $60,832,500

Species Relevant to MAFMC according to value in 1998: Bluefish (0.1%), Butterfish (0.0%), Summer Flounder (0.2%), Atlantic Mackerel (0.0%), Scup (0.0%), Black Sea Bass (0.0%, Smooth Dogfish (0.0%), Spiny Dogfish (0.0%).

Virginia Beach, VA/ Lynnhaven

Most of the commercial fishing activity in Virginia Beach occurs in the Lynhaven section, along Long Creek, which empties into Lynhaven Bay and eventually Chesapeake Bay.Two active federally permitted dealers in this port also operate as packing houses for two out-or-town dealers. In the past, there also was significant activity at Rudee Inlet on the Atlantic side of the city, but now there are only 3 or 4 commercial boats that work out of there.

The commercial fishery at Virginia Beach/Lynhaven is inlet-dependent and pressured by competition for waterfront from tourist-related development and recreational boaters and fishers. The major gear type used as reported to the NMFS is the sink gill-net, used to catch a large number of species including bluefish, striped bass, Atlantic croaker, summer flounder, shad, dogfish, weakfish and spot (Table VA-VB1). Drift and stake gill nets are also used, the latter for spiny dogfish and bluefish among other species. This is also a center of pot fishing, for blue crabs, eels, conchs (whelks) and fish. The fish catches were mainly black sea bass and tautog. Handlines accounted for 9% of the landed value in 1998, mostly from black sea bass and summer flounder catches, but also striped bass, tautog, tilefish, tunas, and others. Pound nets accounted for 3.3% of the value in 1998; species included striped bass, bluefish, butterfish, Atlantic croaker, summer flounder, Spanish mackerel, spot, and weakfish.

Table VA-VB1: Landings by Gear Type, Virginia Beach/Lynhaven, 1998

GEAR TYPE: VIRGINIA BEACH/LYNHAVEN	LBS. (%)	VALUE (%)
By Hand	0.0	0.0
Common Seine, Haul Seine	0.7	0.7
Dredge, conch	0.3	0.9
Dredge, Crab	0.8	1.0
Gill Net, Drift	1.3	1.0
Gill Net, Sink	70.1	43.3
Gill Net, Stake	0.2	0.1
Handline	2.0	9.2
Pots & Traps, Blue Crab	12.9	18.3
Pots & Traps, Conch	3.7	14.1
Pots & Traps, Eel	0.1	0.2
Pots & Traps, Fish	2.8	7.8
Pound Net	5.1	3.3

Tongs & Grabs, Clam, Patent	0.0	0.0

Total Landings, rounded, 1998: 7,812,000 lbs.
Total Value, rounded, 1998: $4,272,800 dollars

Note: "0.0" means some activity but less than .06%

By species blue crab represented the highest value (19%). Next was black sea bass, which comprised 16% of 1998 landed value, mostly from handlining and fish pots (Table VA-VB2). Gillnetting for dogfish is another very important fishery. Atlantic croaker and striped bass are significant catches from the gill-net, handline, and pound-net fisheries, as is spot. Channeled whelk, caught in conch pots, made up 11% of value. The total number of species, though, is as always in this region very large: 65.

Table VA-VB22: Landings by Major Species, Virginia Beach/Lynhaven, 1998

MAJOR SPECIES: VIRGINIA BEACH/LYNHAVEN	LBS. (%)	VALUE (%)
Striped Bass	4.4	11.0
Blue Crab	13.7	19.1
Atlantic Croaker	**	**
Spiny Dogfish	**	**
Black Sea Bass	4.2	15.6
Spot	14.1	8.8
Channeled Whelk	2.8	11.2
Conch	1.4	5.3
Other Fish, Industrial	2.2	0.3

Number of Species: 65

Note: ** indicates confidential data due to small number of businesses involved.

Other species of MAFMC interest by percentage value, 1998: Bluefish (0.7), Butterfish (0.7), Summer Flounder (0.3), Atlantic Mackerel (**), Scup (**), Dogfish, Other (0.3), Dogfish, Smooth (**), Tilefish (**), Loligo Squid (**).

Newport News, VA

Sea scalloping is the principal fishery of Newport News, accounting for 72% of landed value in 1998. Scallopers use both dredges and bottom otter trawls (Table VA-NN1). Another fishery is finfish dragging (8.2% of value, 24.5% of landings) for a large variety of species. Summer flounder, angler, and black sea bass are landed in significant quantities (Table VA-NN2). Small scale inshore and bay fisheries are part of the waterman complex. They include clamming (hard clams or quahogs) and oystering using dredges, patent tongs, tongs and rakes; drift and sink gill-netting; pot-fishing and dredging for crabs (blue crabs were 28% of landings, 7% of value) and oysters; pot fishing for conch and eels and seining.

Table VA-NN1: Landings by Gear Type, Newport News, VA, 1998

GEAR TYPES, NEWPORT NEWS	LBS. (%)	VALUE (%)
Common Seine, Haul Seine	0.0	0.0
Dredge, Clam	0.0	0.0
Dredge, Crab	1.4	0.4
Dredge, Oyster	0.0	0.0
Dredge, Sea Scallop	32.9	59.7
Gill Net, Drift	0.0	0.0
Gill Net, Sink	1.0	0.3
Handline	0.0	0.0
Pots/Traps, Blue Crab	26.4	7.1
Pots/Traps, Conch	0.0	0.0
Pots/Traps, Eel	0.1	0.0
Tongs/Grabs, Oyster	0.5	0.6
Tongs/Grabs, Clam	2.4	6.0
Otter Trawl, Bottom, Fish	26.4	10.3
Otter Trawl, Bottom, Other	0.0	0.0
Otter Trawl, Bottom, Scallop	8.7	15.5

Total Landings, rounded, 1998: 5,742,500 lbs.
Total Value, rounded, 1998: $15,945,700 dollars

Table VA-NN2: Landings by Major Species, Newport News, VA, 1998

MAJOR SPECIES: NEWPORT NEWS, VA	LBS. (%)	VALUE (%)
Crab, Blue	27.7	7.3
Flounder, Summer	19.8	8.6
Quahog	2.4	6.1
Scallop, Sea	34.4	72.1
Sea Bass, Black	2.4	0.9
Angler	7.0	3.0

Number of Species: 59

Other species of MAFMC interest, by percentage value 1998: Bluefish (0.2), Butterfish (0.0), Scup (0.0), Smooth Dogfish (0.0), Tilefish (0.0), Loligo Squid (0.4).

Norfolk, VA

The commercial fishery of Norfolk, VA today is actually typical of the more rural waterman communities. Only a few fish houses are left to buy from local fishers; other docks and wholesalers have closed down, and one wholesaler has changed to a retail store and restaurant. The fishery is a small inshore and bay fishery. Principal gears used are crab pots (55% of value), crab dredges (10%), clam patent tongs and rakes (4%), handlines (10%) and sink gill-nets (12%). Other gears are haul seines, conch dredges, and eel and fish pots.

Striped bass (10% of value) are caught with gill-nets, handlines and seines, as are Atlantic croaker (4% of value) and other estuarine and anadromous species. The small black sea bass fishery here (2.2% of value) is carried out with handlines, as is the summer flounder fishery (2.1%). Blue crabs make up two-thirds of the value of Norfolk's catch (64%); hard clams or quahogs account for 4%, and conch 4% as well.

Hampton and Seaford, VA

For purposes of discussing fishery landings and preserving confidentiality, we have combined weighout data for Hampton (within the Metropolitan Statistical Area depicted above) and Seaford (within York County, census and employment data for which are offered below). Gear-type data (Table VA-H1) show that sea-scalloping with dredges is the single-most important fishery by value; otter-trawl dragging for finfish is highest for poundage. Some draggers are also used for scalloping. Gill-netting, crab potting and dredging, seining, and tonging for clams are other techniques used in these two ports (Seaford is almost entirely devoted to scalloping, but scalloping is also important in Hampton).

Like Newport News, Hampton and Seaford are important sea scalloping ports near the mouth of Chesapeake Bay. Scallops accounted for 69% of landed value in 1998. In Hampton, a significant portion of the scallops are caught with otter trawls rather than scallop dredges. The sea scallop fleet of Seaford relies entirely on dredges and accounts for virtually all of the landings and landed value there. Besides scallops these dredge-equipped vessels caught large amounts of angler as well as a small amount of summer flounder.

Finfish dragging is also important in Hampton. Species diversity is extremely high. The otter trawl fleet of Hampton takes *Illex* and *Loligo* squid, black sea bass (a substantial amount is also caught with handlines); Atlantic mackerel; Atlantic croaker (a large portion was caught by haul seines as well as pound nets and sink gill nets); and angler (although most was landed by scallop dredges and scallop otter trawls). A small amount of pelagic longlining is also done from Hampton, for black tip, mako shortfin and thresher sharks and tuna (big eye, yellowfin, albacore)

The inshore and bay fisheries of Hampton include the pound-net and seine fisheries for Atlantic croaker, gill-netting and handlining, blue crabs, (caught with dredges, pots, and scrapes) and hard clams or quahogs (harvested with patent tongs and crabs). We have combined the weighout data for Hampton and Seaford to preserve the confidentiality of data for fisheries with few businesses involved. Species diversity in the landings at Hampton and Seaford is extremely high, 79 in 1998 (Table VA-H2). Fourteen had either poundage or value at or above 2% in 1998, led by sea scallops, summer flounder, Illex squid, Atlantic croaker, blue crab, and angler.

Table VA-H1: Landings by Gear Type, Hampton and Seaford, VA, 1998

GEAR TYPE: HAMPTON & SEAFORD	LBS (%)	VALUE (%)
Common Seine, Haul Seine	4.6	0.7
Dredge, Crab	1.6	0.8
Dredge, Scallop, Sea	16.6	57.2
Gill Net, Drift	0.7	0.2
Gill Net, Sink	8.2	2.1
Handline	0.3	0.2
Longline, Pelagic	0.1	0.1
Pots & Traps, Blue Crab	9.2	3.9
Pots & Traps, conch	0.0	0.0
Pots & Traps, Eel	0.0	0.0
Pots & Traps, fish	0.0	0.0
Scrapes	0.0	0.0
Tongs & Grabs, Clam, Patent	0.7	3.4
Otter Trawl, Bottom, Fish	53.5	16.5
Otter Trawl, Bottom, Scallop	4.4	14.7
Otter Trawl, Bottom, Shrimp	0.0	0.0
Pound Nets	0.0	0.0

Total Landings, rounded, 1998: 9,089,500 lbs.
Total Value, rounded, 1998: $13,311,000 dollars

Table VA-H2: Major Species Landed, Hampton and Seaford, VA, 1998

MAJOR SPECIES: HAMPTON & SEAFORD	LBS (%)	VALUE (%)
Angler	3.6	3.1
Crab, Blue	10.8	4.7
Croaker, Atlantic	13.2	2.1
Flounder, Summer	11.1	9.4
Mackerel, Atlantic	**	**
Scallop, Sea	17.3	68.8
Sea Bass, Black	2.9	2.6
Squid, Illex	**	**
Squid, Loligo	3.2	0.9
Other Fish, Industrial	2.1	0.1
Striped Bass	4.8	1.1
Herring, NK	**	**
Herring, Atlantic	**	**
Quahog	1.3	4.2

Number of Species: 79

Note: ** indicates confidential data due to small number of businesses involved.

Other species of MAFMC interest, by percentage value, 1998: Bluefish (0.4), Butterfish (0.1), Scup (0.1), Spiny Dogfish (0.0), Tilefish (0.0).

Northampton County, VA

Northampton County is at the southernmost tip of the Delmarva peninsula. Among its fishing ports are Oyster, inside the barrier islands of the Atlantic coast, and Cape Charles, at the entrance to the Chesapeake Bay, but most of the landings come from smaller sites coded as "Other Northampton" in NMFS weighout data. The fisheries are inshore and estuarine, dominated by blue crabs, Atlantic croaker, hard clams, and horseshoe crabs (Table VA-N2). Weakfish/squeteague and striped bass are among the 45 other species landed commercially in this area of Virginia.

Reflecting the importance of blue-crabs, the most important single gear-type is the blue crab pot (Table VA-N1). Pots are also used for conch, eel, and fish (the 1998 catches of the fish pots were Atlantic croaker and northern puffer, the latter a most unusual specialty). Dredges are used for hard clams, conch, horseshoe crabs, and blue crabs. Scrapes are used for crabs and eels; clams are harvested with patent tongs and "by hand."

Pound-nets are also important, both for crab and for fish. The fish pound nets catch Atlantic croakers, striped bass, summer flounder, weakfish and others, totaling 32 species. Otter trawl and "unknown" constitute the next largest gear types, totaling 8% of value; both were almost entirely horseshoe crab harvests in 1998. Gill-nets are used for a large variety of species; drift gill nets for 30 species, including striped bass, Atlantic croaker, and spot; sink gill nets for 25 species, including American shad and weakfish. The

NMFS dealer weighout data used for landings do not completely reflect the active, inshore fishery of Virginia, which is recorded by the State of Virginia. On the other hand, they do indicate the variety of techniques and fisheries.

Table VA-N1: Landings by Gear Type, Northampton County, VA, 1998

GEAR TYPE: NORTHAMPTON CO., VA	LBS (%)	VALUE (%)
By Hand	0.3	2.3
By Hand, Oyster	0.0	0.0
Common, Haul Seine	0.0	0.0
Dredge, Clam	0.3	3.4
Dredge, Conch	0.1	0.3
Dredge, Crab	6.4	7.9
Dredge, Other	0.3	0.1
Gill Net, Drift	6.1	4.9
Gill Net, Sink	4.7	4.4
Gill Net, Stake	0.1	0.1
Handline	0.2	0.4
Pots & Traps, Blue Crab	28.7	33.6
Pots & Traps, Conch	0.4	1.6
Pots & Traps, Eel	0.0	0.0
Pots & Traps, Fish	0.1	0.2
Pound Net, Crabs	0.2	0.6
Pound Net, Fish	24.0	14.7
Scrapes	0.0	0.1
Tongs & Grabs, Clam, Patent	0.0	0.3
Otter Trawl, Bottom, Fish	16.7	13.9
“Unknown” (Horseshoe Crab)	11.4	11.1

Total Landings, rounded, 1998: 8,468,400 lbs.
Total Value, rounded, 1998: $5,001,400 dollars

Note: "0.0" indicates some activity but less than 0.06%

Table VA-N2: Landings by Major Species, Northampton County, VA, 1998

MAJOR SPECIES: NORTHAMPTON CO., VA	LBS. (%)	VALUE (%)
Bass, Striped	1.3	3.1
Crab, Blue	34.9	41.2
Crab, Horseshoe	28.2	25.2
Croaker, Atlantic	21.4	13.1
Quahog	0.5	2.9
Spot	2.4	1.4
Conch	0.8	2.9
Clams, Bloodarc	0.2	2.9
Weakfish	5.1	2.5

Number of Species: 49

Other species of MAFMC interest, by percentage value 1998: Bluefish (0.6), Butterfi sh (0.1).

Accomack County and Chincoteague, VA

The visiting otter trawl fishery accounts for almost half of Chincoteague's 1998 landed value; summer flounder predominates in this fishery and is the leading species for landed value (39%). Like other Mid-Atlantic otter trawl fleets, this one is highly diverse, landing 19 species in 1998, led by summer flounder, black sea bass, and Loligo squid. There is a small drift gill-net fishery for striped bass, Atlantic croaker and other species and a large sink gill-net fishery (27% of Chincoteague's value), mainly for angler, but also spiny dogfish, Atlantic mackerel, and other species. Angler was almost as valuable as fluke in 1998. Some handlining and longlining for tunas and sharks takes place, and in1998 16% of the value came from fish pots, mainly black sea bass. Less than 5% of Chincoteague's fishing activity, in terms of value, came from clamming, crabbing and other estuarine and bay fisheries, which otherwise predominate in the Virginia and Maryland region.

Table VA-AC1 shows 1998 landings and value, broken down by percentage for gear type and major species, combining Chincoteague's landings with those of the many small waterman fisheries of Accomack County, as well as the port of Wachapreague. Seventy-two species were landed in 1998, primarily blue crabs. Crabs are caught with dredges, pots, scrapes, and trot-lines. There is also oystering and hard-clamming. Angler and summer flounder, mainly from Chincoteague's gill-net and otter trawl fisheries, account for 2.2% and 3.8% of the county's total value. Striped bass, Atlantic croaker, and conch are other important species.

The major gear types are crab pots (52.2% of value) and conch and fish pots (4.9%); crab scrapes and dredges. Also important are gillnets (19.8% of value); otter trawls; and "by hand" referring to treading, hand rakes, and other techniques used to harvest hard clams, oysters and horseshoe crabs.

Table VA-CH1: Landings by Gear Type, Accomack County, VA, 1998

GEAR TYPE: CHINCOTEAGUE & OTHER ACCOMACK CO, VA	LBS. %	VALUE %
By Hand	0.5	2.4
By Hand, Oyster	0.0	0.0
Dredge, clam	0.1	0.5
Gill Net, Drift	15.0	7.9
Gill Net, Sink	19.5	11.8
Gill Net, Stake	0.1	0.1
Handline	0.0	0.1
Longline Pelagic	0.0	0.0
Pots & Traps, Blue Crab	45.9	52.2
Pots & Traps, Conch	1.5	3.1
Pots & Traps, Fish	1.2	1.8
Rakes, Other	0.0	0.1
Trawl, Otter, Bottom, Fish	3.3	4.4
Cast Nets	0.1	0.1
Seines	0.7	0.3
Dredge, Conch	1.9	1.5
Dredge, Crab	4.4	4.3
Dredge, Oyster	0.1	0.3
Pots & Traps, Eel	0.0	0.0
Pound Net, Crab	0.1	0.3
Pound Net, Fish	3.2	0.8
Scrapes	2.1	7.3
Tongs & Grabs, Patent	0.1	0.7
Trot Line	0.1	0.1

Total Landings, rounded, 1998: 11,077,100 lbs.
Total Value, rounded, 1998: $8,485,000 dollars

Table VA-AC2: Landings by Major Species, Accomack County, VA, 1998

MAJOR SPECIES: ACCOMACK CO, VA	LBS. (%)	VALUE(%)
Crab, Blue	52.2	63.9
Flounder, Summer	2.4	3.8
Angler	**	**
Bass, Striped	1.5	2.7
Croaker, Atlantic	**	**
Dogfish, Spiny	**	**
Quahog	0.6	3.4
Horseshoe Crab	2.5	1.5
Conch	1.6	3.3
Menhaden	2.8	0.3
Spot	8.2	4.1

Number of Species: 72

Note: ** indicates confidential data due to the small number of businesses involved.

Other Species of MAFMC interest, by percentage value, 1998: Bluefish (0.5), Butterfish (0.1), Atlantic Mackerel (0.1), Scup (0.0), Black Sea Bass (1.7), Tilefish (**), Loligo Squid (**).

Carteret County, NC (includes fishing centers of Morehead City, Beaufort, Bettie, Harker's Island, Davis, Stacy, Sea Level, Atlantic, Cedar Island)

Carteret County has the largest fishery in terms of poundage and second largest in terms of value in North Carolina (Table NC1). Total 1998 landings were over 80 million lbs, but value was little more than 21 million lbs., largely due to the low value of species such as menhaden and thread herring caught by purse-seining. Other important fisheries were crab-potting, shrimp trawling, fluke trawling, hard-clamming, and the use of pound-nets, sink gill nets, longlines, and other gears for a large variety of finfishes (the total number of species landed was 69) (Tables NC-CC1, 2).

Table NC-CC1: Landings by Gear Type, Carteret County, North Carolina, 1998

GEAR TYPE	LBS. %	VALUE %
Beach seine	0.0%	0.0%
By hand	0.1%	2.0%
Cast net	0.1%	0.0%
Channel net	0.1%	0.5%
Clam dredge (hydraulic)	0.0%	0.7%
Clam trawl, kicking	0.1%	2.2%
Common seine	0.0%	0.0%
Crab pot	6.0%	13.4%
Crab trawl	0.6%	1.4%
Fish pot	0.0%	0.2%
Flounder trawl	2.4%	9.1%
Flynet	0.6%	0.7%
Gigs	0.0%	0.1%
Gill net (drift)	0.1%	0.1%
Gill net (runaround)	0.5%	1.1%
Gill net set (float)	0.4%	1.1%
Gill net set (sink)	3.7%	5.4%
Haul seine	1.7%	2.9%
Longline bottom	0.0%	0.1%
Longline surface	0.1%	0.9%
Other (including conf.)	78.7%	22.8%
Oyster dredge	0.0%	0.1%
Peeler pot	0.0%	0.1%
Pound net	1.0%	5.5%
Purse seine	0.0%	0.0%
Rakes bull	0.0%	0.5%
Rakes hand	0.2%	3.8%
Rod-n-reel	0.8%	5.0%
Scallop dredge (bay)	0.1%	1.1%
Scallop dredge (sea)	0.0%	0.0%
Scallop scoop	0.0%	0.0%
Scallop trawl	0.0%	0.0%

Shrimp trawl	2.4%	16.7%
Skimmer trawl	0.1%	1.1%
Swipe net	0.0%	0.0%
Tongs, hand	0.0%	0.8%
Trolling	0.1%	0.4%

Total landings, rounded, 1998: 80,417,400 lbs.

Table NC-CC2: Landings by Major Species, Carteret County, NC, 1998

MAJOR SPECIES >2%	LBS. %	VALUE %
Unclassified shrimp	1.9%	16.7%
Crabs, blue, hard	7.1%	15.4%
Croaker, atlantic	2.7%	3.0%
Flounders, fluke	2.0%	14.0%
Other (including conf.)	78.7%	22.8%
Spot	1.5%	2.4%
Weakfish (seatrout, grey)	1.6%	2.8%
Clam, hard (meats)	0.4%	9.2%
Groupers	0.2%	1.9%

Number of species: 69

Pamlico County, NC

Pamlico County (pop. 11,372, 1990) had impressive total landings in 1998 of over 10 million pounds, worth over 9 million dollars. Important fishing centers include Bayboro, Vandemere, Hobucken and Oriental. Fishing takes place in the sounds and tidal rivers as well as coastal marine waters. Crab-potting, shrimp trawling, and flounder trawling are the major fisheries. Blue crabs accounted for 62% of the value in 1998, shrimp 13%, and fluke 19%. Fluke were caught mainly in trawls ("flounder trawls") but also in crab pots, crab trawls, drift or runaround gill-nets, set gill nets (float and sink), haul seines, pound nets, shrimp trawls, and swipe nets. Like other Mid-Atlantic areas, this is a very diversified fishing region, 46 species being landed by 19 different techniques or gears (Tables NC-PC1, 2).

Table NC-PC1: Landings by Gear Type, Pamlico County, NC, 1998

GEAR TYPE	LBS. %	VALUE %
By hand	0.0%	0.0%
Crab pot	72.0%	57.2%
Crab trawl	7.3%	5.5%
Eel pot	0.0%	0.0%
Flounder trawl	8.5%	16.6%
Flynet	0.0%	0.0%
Gill net (drift)	0.0%	0.0%
Gill net (runaround)	2.7%	1.7%
Gill net set (float)	2.5%	3.2%
Gill net set (sink)	0.5%	0.4%

Haul seine	0.0%	0.0%
Other (including conf.)	1.1%	1.4%
Oyster dredge	0.1%	0.3%
Peeler pot	0.0%	0.0%
Pound net	0.0%	0.0%
Rod-n-reel	0.0%	0.0%
Scallop trawl	0.0%	0.3%
Shrimp trawl	5.3%	13.5%
Swipe net	0.0%	0.0%

Total landings, 1998, rounded: 10,502,300 lbs.
Total value, 1998, rounded: 9,271,800dollars

Table NC-PC2: Landings by Major Species, Pamlico County, NC, 1998

MAJOR SPECIES >2%	LBS. %	VALUE %
Unclassified shrimp	4.9%	13.1%
Crabs, blue, hard	78.5%	60.1%
Flounders, fluke	9.4%	19.3%
Mullets	3.0%	1.6%
Crabs, blue, peeler	0.9%	2.1%

Number of species: 46

Beaufort County, NC

Beaufort County (pop. 42,283, 1990) is an important fishing county, accounting for over 10 million lbs. and 8 million dollars in 1998 (Tables NC-BC1,2). Bellhaven is the principal fishing port. Blue crabs, caught with pots, trawls, trotlines, and other methods, comprise almost all of the landings and value. Fluke made up over 3% of the value. Shrimp is also important although not shown below because of confidentiality.

Table NC-BC1: Landings by Gear-Type, Beaufort County, NC, 1998

GEAR TYPE	LBS. %	VALUE %
Crab pot	85.6%	82.9%
Crab trawl	10.0%	10.0%
Eel pot	0.1%	0.2%
Fish pot	0.0%	0.0%
Flounder trawl	0.0%	0.0%
Fyke net	0.0%	0.0%
Gigs	0.0%	0.0%
Gill net (runaround)	0.0%	0.0%
Gill net set (float)	1.4%	1.1%
Gill net set (sink)	1.2%	1.9%
Other (including conf.)	1.5%	3.7%
Oyster dredge	0.0%	0.0%
Peeler pot	0.0%	0.0%
Pound net	0.0%	0.0%
Rod-n-reel	0.0%	0.0%
Shrimp trawl	0.1%	0.1%
Trolling	0.0%	0.0%
Trotline	0.0%	0.0%

Total landings, rounded, 1998: 10,147,000 lbs.
Total value, rounded,1998: 8,035,100 dollars

Table NC-BC2: Landings by Major Species, Beaufort County, NC, 1998

MAJOR SPECIES >2%	LBS. %	VALUE %
Crabs, blue, hard	94.4%	89.8%
Flounders, fluke	1.4%	3.1%
Other (including conf.)	1.5%	3.7%

Number of species: 38

Hyde County, NC

Hyde County (pop. 5,411 in 1990) although small in population (reportedly there is only one traffic light in the county) is the third largest fishing county of North Carolina, with total landings over 16 million lbs. and value over 10 million dollars in 1998 (Tables NC-HC1,2). Fishing centers include Swan Quarter, Engelhard and Ocracoke. Blue crabs and fluke are the two most important species in terms of value; dogfish, and Atlantic croaker are also significant, and 56 other species are caught. Gears used are the full array of estuarine and inshore techniques, particularly crab pots and trawls, sink and float set gill nets, shrimp trawls, pound nets, and flounder trawls.

Table NC-HC1: Landings by Gear Type, Hyde County, NC, 1998

GEAR TYPE	LBS. %	VALUE %
By hand	0.0%	0.0%
Cast net	0.0%	0.0%
Crab pot	63.0%	58.4%
Crab trawl	4.4%	3.8%
Fish pot	0.0%	0.0%
Flounders trawl	1.9%	5.0%
Fly net	0.3%	0.6%
Gill net (runaround)	0.4%	0.3%
Gill net set (float)	2.2%	2.9%
Gill net set (sink)	17.8%	12.5%
Haul seine	0.0%	0.0%
Longline bottom	0.0%	0.0%
Longline shark	0.0%	0.0%
Other (including conf.)	5.7%	3.2%
Oyster dredge	0.1%	0.9%
Peeler pot	0.0%	0.0%
Pound net	1.5%	3.6%
Rakes bull	0.0%	0.0%
Rakes hand	0.0%	0.0%
Rod-n-reel	0.0%	0.0%
Shrimp trawl	2.5%	8.5%
Swipe net	0.0%	0.0%
Tongs, hand	0.0%	0.0%
Trolling	0.2%	0.4%

Total landings, rounded, 1998: 16,079,800 lbs.
Total value, rounded,1998: 10,921,600 dollars

Table NC-HC2: Landings by Major Species, Hyde County, NC, 1998

MAJOR SPECIES >2%	LBS. %	VALUE %
Unclassified shrimp	2.3%	8.2%
Crabs, blue, hard	66.2%	58.5%
Croaker, Atlantic	8.3%	4.1%
Flounder, fluke	5.9%	16.0%
Other (including conf.)	5.7%	3.2%
Sharks, dogfish	3.8%	0.8%

Number of species: 62

Dare County, NC

Dare County (pop. 22,746, 1990) saw over 36.6 million pounds and 23.5 million dollars from fish and shellfish (and turtle) landings in 1998, the second highest county in the state in terms of pounds and first in terms of dollars

(Tables NC-DC1,2). Fishing centers include Wanchese, Hatteras, and Mann's Harbor. Fluke (15%) was second to crabs (40%) in terms of value, but a much wider range of products were significant than in other North Carolina counties, because of the importance of ocean as well as estuarine fisheries. These included bluefish, dogfish, squid, weakfish, anglerfish, king mackerel, sharks, and tuna. The fisheries range from estuarine fisheries (crab-pots, pound-nets, turtle pots, fyke nets, etc.) to offshore longlining.

Table NC-DC1: Landings by Gear Type, Dare County, NC, 1998

GEAR TYPE	LBS. %	VALUE %
Beach seine	1.5%	1.3%
By hand	0.0%	0.0%
Cast net	0.1%	0.0%
Crab pot	30.6%	33.0%
Crab trawl	0.6%	0.5%
Eel pot	0.0%	0.1%
Fish pot	0.1%	0.2%
Flounder trawl	3.3%	7.5%
Flynet	13.2%	7.7%
Fyke net	0.0%	0.0%
Gigs	0.0%	0.0%
Gill net (runaround)	1.0%	1.0%
Gill net set (float)	0.7%	0.8%
Gill net set (sink)	36.4%	22.5%
Haul seine	0.7%	0.5%
Longline bottom	0.0%	0.0%
Longline shark	1.5%	0.8%
Longline surface	2.7%	5.8%
Other (including conf.)	0.6%	0.4%
Oyster dredge	0.0%	0.0%
Peeler pot	1.1%	5.6%
Pound net	2.1%	3.4%
Rakes bull	0.0%	0.0%
Rakes hand	0.0%	0.0%
Rod-n-reel	0.6%	1.4%
Shrimp trawl	0.4%	1.2%
Trolling	2.8%	6.1%
Turtle pot	0.0%	0.0%

Total landings, rounded, 1998: 36,625,800 lbs.
Total value, rounded, 1998: 23,511,500 dollars

Table NC-DC2: Landings by Major Species, Dare County, NC, 1998

MAJOR SPECIES >2%	LBS. %	VALUE %
Anglerfish (goosefish)	1.8%	1.9%
Bluefish	6.4%	2.6%
Crabs, blue, hard	30.1%	27.8%
Croaker, atlantic	18.9%	9.4%
Flounders, fluke	5.2%	15.0%
Mackerel, king	2.0%	4.7%
Sharks	2.7%	1.4%
Sharks, dogfish	10.9%	2.3%
Squid	2.4%	2.0%
Tuna	2.6%	5.2%
Weakfish (seatrout, grey)	4.7%	3.9%
Crabs, blue peeler	0.7%	2.2%
Crabs, blue, soft	1.6%	9.2%

Number of species: 69

Other North Carolina Counties:

Commercial fishing is important in many other North Carolina counties as well. Following are profiles of counties for which landings were reported in 1998, in rough geographical order, from southwest to northeast. Counties where landings were very small in 1998 are signified by full indentations and italics. Population figures for 1997 are from Diaby (1999:35), based on the July 1997 estimate from the Office of State Planning, Office of the Governor. Estimates of fishing income were derived from various sources described in Diaby (1999: 35).

Brunswick, Pender, and related Inland Counties

Brunswick County (pop. 65,200, 1997), at the southwestern end of the coast, has a diversified estuarine and inshore fishery, which yielded almost 3 million lbs and over 4.8 million dollars in 1998 (Tables NC-BC1,2). Shrimp trawls and rod-n-reel account for most of the landings by value; shellfish techniques ("by hand, bull rakes, hand rakes, hand tongs"), crab pots, trolling, and other techniques are also found. The major species by value was shrimp (48%); it was followed by a fairly even representation of porgies, snappers, groupers, hard clams, oysters, spot, triggerfish, and swordfish. In 1990 89 white men and 36 black men, plus 12 white women, claimed the occupation of fisher, and 23 white men were captains and other officers on the census. According to Diaby (1999: 35), there were 688 ETS issued in 1997, and the average fishing income that year was $11,572, comapred with an average annual wage per worker of $23,860.

Pender County (pop. 37,208, 1997), up the Cape Fear River from Wilmington, is the site of estuarine and ocean fisheries, amounting to about $770,000 worth, for 535,000 lbs. in 1998. 19 gear types were used that year, ranging from shrimp trawls and four different kinds of gill-nets to a variety of shell-fishing techniques and small scale nets (butterfly net, cast net, channel

net). Shrimp, clams, crabs, and oysters were major. Fluke made up 2.1% of value and porgies 3.2% of value. Other ocean fishes are king mackerel, spot, snappers, and groupers. In 1990 66 white males declared fishing as their occupation. Diaby (1999: 35) reports 239 ETS issued in 1997, with average fishing income of $8,599 compared with an average annual wage of $19,329.

Bladen County, up the Cape Fear River, was the site of a gill-net fishery, plus a little oystering, haul-seining and crab potting in 1998. Species caught included crabs, spot, shad, croaker, and other bay and estuarine species. The 1990 census showed 8 black men as fishers. Robeson County, far inland up the same river, had a few landings in 1998 as well.

Columbus County, between Brunswick and Bladen Counties and on the Cape Fear River, had a small fishery, mainly oysters but also small amounts of spot, shad, fluke, bluefish, and crabs. It was valued at less than $70,000 in 1998. Techniques include crab pots, gill nets, gigs, and "by hand." The 1990 census showed no fishers as occupational types.

For additional information, refer to the sections on description of fishing activities (section 7), economic characteristics of the fishery (section 8), and the fishery impact statement (section 9.2.6) of Amendment 5 to the Atlantic mackerel squid and butterfish FMP.

4.3.4 Consistency with Applicable Laws

4.3.4.1 The Amendment Relative to the National Standards

Section 301(a) of the MSFCMA states: "Any fishery management plan prepared, and any regulation promulgated to implement such plan pursuant to this title shall be consistent with the following National Standards for fishery conservation and management." The following is a discussion of the standards and how this framework meets them.

4.3.4.1.1 National Standard 1 - Overfishing Definition

“Conservation and management measures shall prevent overfishing while achieving, on a continuous basis, the optimum yield from each fishery for the United States fishing industry.”

The Sustainable Fisheries Act (SFA), which reauthorized and amended the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) made a number of changes to the existing National Standards. With respect to National Standard 1, the SFA imposed new requirements concerning definitions of overfishing in US fishery management plans. In order to comply with National Standard 1, the SFA requires that each Council FMP define overfishing as a rate or level of fishing mortality that jeopardizes a fisheries capacity to produce maximum sustainable yield (MSY) on a continuing basis and defines an overfished stock as a stock size that is less than a minimum biomass threshold.

The SFA also requires that each FMP specify objective and measurable status determination criteria for identifying when stocks or stock complexes covered by the FMP are overfished. To fulfill the requirements of the SFA, status determination criteria are comprised of two components: 1) a maximum fishing mortality threshold and 2) a minimum stock size threshold. The maximum F threshold is specified as F_{msy}. The minimum biomass threshold is specified as ½ the MSY level. The overfishing definitions for each of the species managed under this FMP was modified in Amendment 8 to comply with the SFA. The only overfishing definition adopted in Amendment 8 which will be affected by this framework action is the fishing mortality control rule for *Loligo* squid.

As noted above, Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management (FMP) was developed to bring the FMP into compliance with the Sustainable Fisheries Act (SFA). The SFA, which reauthorized and amended the Magnuson-Stevens Act, made a number of changes to the existing National Standards, as well as to definitions and other provisions in the Magnuson-Stevens Act, that caused the Guidelines to be significantly revised. The most significant changes were made to National Standard 1, which imposed new requirements concerning definitions of overfishing in fishery management plans. The overfishing definition for Loligo was revised in Amendment 8 to comply with the SFA as follows: overfishing for *Loligo* was defined to occur when the catch associated with a threshold fishing mortality rate of F_{max} is exceeded (F_{max} is a proxy for F_{msy}). When an estimate of F_{msy} becomes available, it will replace the current overfishing proxy of F_{max}. Annual quotas are specified which correspond to a target fishing mortality rate. Target F was defined as 75% of the F_{msy} when biomass is greater than B_{msy}, and decreases linearly to zero 50% of B_{MSY}. Maximum OY is specified as the catch associated with a fishing mortality rate of F_{max}. In addition, the biomass target is specified to equal B_{MSY}.

The most recent assessment of the Loligo stock (SAW 29) concluded that the stock was approaching an overfished condition and that overfishing was occurring (NMFS 1999). A production model indicated that current biomass was less than B_{msy}, and near the biomass threshold of 50% B_{MSY}. There was high probability that fishing mortality exceeded F_{msy} in 1998. The average F from the winter fishery (October to March) over the last five years averaged 180% of F_{MSY}, and F from the summer fishery equaled F_{MSY}. However, the production model also indicated that the stock has the ability to quickly rebuild from low stock sizes. Length based analyses indicated that fully-recruited fishing mortality is greater than F_{max} and stock biomass was among the lowest in the assessment time series (1987-1998). Recent survey indices of recruitment were well below average.

The new requirements of the SFA required the Council to take remedial action for 2000 to rebuild the stock to a level which will produce MSY (B_{msy}) given the status determination that *Loligo* was approaching an overfished state. The control rule in Amendment 8 specifies that the target fishing mortality rate must be reduced to zero if biomass falls below 50% of B_{msy}. The target fishing mortality rate increases linearly to 75% of F_{msy} as biomass increases to B_{msy}. However, projections made in SAW 29 indicated that the control rule appeared to be overly conservative. Projections from SAW 29 indicated that the Loligo

biomass could be rebuilt to levels approximating B_{msy} in three years if fishing mortality was reduced to the target mortality rate specified in Amendment 8 of 75% of F_{msy}. The yield associated with this fishing mortality rate (75% of F_{msy}) in 2000, assuming status quo F in 1999, was estimated to be 11,732 mt in SAW 29. In determining the specification of ABC for the year 2000, the Council considered advice offered by SAW 29 which indicated that the control rule adopted in Amendment 8 was too conservative. Model projections presented in the most recent assessment demonstrated that the stock could be rebuilt in a relatively short period of time, even at fishing mortality rates equivalent to 75% F_{msy}. Based on Monitoring Committee projections, the Council chose an *ad hoc* approach and specified ABC as the yield associated with 90% F_{msy} or 13,000 mt in 2000.

The Council is replacing the control rule because it was determined to be unnecessarily restrictive by SAW 29. For example, yield projections conducted since development of the overfishing control rule indicated that the *Loligo* stock could rebuild to B_{msy} in a relatively short period of time. In retrospect, the stock quickly rebounded to the B_{msy} level by 2000. If the Council had followed the control rule in 2000, the fishery would have been closed for the year. The basic elements of the overfishing definition required by the SFA, the overfishing threshold (F_{msy}) and minimum biomass threshold (½ B_{msy}) are retained. Since the proposed overfishing definition contains the necessary elements and provisions for stock rebuilding prescribed by the SFA, this framework action is consistent with National Standard 1.

4.3.4.1.2 National Standard 2 - Scientific Information

"Conservation and management measures shall be based upon the best scientific information available."

The analyses in this framework are based on the best scientific information available. The changes to the control rule for *Loligo* are based on the recommendations of SAW 29. Therefore, this framework action is consistent with National Standard 2.

4.3.4.1.3 National Standard 3 - Management Units

"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."

Each species in the management unit of this FMP is managed as a single unit throughout its range, from Maine through Florida. The proposed action does not alter the management unit.
Therefore, this framework action is consistent with National Standard 3.

4.3.4.1.4 National Standard 4 - Allocations

"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 a manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges."

This framework action is not expected to significantly alter the allocation of any of the resources managed under this FMP. The two measures with possible allocation effects are the *Illex* moratorium extension for one year and the *Illex* exemption from the *Loligo* trip limit. If the *Illex* moratorium were to be allowed to expire, the fishery would revert to an open access condition. The likely outcome would be an influx of new entry into the fishery (additional overcapitalization of the fishery) and a reduction in the amount landed by current permit holders. Depending on the level of entry, the allocation effects of *not* extending the moratorium could be severe. However, since the moratorium for *Illex* is already in place and is being extended for one year, no allocation effects from the extension are anticipated. The level of re-allocation of the *Loligo* resource due the *Illex* exemption will depend on largely on when the directed fishery for *Loligo* is closed in quarter 3. Based on the most recent and complete three year data set which could be analyzed (1997-1999), a closure of the *Loligo* fishery is most likely to occur during week 38 (i.e., the last two weeks of September would be closed to directed *Loligo* fishing). Even under the worst case scenario, the overall reduction in total annual revenues for vessels in the *Loligo* fishery is expected to be less than 0.3% (assuming the directed *Loligo* fishery is closed the last two weeks of quarter 3). Under the scenario based on 1999 observed *Loligo* bycatch in the *Illex* fishery, the overall reduction in total annual revenues for vessels in the *Loligo* fishery is expected to be less than 0.1% (again, assuming the directed *Loligo* fishery is closed the last two weeks of quarter 3). If *Illex* fishermen do not alter their fishing behavior (i.e., projections based on observed *Loligo* bycatch in 1999 would be valid), the worst case scenario would occur if the directed *Loligo* fishery is closed beginning in week 31 (August 1). Under this scenario, the overall reduction in total annual revenues for vessels in the *Loligo* fishery is expected to be less than 0.5%. Thus, under any scenario considered the, the re-allocation of Loligo landings due to the *Illex* exemption is expected to be minimal. Without the exemption, *Loligo* taken as bycatch in the directed *Illex* fishery in excess of 2,500 pounds would have to be discarded. Under the exemption, these *Loligo* would be landed and counted against the total annual quota. Thus the exemption is a reasonably calculated to promote conservation. The proposed action is consistent with National Standard 4. In addition, the Council proposes to evaluate this measure on an annual basis and to make recommendations relative to the continuance of the exemption program in the future. As a result, if the Council concludes that the exemption has resulted in *Loligo* bycatch in the *Illex* fishery in excess of the levels anticipated in the current analysis the program will be discontinued.

4.3.4.1.5 National Standard 5 - Efficiency

“Conservation and management measures shall, where practicable, consider efficiency in the utilization of the fishery resources; except that no such measure shall have economic allocation as its sole purpose.”

The management program implemented by the Amendments to the Atlantic Mackerel, Squid, and Butterfish FMP are intended to allow the fisheries managed pursuant to this FMP to operate at the lowest possible cost (e.g., fishing effort, administration, and enforcement) given the FMP’s objectives. The management measures proposed in Framework 2 place no restrictions on processing, or marketing and no unnecessary restrictions on the use of efficient techniques of harvesting. Therefore the proposed action is consistent with National Standard 5.

4.3.4.1.6 National Standard 6 - Variations and Contingencies

“Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.”

The purpose of the proposed action for *Loligo* squid is designed to take into account the annual variation in abundance and availability of *Loligo* squid to the Atlantic coast fisheries so that overfishing is avoided while achieving maximum utilization of any given year class. Since abundance cannot be forecast reliably, real time assessment and management of the *Loligo* stock this will allow the stock to be utilized at al level consistent the fishing mortality target and current abundance. Therefore, the proposed action is consistent with National Standard 6.

4.3.4.1.7 National Standard 7 - Cost and Benefits

“Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.”

The description of how this National Standard is met by the FMP was described in Amendments 5, 6 and 8. This framework action is not expected to alter the costs of management under this FMP. Therefore, there is no reason to alter the conclusion that this framework is consistent with National Standard 7.

4.3.4.1.8 National Standard 8 - Communities

“Conservation and management measures shall, consistent with the conservation requirements of the Magnuson-Stevens 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.”

A complete description of the ports and their reliance on various species, including Atlantic mackerel, squid and butterfish is given in Section 3.4. The purpose of this FMP has been to provide a framework for the orderly

development of the Atlantic mackerel, *Loligo* and *Illex* squid and butterfish fisheries while preventing overfishing. Therefore, most if not all of the fishing communities along the US east coast have been positively impacted by the FMP. There were likely some fishermen who may have caught *Illex* that did not qualify for the moratorium under Amendment 5 and were reduced to catching bycatch quantities. This issue was discussed in section 9.2.2 of Amendment 5 to the FMP and in the resubmission document for Amendment 5.

Another issue raised during the development of Amendment 5 was that the limited entry provisions reduced the possibility that fishermen would enter the fishery that never participated in these fisheries. The most frequently mentioned group of fishermen identified in this category are those that have been negatively impacted by the severely overfished condition of the North East groundfish resources. They are seeking alternative species. However, it was the Council's conclusion that the harvesting capacity of the fleet that will qualify for the moratoria plus the fleet that will harvest the bycatch allowance can take the maximum optimum yields for the species involved and no extra capacity is needed in the fishery. The major benefit to be realized through implementation of recent Amendments to this FMP is that overfishing and over-capitalization in these fisheries will be avoided in the future. This framework action would extend the moratorium on entry into the *Illex* fishery for an additional year.

The proper management of the stock complexes managed under this FMP through implementation of the management measures described in recent Amendments have been beneficial to the commercial and recreational fishing communities of the Atlantic Coast. By preventing overfishing of the stocks and overcapitalization of the industry, positive benefits to the fishing communities have and will continue to be realized. Therefore, this Framework Action is consistent with National Standard 8.

4.3.4.1.9 National Standard 9 - Bycatch

“Conservation and management measures shall, to the extend practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.”

This national standard requires Councils to consider the bycatch effects of existing and planned conservation and management measures. Bycatch can, in two ways, impede efforts to protect marine ecosystems and achieve sustainable fisheries and the full benefits they can provide to the Nation. First, bycatch can increase substantially the uncertainty concerning total fishing-related mortality, which makes it more difficult to assess the status of stocks, to set the appropriate optimal yield (OY) and define overfishing levels, and to ensure that OYs are attained and overfishing levels are not exceeded. Second, bycatch may also preclude other more productive uses of fishery resources.

The term "bycatch" means fish that are harvested in a fishery, but that are not sold or kept for personal use. Bycatch includes the discard of whole fish at sea or elsewhere, including economic discards and regulatory discards, and

fishing mortality due to an encounter with fishing gear that does not result in capture of fish (i.e., unobserved fishing mortality). Bycatch does not include any fish that legally are retained in a fishery and kept for personal, tribal, or cultural use, or that enter commerce through sale, barter, or trade. Bycatch does not include fish released alive under a recreational catch-and-release fishery management program. A catch-and-release fishery management program is one in which the retention of a particular species is prohibited. In such a program, those fish released alive would not be considered bycatch.

The commercial fishery for Atlantic mackerel is primarily prosecuted with otter trawls . For example, in unpublished NMFS dealer reports indicate that 94.2% of all Atlantic mackerel landings were taken with otter trawls in 1999. The remaining gears were of minor importance and included pound nets (2.3%), floating traps (1.5%), sink gill nets (1.5%), and other (0.5%). The fishery is managed through the specification of annual quotas. No management measures are in place which would cause discarding of Atlantic mackerel in the commercial fishery. The most recent stock assessment for Atlantic mackerel concluded that discards in the Atlantic mackerel fishery are insignificant in recent years (NMFS 1996b). Therefore, discards in the commercial Atlantic mackerel fishery in SAW-20, as in previous assessments, were not estimated.

The 1996 NMFS sea sampling data is the most recent at-sea observation data available to the Council to characterize catch and discards in the commercial Atlantic mackerel fishery using otter trawls based on at-sea observations. Trips which caught and landed 1000 lbs or more of Atlantic mackerel are characterized in Table 21. A total of 13 species was taken in association with Atlantic mackerel. Overall, 12.6 % of the weight caught on these trips was discarded. Atlantic mackerel and Atlantic herring accounted for 58.8% and 33.9% of the total weight caught, respectively. Atlantic mackerel discard rates were moderate (16% of total weight of mackerel caught) and accounted for roughly 75% of the total weight discarded. The discard rates for individual species ranged form zero for silver hake to 72% for black sea bass. However, the total weight of species other than Atlantic mackerel and herring accounted for less than 10% of the total weight caught.

The degree to which the 37 trips sampled in NMFS sea sampling program accurately describe discards in the commercial Atlantic mackerel fishery is unknown. However, in addition to the at-sea sampling observations described above, unpublished NMFS vessel trip report (VTR) data are available for 1999 to characterize discards. The catch disposition for each species taken on trips that landed 10,000 lbs or more of Atlantic mackerel, based on unpublished 1999 vessel trip reports (submitted by fishermen as required by the FMP), is given in Table 22. Overall, only 0.4% of the total weight landed was reported as discarded. Atlantic mackerel accounted for 85.6% of the total weight landed on 254 trips that landed 10,000 lbs or more of Atlantic mackerel. The discard rate for Atlantic mackerel on these trips, based on VTR data, was low (0.2%). The only species with high discard rates were striped bass (75.5%) and spiny dogfish. However, the total weight caught for both species was very small. Overall, discarding in the commercial Atlantic mackerel appears to be minimal based on unpublished NMFS VTR data.

There is also a significant recreational fishery for Atlantic mackerel. Estimates of recreational catch and discard in the recreational fishery for mackerel are available from the MRFSS. MRFSS data indicate that the percentage of Atlantic mackerel taken in the recreational fishery that are released after capture (MRFSS Type B2) is generally less than 12% of the total caught in most years. In addition, the majority of the fish released alive are expected to survive after release, and therefore, are not defined as bycatch under the new SFA. There are no recreational management measures for Atlantic mackerel which cause discarding. The limited amount of discarding that does occur in the recreational fishery is due to fishermen preference and behavior and is unrelated to management of the resource.

The commercial fishery for *Loligo* is primarily prosecuted with otter trawls. For example, unpublished NMFS dealer reports indicate that greater than 99% of all *Loligo* landings in 1999 were taken with otter trawls. The fishery is managed through the specification of annual quotas. The most recent stock assessment indicated that discards of *Loligo* in the commercial fishery do occur, however limited data are available to quantify the extent of discarding by vessels targeting *Loligo*. The most recent stock assessment reported that only two winter sea sampling trips which targeted *Loligo* were available for analysis. The percentage of *Loligo* discarded by weight ranged from 4-19%. For both trips, the reason given for discarding was that the squid discarded were below marketable size. The assessment was uncertain if the levels of discarding from these trips were representative of the winter squid fishery overall. Additional discard data were available from the Massachusetts Division of Marine Fisheries for the Nantucket and Vineyard Sound Fishery collected during May of 1990-1992. These data indicated that less than 2% by weight of *Loligo* taken in this fishery were discarded. Based on the limited data presented in the most recent assessment, it appears that discarding of *Loligo* does occur on a limited basis. While the data are sparse, the levels that occur appear to be relatively low and are related to marketability.

The 1996 NMFS sea sampling data is the most recent at-sea observation data available to the Council to characterize catch and discards in the *Loligo* squid fishery. Trips which caught and landed 500 lbs or more of *Loligo* squid are characterized in Table 23. The lack of data from the directed *Loligo* fishery in the NMFS sea sampling program is confirmed by the 1996 data. *Loligo* accounted for a minority fraction of the total weight caught in these trips.

A total of 19 species was taken in addition to *Loligo* in 77 trips which landed at least 500 lbs of *Loligo*. Overall, 15.4% of the weight caught on these trips was discarded. Atlantic mackerel and *Loligo* squid accounted for 56.8% and 24.3% of the total weight caught, respectively. Atlantic mackerel accounted for most of the total weight discarded (64%). *Loligo* discard rates were very low (1.1% of total weight of *Loligo* caught).

The degree to which the 41 trips sampled in NMFS sea sampling program which landed at least 500 lbs of *Loligo* accurately characterize discards in the

directed *Loligo* fishery is unknown. However, in addition to the at-sea sampling observations described above, unpublished NMFS vessel trip report (VTR) data are available for 1999 to characterize discards. The catch disposition for each species taken on trips that landed 2,500 lbs or more of *Loligo* based on unpublished 1999 vessel trip reports (submitted by fishermen as required by the FMP) is given in Table 24. Overall, only 0.4 % of the total weight landed was reported as discarded. *Loligo* accounted for 61.5% of the total weight landed on 2,098 trips. The discard rate for *Loligo* based on VTR data was low (<0.1%). Species with high discard rates were haddock, sunfish and hammerhead shark (all 100%),skates (40.5%) yellowtail flounder (35.6%),and cod (18,8%).

The commercial fishery for *Illex* is primarily prosecuted with otter trawls. For example, unpublished NMFS dealer reports indicated that greater than 99% of all *Illex* landings in 1999 were taken with otter trawls. The fishery is managed through the specification of annual quotas. No management measures are in place which would cause discarding of *Illex* in the commercial fishery. The most recent stock assessment for the species indicated that discards were not available for directed *Illex* trips. However, anecdotal information from industry suggested that discarding of *Illex* is minimal. This conclusion is also supported by confidential observer data collected during foreign and joint venture fishing operations for *Illex* in the late 1980's which indicated that discarding of Illex was negligible in comparison to landings (NMFS 1996a). NMFS (1996a) concluded that, in general, *Illex* tend to school by size, and targeting of larger squid by the fishery, suggests low discard rates.

The 1996 NMFS sea sampling data, the most recent at-sea observation data available to the Council to characterize catch and discards in *Illex* fishery, support the above conclusion. Trips which caught and landed 1000 lbs or more of *Illex* are characterized in Table 25. A total of 13 species was taken in association with *Illex* on these trips. Overall, only 1.4 % of the weight caught on these trips was discarded. *Illex* accounted for 95.3% of the total weight caught. *Illex* discards were very low (<0.01% of total weight of *Illex* caught). The discard rates for the other species were also very low.

In addition to the at-sea sampling observations described above, unpublished NMFS vessel trip report (VTR) data are available for 1999 to characterize discards. The catch disposition for each species taken on trips that landed 5,000 lbs or more of *Illex* , based on unpublished 1999 vessel trip reports (submitted by fishermen as required by the FMP), is given in Table 26. Overall, only 0.2% of the total weight landed was reported as discarded. *Illex* accounted for 78% of the total weight landed on 222 trips that landed 5,000 lbs or more of *Illex*. The discard rate for *Illex* on these trips was very low (<0.1%). Overall, discarding in the *Illex* fishery appears to be very minimal based on unpublished NMFS VTR data.

The commercial fishery for butterfish is also primarily prosecuted with otter trawls (unpublished NMFS dealer reports indicated that greater than 95% of butterfish landings in 1999 were taken with otter trawls). The fishery is

managed through the specification of annual quotas. No management measures are in place which would cause discarding of butterfish in the commercial fishery. The most recent stock assessment for butterfish indicated that discards of butterfish do occur in the commercial fishery, however limited data are available to quantify the extent of discarding by vessels targeting butterfish (NMFS 1994). Discarding of butterfish on non-directed trips appears to be high, ranging from 69-100%. However, the data suggested that the available sea sample data are not representative of the directed fishery for butterfish. NMFS (1994) concluded that further evaluation of the precision and design of the sea sampling program in adequately characterizing butterfish discards in the directed fishery is needed before attempting to estimate the absolute magnitude of discards.

The 1996 NMFS sea sampling data is the most recent at-sea observation data available to characterize catch and discards in the butterfish fishery for otter trawls. Otter trawl trips which caught and landed 500 lbs or more of butterfish are characterized in Table 27. The lack of data from the directed butterfish fishery in the NMFS sea sampling program is confirmed by the 1996 data. Butterfish accounted for a minority fraction of the total weight caught in these trips. A total of 10 species was taken in addition to butterfish in 26 trips which landed at least 500 lbs of butterfish. Overall, only 1.0% of the weight caught on these tows was discarded.

The degree to which the trips sampled in NMFS sea sampling program which landed at least 500 lbs of butterfish accurately characterize discards in the directed butterfish fishery is unknown. However, in addition to the at-sea sampling observations described above, unpublished NMFS vessel trip report (VTR) data are available for 1999 to characterize discards. The catch disposition for each species taken on trips that landed 500 lbs or more of butterfish based on unpublished 1999 vessel trip reports (submitted by fishermen as required by the FMP) is given in Table 28. Overall, only 0.5% of the total weight landed was reported as discarded. Butterfish accounted for only 11.0% of the total weight landed on 1,573 trips. The discard rate for butterfish, based on VTR data, was low (1.0%). Species with high discard rates (>50%) were haddock, sunfishes, and hammerhead shark (all 100%) Atlantic herring (64.0%), and skates (52.9%).

An additional measure imposed in Amendment 5 to the FMP designed to minimize discards in the squid and butterfish fisheries was the creation of a non-moratorium incidental catch allowance. Amendment 5 created a limited access program for the squids and butterfish. To avoid discarding of squid and butterfish taken by non-moratorium vessels during the prosecution of other fisheries, a non-moratorium incidental permit category was created. Vessels that did not qualify for a *Loligo*/butterfish or *Illex* moratorium permit may land *Loligo*, *Illex*, and/or butterfish if (1) it possesses an incidental catch permit, (2) fishes with a net legal in the directed fishery, (3) lands no more that 2,500 pounds of *Loligo* and/or butterfish or 5,000 pounds of *Illex* per trip, and (4) the operator of the vessel files the appropriate trip reports. The incidental catch allowance may be adjusted by the Regional Administrator based on the recommendation of the Council. This management measure was

implemented specifically to minimize discarding of these species in non-directed fisheries.

The amount of discarding in the commercial fisheries for these species should be also be minimized since capping the fishery at 1996 levels avoided overfishing of the squids and butterfish. Also, state and federal mesh regulations already in effect for other species (i.e., summer flounder, weakfish, black sea bass, etc.) will reduce the bycatch of small butterfish. In addition, Amendment 8 added framework provisions described in Section 3.1.1 to deal with discard problems in the future, should they arise. Specifically, if a discard problem is identified, gear restrictions could be implemented to reduce discard mortality. All of these factors will result in the minimization of bycatch and discard mortality in the commercial fisheries for these species, to the extent practicable. Therefore, National Standard 9 is satisfied.

The Council recognizes the need for improved estimates of discards for all of the fisheries managed under this FMP. This will require increased at-sea sampling intensity over a broader temporal and geographical scope than is currently available. The Council's Comprehensive Management Committee has begun to address this issue and has appointed a member to participate on the Atlantic Comprehensive Coastal Statistics Programs (ACCSP) Discard Prioritization Committee. This committee was formed to address the need for collection of discard data. The Discard Prioritization Committee will provide guidance to the At-Sea Observer Program by initiating development of priorities and target sampling levels for collection of discard/releases information on recreational, for-hire and commercial fisheries. The Committee is developing a plan to implement sampling through existing or new data collection programs. The data collected through the ACCSP qualitative release, discard and protected species interactions monitoring program will be used to prioritize and modify the quantitative release, discard and protected species interactions data collection programs.

4.3.4.1.10 National Standard 10 - Safety at Sea

"Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea."

The changes to the management system proposed in this framework should not affect the vessel operating environment, gear loading requirements or create derby style fisheries for Atlantic mackerel, squid or butterfish. The Council developed this FMP and subsequent amendments with the consultation of industry advisors to help ensure that this was the case. In summary, the Council has concluded that the proposed framework action will not impact or affect the safety of human life at sea. Therefore the action is consistent with National Standard 10.

4.3.4.2 OTHER MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT REQUIREMENTS

Section 303(a)(12) of the MSFCMA requires the Councils to 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. This requirement was addressed under section 3.4.9 of Amendment. 8.

Section 303(a)(13) of the MSFCMA requires the Councils to include a description of the commercial, recreational, and charter fishing sectors which participate in the fishery and, to the extend practicable, quantify trends in landings of the managed fishery resources by the commercial, recreational, and charter fishing sectors. The description of fishing activities for the Atlantic mackerel, squid and butterfish fisheries are presented in section 7 (Description of Fishing Activities) of Amendments 5. However, additional information pertaining the recreational and charter fishing sectors is presented below in section 5.2.1 of Amendment 8 (Additional Characterization of the Recreational and Party/Charter Fisheries).

Section 303(a)(14) of the MSFCMA requires that 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 commercial, recreational, and charter fishing sectors in the fishery. This requirement has been addressed under the section 3.4 (The Amendment Relative to the National Standards) in Amendment 5.

5.0 ENVIRONMENTAL IMPACTS OF THE ALTERNATIVES

5.1 Biological Impacts

5.1.1 Moratorium on entry to *Illex* fishery

5.1.1.1 Extend the moratorium on entry to the *Illex* fishery for an additional year (moratorium on entry to the *Illex* fishery would expire in 2003 unless extended in next Amendment) (Preferred Alternative).

The *Illex* fishery is managed pursuant to this FMP through an annual quota specification process. Annual quotas are specified based on the overfishing definition established in Amendment 8. The approved overfishing definition for *Illex* is, "Overfishing for *Illex* will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{MSY} is exceeded... Maximum OY will be specified as the catch associated with a fishing mortality rate of F_{MSY}. In addition, the biomass target is specified to equal B_{MSY}. The minimum biomass threshold is specified as ½ B_{MSY}." The Max OY for *Illex* squid is currently specified at 24,000 mt. The Council specified ABC at 24,000 mt for 2001, which is equal to the quota associated with F_{MSY}.

Since the annual quota is the chief mechanism used to control fishing mortality in the *Illex* fishery, an extension of the moratorium on entry to the *Illex* fishery is not expected to have any negative biological impacts on the *Illex* stock. To the contrary, this measure is expected to have a positive

impact on the *Illex* stock because it would prevent additional over-capitalization of the *Illex* fishery and help to prevent overfishing. If the moratorium on entry to the *Illex* fishery was not extended, the fishery would revert to open access conditions. Under open access conditions, it is likely that a much larger number of vessels would enter the fishery. This could result in dramatic increases in fishing effort in the *Illex* fishery and, in turn, increase the chance that the annual quota might be exceeded and that the overfishing threshold might be exceeded.

5.1.1.2 Extend the moratorium on entry to the *Illex* fishery for an additional five years

The *Illex* fishery is managed pursuant to this FMP through an annual quota specification process. Annual quotas are specified based on the overfishing definition established in Amendment 8. The approved overfishing definition for *Illex* is, "Overfishing for *Illex* will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{MSY} is exceeded... Maximum OY will be specified as the catch associated with a fishing mortality rate of F_{MSY}. In addition, the biomass target is specified to equal B_{MSY}. The minimum biomass threshold is specified as ½ B_{MSY}." The Max OY for *Illex* squid is currently specified at 24,000 mt. The Council specified ABC at 24,000 mt for 2001, which is equal to the quota associated with F_{MSY}.

The most recent assessment of the *Illex* stock (SAW-29) concluded that the stock is not in an overfished condition and that overfishing is not occurring. The previous assessment, the 21st Northeast Regional Stock Assessment (1996), had concluded that the U.S. *Illex* stock is fully-exploited. Due to a lack of adequate data, the estimate of yield at F_{MSY} was not updated in SAW-29. However, an upper bound on annual F was computed for the U.S. exclusive economic zone (EEZ) portion of the stock based on a model that incorporated weekly landings and relative fishing effort and mean squid weights during 1994-1998. These estimates of F were well below the biological reference points. Current absolute stock size is unknown and no stock projections were done in SAW-29.

Since the annual quota is the chief mechanism used to control fishing mortality in the *Illex* fishery, an extension of the moratorium on entry to the *Illex* fishery is not expected to have any negative biological impacts on the *Illex* stock. To the contrary, this measure is expected to have a positive impact on the *Illex* stock because it would prevent additional over-capitalization of the *Illex* fishery and help prevent overfishing. If the moratorium on entry to the *Illex* fishery was not extended, the fishery would revert to open access conditions. Under open access conditions, it is likely that a much larger number of vessels would enter the fishery. This could result in dramatic increases in fishing effort in the *Illex* fishery and, in turn, increase the chance that the annual quota might be exceeded and that the overfishing threshold might be exceeded.

5.1.1.3 Allow the moratorium on entry to the *Illex* fishery to expire in 2002 (no action)

Under this option, the *Illex* moratorium would expire in July of 2002 and the fishery would revert to open access conditions. Under open access conditions, it is likely that a much larger number of vessels would enter the fishery. This could result in dramatic increases in fishing effort in the *Illex* fishery and, in turn, increase the chance that the annual quota might be exceeded and that the overfishing threshold might be exceeded. This is especially true in the *Illex* fishery because a very large proportion of the annual catch is taken during a relatively short period of time (primarily in August or September). Because the fishery is compressed into a relatively short time period, it becomes increasingly difficult to monitor the landings in the fishery during periods of extremely high effort and landings. This problem would be expected to become much more acute under open access, derby style conditions and thus would increase the chance that annual quota would be exceeded and that overfishing would result. A quota overage would be much more likely under open access conditions because of the difficulty in monitoring this fishery due to it's short duration. Hence, the annual quota may not provide adequate protection against overfishing under the no action alternative.

This would have a negative impact on the *Illex* stock which, in turn, would be expected to negatively affect the large number of species and stocks of marine mammals and predatory fish which prey on *Illex* squid. Known predators of Illex are the fourspot flounder, goosefish, and swordfish. Illex is probably eaten by a substantially greater number of fish, however, partially digested animals are often difficult to identify and are simply recorded as squid remains, with no reference to the species. There are at least 47 other species of fish that are known to eat "squid". All of these species could be negatively impacted if the abundance of *Illex* were to decline as a result of overfishing.

5.1.2 Timeliness of Quota Specifications for Atlantic mackerel, *Loligo* and *Illex* squid and Butterfish

5.1.2.1 If annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, the previous year's specifications shall apply until the final rule for new specifications is implemented (excluding TALFF specifications) (Preferred Alternative)

Under this measure, if annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid are not published by the NMFS prior to the start of the fishing year, the previous year's specifications shall apply until the final rule implementing the new quota specifications are published. As noted above, this measure does not apply to TALFF specifications.

The Council proposes as part this framework action that in the case that annual specifications for mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications shall apply (excluding TALFF specifications). The primary reason for this action is that in recent years, publication of the final rule implementing the annual specifications for Atlantic mackerel, squid and butterfish has not occurred until after the start of the fishing year. For example, the final rule

implementing the quota specifications for Atlantic mackerel, squid and butterfish for 2000 was not published until March of 2000. Because the specifications were not in place by the start of the fishing season, the fishery for *Loligo* could not be regulated for the first several months of the fishery. The Council set the 2000 quota specifications for *Loligo* squid based on the Monitoring Committee projections which resulted in an ABC equal to the yield associated with 90% F_{msy} or 13,000 mt. Management advice from SAW 29 made special note of the fact that yield from this fishery should be distributed throughout the fishing year. Given that the permitted *Loligo* fleet historically had demonstrated the ability to land Loligo in excess of the quota specified for 2000, the Council recommended that the annual quota be sub-divided into three quota period or trimesters. The 2000 quota was allocated to each period based on the proportion of landings occurring in each trimester from 1994-1998. Based on the seasonal distribution of landings during this time period, the quota for January-April was 5,460 mt (42% of the total), the quota for May-August was 2,340 mt (18% of the total), and the quota for September-December was 5200 mt (40% of the total). The directed fishery during the first two trimester periods was to be closed when 90% of the amount allocated to the period was landed and then a trip limit of 2,500 pounds would remain in effect until the quota period ends. Any underages from trimesters one and two were to be applied to the next trimester and overages were to be deducted from trimester three. The directed fishery was closed in the third trimester when 95% of the annual quota was taken. The intent of the Council was for the fishery to operate at the 2,500 trip limit level for the remainder of the third quota period.

Since the 2000 specifications were not published until late in the first trimester of 2000, the fishery could not be closed when 90% of the quota allocated to trimester one was landed and an overage resulted. In general, quota overages make it more likely that the target fishing mortality will be exceeded and increase the chance that overfishing of the stock might occur, even though the overage is deducted from later periods. In the worst case scenario, failure to publish the annual specifications until very late in the fishing year (or not at all) would result in unregulated fishing. The inability to control landings in the fishery can be expected to greatly increase the chance that overfishing might occur. This would have a negative impact on the *Loligo* stock which, in turn, would be expected to negatively effect the large number of species and stocks of marine mammals and predatory fish which prey on *Loligo* squid. Juvenile and adult *Loligo* are preyed upon by many pelagic and demersal fish species, as well as marine mammals and diving birds (Lange and Sissenwine 1980, Vovk and Khvichiya 1980, Summers 1983). Marine mammal predators include long-finned pilot whale, *Globicephala melas*, and common dolphin, *Delphinus delphis* (Waring *et al.* 1990, Overholtz and Waring 1991, Gannon *et al.* 1997). Fish predators include bluefish, sea bass, mackerel, cod, haddock, pollock, silver hake, red hake, sea raven, spiny dogfish, angel shark, goosefish, dogfish and flounder (Maurer 1975, Langton and Bowman 1977, Gosner 1978, Lange 1980). All of these species could be negatively impacted if the abundance of *Loligo* were to decline as a result of overfishing.

Another possibility which could arise under this alternative would be the situation where the Council and NMFS propose to reduce the quota specification for *Loligo* in the upcoming fishing year. In this case, the previous year's quota specification (which is higher) would be apply until the lower specification for the new year was implemented. In this situation, the fishery would be allowed to land a greater amount during the first quarter than the new specifications would have allowed if they had been published. However, this additional amount would be less than the amount expected to be landed under the no action alternative since the preferred alternative allows for regulation and closure of the first quarter based on the previous years specification.

In the case of Atlantic mackerel, industry members testified that this delays in publishing the annual quota specifications has had a negative impact on possible Joint Venture activities for Atlantic mackerel, due to timing of the winter Atlantic mackerel fishery and the uncertainty about the upcoming year's JV specifications. To help alleviate this situation, the Council is proposing that, in the event the annual specifications for mackerel are not published by the NMFS prior to the start of the fishing year, that the previous year's specifications will apply (excluding TALFF specifications). Since the Atlantic mackerel specifications in recent years are far below the level of ABC, this measure is not expected to have any negative biological impacts on the Atlantic mackerel stock. The only specification for Atlantic mackerel that would be significantly impacted by this measure would be the JV specification. Under current rules, if annual specifications are not published prior to the beginning of the fishing year, JV activities are not permitted. Under the proposed measure, JV operations could occur based on the previous years JV specification. For example, the 2001 Atlantic mackerel, squid and butterfish specifications were recently published on March 2, 2001(the fishing year began on January 1, 2001). As a result, no JV activity could have occurred until March 2, 2001. Under the proposed measure, the 2000 JV specification of 20,000 mt would have applied and JV activities could have been conducted under this provision. This level of fishing activity is not expected to have a negative impact on the Atlantic mackerel stock based on conclusions reached by the Council in the Environmental Assessment for the 2000 Atlantic mackerel, squid and butterfish specifications. This conclusion was reached because the recent specifications for Atlantic mackerel represent only a fraction of the Allowable Biological Catch (ABC). As result, JV landings of up to 20,000 mt in addition to recent levels of US domestic production, are not expected to negatively affect the abundance of the Atlantic mackerel stock. Another possibility which could arise under this alternative would be the situation where the Council and NMFS propose to significantly reduce or eliminate the JVP specification in the upcoming fishing year. The Council discussed this possibility and intends to disapprove JVP applications when this situation arises.

Quota monitoring and subsequent regulation of fishing mortality in the *Illex* and butterfish fisheries have not been negatively affected by the delays in publishing the annual specifications. In the case of *Illex*, this is because the directed fishery does not occur until June. For example, only about 1.4% of the 1999 *Illex* landings were taken in the first quarter (Table 29). In the

case of butterfish, the has landed only about 30-35% of ABC in recent years. As a result, this measure is not expected to have any biological impact on either of these stocks based on the recent dates on which the specifications have been published in recent years.

5.1.2.2 If annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, the Atlantic mackerel, *Loligo* and *Illex* squid and butterfish fisheries operate without specifications and Joint Ventures cannot be conducted until the final rule for new specifications is implemented (no action/status quo)

Under this option (no action), if annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid are not published by the NMFS prior to the start of the fishing year, the fishery opens without quota specifications. In recent years, publication of the final rule implementing the annual specifications for Atlantic mackerel, squid and butterfish has not occurred until after the start of the fishing year. For example, the final rule implementing the quota specifications for Atlantic mackerel, squid and butterfish for 2000 was not published until March 28, 2000. Because the specifications were not in place by the start of the fishing season, the fishery for *Loligo* could not be regulated for the first several months of the fishery. The Council set the 2000 quota specifications for *Loligo* squid based on the SAW 29 projections which resulted in an ABC equal to the yield associated with 90% F_{msy} or 13,000 mt. Management advice from SAW 29 made special note of the fact that yield from this fishery should be distributed throughout the fishing year. Given that the permitted *Loligo* fleet historically had demonstrated the ability to land Loligo in excess of the quota specified for 2000, the Council recommended that the annual quota be sub-divided into three quota period or trimesters. The 2000 quota was allocated to each period based on the proportion of landings occurring in each trimester from 1994-1998. Based on the seasonal distribution of landings during this time period, the quota for January-April was 5,460 mt (42% of the total), the quota for May-August was 2,340 mt (18% of the total), and the quota for September-December was 5200 mt (40% of the total). The directed fishery during the first two trimester periods was to be closed when 90% of the amount allocated to the period was landed and then a trip limit of 2,500 pounds would remain in effect until the quota period ends. Any underages from trimesters one and two were to be applied to the next trimester and overages were to be deducted from trimester three. The directed fishery was closed in the third trimester when 95% of the annual quota has been taken. The intent of the Council was for the fishery to operate at the 2,500 trip limit level for the remainder of the third quota period.

Since the 2000 specifications were not published until late in the first trimester of 2000, the *Loligo* fishery could not be closed when 90% of the quota allocated to trimester one was landed and an overage resulted. In general, quota overages make it more likely that the target fishing mortality will be exceeded and increase the chance that overfishing of the stock might occur, even though the overage is deducted from later periods. In the worst case scenario, failure to publish the annual specifications until very late in the fishing year (or not at all) would result in unregulated fishing. The inability to control landings in the fishery can be expected to greatly

increase the chance that overfishing might occur. This would have a negative impact on the *Loligo* stock which, in turn, would be expected to negatively effect the large number of species and stocks of marine mammals and predatory fish which prey on *Loligo* squid. Juvenile and adult *Loligo* are preyed upon by many pelagic and demersal fish species, as well as marine mammals and diving birds (Lange and Sissenwine 1980, Vovk and Khvichiya 1980, Summers 1983). Marine mammal predators include long-finned pilot whale, *Globicephala melas*, and common dolphin, *Delphinus delphis* (Waring *et al.* 1990, Overholtz and Waring 1991, Gannon *et al.* 1997). Fish predators include bluefish, sea bass, mackerel, cod, haddock, pollock, silver hake, red hake, sea raven, spiny dogfish, angel shark, goosefish, dogfish and flounder (Maurer 1975, Langton and Bowman 1977, Gosner 1978, Lange 1980). All of these species could be negatively impacted if the abundance of Loligo were to decline as a result of overfishing.

Under these conditions, no JV is specified for Atlantic mackerel for the new fishing year and therefore no mackerel JV operations can be conducted until the final rule implementing the new quota specifications is published. In the case of Atlantic mackerel, industry members testified that delays in publishing the annual quota specifications has had a negative impact on possible Joint Venture activities for Atlantic mackerel, due to timing of the winter Atlantic mackerel fishery and the uncertainty about the upcoming year's JV specifications. The no action alternative relative to Atlantic mackerel is not expected to have any negative biological consequences for the Atlantic mackerel stock since mackerel landings would be expected to be lower under this scenario (i.e., no JV landings).

Quota monitoring and subsequent regulation of fishing mortality in the *Illex* and butterfish fisheries have not been negatively affected by the delays in publishing the annual specifications. As a result, the no action alternative is not expected to have any biological impact on either of these stocks based on the dates on which the specifications have been published in recent years.

5.1.2.3 If annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, a set of default specifications shall apply for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish fisheries until the final rule for new specifications is implemented (excluding TALFF specifications)

Under this measure, if annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid are not published by the NMFS prior to the start of the fishing year, the fishery opens under a set of default quota specifications. Under this option quotas would be specified which correspond to the three year average of quota specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish for the period 1999-2001, except for TALFF which be set equal to zero under the default measures.

The biological consequences of this action are expected to be similar to those described in Section 5.1.2.1 for the preferred alternative. That is, the biological consequences of this action are expected to be positive since it

would allow for regulation of fishing mortality which would, in turn, prevent overfishing

5.1.2.4 If annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, the fisheries for these species will be closed until the final rule for new specifications is implemented.

Under this measure, if the annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, the fisheries for these species will be closed until the final rule for new specifications is published. In other words, the landing of all four species in the management unit would be prohibited until the final for new specifications is published.

The biological consequences of this action are expected to be similar positive relative to the to other alternatives described in previous sections. That is, the biological consequences of this action are expected to be overwhelmingly positive since fishing mortality would be reduced to near zero and thus the chance that overfishing could occur would be virtually eliminated.

5.1.2.5 If annual specifications for Atlantic mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications shall apply until the final rule for new specifications is implemented (excluding TALFF specifications).

Under this measure, if annual specifications for Atlantic mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications shall apply until the final rule implementing the new quota specifications are published. As noted above, this measure does not apply to TALFF specifications.

Atlantic mackerel industry members testified that delays in publishing the annual quota specifications have had a negative impact on possible Joint Venture activities for Atlantic mackerel, due to timing of the winter Atlantic mackerel fishery and the uncertainty about the upcoming year's JV specifications. To help alleviate this situation, the Council is proposing under this alternative that, in the event the annual specifications for mackerel are not published by the NMFS prior to the start of the fishing year, that the previous year's specifications will apply (excluding TALFF specifications). Since the Atlantic mackerel specifications in recent years are far below the level of ABC, this measure is not expected to have any negative biological impacts on the Atlantic mackerel stock. The only specification for Atlantic mackerel that would be significantly impacted by this measure would be the JV specification. Under current rules, if annual specifications are not published prior to the beginning of the fishing year, JV landings are not permitted. Under the proposed measure, JV operations could occur based on the previous years JV specification. For example, the 2001 Atlantic mackerel, squid and butterfish specifications were recently published on March 2, 2001(the fishing year began on January 1, 2001). As a

result, no JV activity could have occurred until March 2, 2001. Under the proposed measure, the 2000 JV specification of 20,000 mt would have applied and JV activities could have been conducted under this provision. This level of fishing activity is not expected to have a negative impact on the Atlantic mackerel stock based on conclusions reached by the Council in the Environmental Assessment for the 2000 Atlantic mackerel, squid and butterfish specifications. This was conclusion was reached because the recent specifications for Atlantic mackerel represent only a fraction of the Allowable Biological Catch (ABC). As result, JV landings of up to 20,000 mt in addition to recent levels of US domestic production, are not expected to negatively affect the abundance of the Atlantic mackerel stock.

5.1.2.6 If annual specifications for Atlantic mackerel are not published by the NMFS prior to the start of the fishing year, a set of default specifications shall apply for Atlantic mackerel until the final rule for new specifications is implemented (excluding TALFF specifications)

Under this measure, if annual specifications for Atlantic mackerel are not published by the NMFS prior to the start of the fishing year, the fishery opens under a set of default quota specifications. Under this option quotas would be specified which correspond to the three year average of quota specifications for Atlantic mackerel for the period 1999-2001, except for TALFF which be set equal to zero under the default measures.

The Atlantic mackerel fishery is managed pursuant to this FMP through an annual quota specification process. Annual quotas are specified based on the overfishing definition established in Amendment 8. Overfishing for Atlantic mackerel is defined to occur when the catch associated with a threshold fishing mortality rate of F_{msy} is exceeded. When SSB is greater than 890,000 mt, the overfishing limit is F_{MSY} (F=0.45), and the target F is the tenth bootstrap percentile of F_{MSY} (F=0.25). To avoid low levels of recruitment, the threshold F decreases linearly from 0.45 at 890,000 mt SSB to zero at 225,000 mt SSB (1/4 B_{MSY}), and the target F decreases linearly from 0.25 at 890,000 mt SSB to zero at 450,000 mt SSB (½ B_{MSY}). Annual quotas are be specified which correspond to a target fishing mortality rate according to this control law. The yield associated with the target fishing mortality rate of F=0.25 adopted in Amendment 8 is 369,000 mt. The ABC recommendation is 347,000 mt (F=0.25 yield estimate of 369,000 mt - the estimated Canadian catch of 22,000 mt).

The Council proposes under this alternative that in the case that annual specifications for mackerel are not published by the NMFS prior to the start of the fishing year, the previous three year’s specifications shall apply (excluding TALFF specifications). The primary reason for this action is that in recent years, publication of the final rule implementing the annual specifications for Atlantic mackerel has not occurred until after the start of the fishing year. Industry members testified that this situation has had a negative impact on possible Joint Venture activities for Atlantic mackerel, due to timing of the winter Atlantic mackerel fishery and the uncertainty about the upcoming year’s JV specifications. To help alleviate this situation, the Council is proposing that, in the event the annual specifications for mackerel are not published by the NMFS prior to the start of the fishing year, that the previous year’s specifications will apply

(excluding TALFF specifications). Since the Atlantic mackerel specifications in recent years recent years are far below the level of ABC, this measure is not expected to have any negative biological impacts on the Atlantic mackerel stock.

5.1.3 *Loligo* overfishing definition and control rule

5.1.3.1 Annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} consistent with requirements of Section 304e of the Magnuson-Stevens Act. In addition, Max OY, ABC, OY, and DAH may be specified for a period of up to three years (Preferred Alternative)

This measure modifies the overfishing definition for *Loligo* squid and allows for the in-season adjustment of the *Loligo* quota. The primary components of the overfishing definition that were required under the SFA and implemented under Amendment 8 (i.e,, the maximum fishing mortality rate threshold (F_{msy}) and the minimum biomass threshold (½ B_{msy})), remain unchanged. Under this measure, an annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} in a time period of at least three years but not greater than five years.

In addition to changes in the overfishing definition, the Council may specify Max OY, ABC, OY and DAH for up to three years. The Atlantic Mackerel Squid and Butterfish Monitoring Committee will meet in late spring to review available NEFSC survey data and develop recommendations about in-season adjustments to these specifications for consideration by the Atlantic Mackerel Squid and Butterfish Committee and the Council. Based on an evaluation of the most recent NEFSC spring and fall trawl survey data, the OY, DAH and ABC may be adjusted to be consistent with the control rule. Based on the recommendations of the Council, the Regional Administrator may make in-season adjustments, as appropriate based on the recommendations of the Council, through publication of a notice in the Federal Register of in-season adjustment action.

The *Loligo* fishery is managed pursuant to this FMP through an annual quota specification process. Annual quotas are specified based on the overfishing definition established in Amendment 8. Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management (FMP) was developed to bring the FMP into compliance with the Sustainable Fisheries Act (SFA). The SFA, which reauthorized and amended the Magnuson-Stevens Act, made a number of changes to the existing National Standards, as well as to definitions and other provisions in the Magnuson-Stevens Act, that caused the Guidelines to be significantly revised. The most significant changes were made to National Standard 1, which imposed new requirements concerning definitions of

overfishing in fishery management plans. The overfishing definition for Loligo was revised in Amendment 8 to comply with the SFA as follows: overfishing for *Loligo* will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{max} is exceeded (F_{max} is a proxy for F_{msy}). When an estimate of F_{msy} becomes available, it will replace the current overfishing proxy of F_{max}. Annual quotas will be specified which correspond to a target fishing mortality rate. Under Amendment 8 , target F was defined as 75% of the F_{msy} when biomass is greater than B_{msy}, and decreases linearly to zero 50% of B_{MSY}. Maximum OY is specified as the catch associated with a fishing mortality rate of F_{max}. In addition, the biomass target is specified to equal B_{MSY}.

The new requirements of the SFA required the Council to take remedial action for 2000 to rebuild the stock to a level which will produce MSY (B_{msy}) given the status determination that *Loligo* was approaching an overfished state. The control rule in Amendment 8 specified that the target fishing mortality rate must be reduced to zero if biomass falls below 50% of B_{msy}. The target fishing mortality rate increases linearly to 75% of F_{msy} as biomass increases to B_{msy}. However, projections made in SAW 29 indicate that the control rule adopted in Amendment 8 appears to be overly conservative. Projections from SAW 29 indicated that the *Loligo* biomass could be rebuilt to levels approximating B_{msy} in three years if fishing mortality was reduced to the target mortality rate specified in Amendment 8 of 75% of F_{msy}. In determining the specification of ABC for the year 2000, the Council considered advice offered by SAW 29 which indicated that the control rule adopted in Amendment 8 was too conservative. Model projections presented in the most recent assessment demonstrated that the stock could be rebuilt in a relatively short period of time (even at fishing mortality rates as high as 75% $F_{msy)}$. Based on projections conducted by the Atlantic Mackerel, Squid and Butterfish Monitoring Committee, the Council chose to specify ABC as the yield associated with 90% F_{msy} or 13,000 mt in 2000.

The most recent NEFSC survey data for *Loligo* squid indicate that abundance of this species has increased significantly since the most recent assessment was conducted (i.e, SAW-29). Estimates of biomass based on NEFSC fall 1999 and spring 2000 survey indices for *Loligo* indicate that the stock is currently at or near B_{msy}. In fact, the 1999 fall survey index was the sixth highest value observed in the time series since 1967 and the second highest since 1987. The 2000 spring survey index for *Loligo* was the tenth highest in the time series since 1968 and the fifth highest since 1987 (Lai, pers.comm). Based on the assumption that the stock will be at or near B_{msy} in 2001, the Council recommended that the 2001 quota be specified as the yield associated with 75% of F_{msy} . The yield associated with 75% of F_{msy} at B_{msy} is 17,000 mt based on projections in SAW-29 (NMFS 1999).

The Council is replacing the control rule because it was determined to be unnecessarily restrictive by SAW 29. For example, yield projections conducted since development of the overfishing control rule indicated that the *Loligo* stock could rebuild to B_{msy} in a relatively short period of time, even at fishing mortality rates approaching F_{msy}. In retrospect, the *Loligo* stock quickly rebounded to the B_{msy} level by 2000. If the Council had followed the

control rule implemented in Amendment 8 for the 2000 fishery, the *Loligo* fishery would have been closed for the entire year.

Under this alternative, the basic elements of the overfishing definition required by the SFA, the overfishing threshold (F_{msy}) and minimum biomass threshold (½ B_{msy}) will be retained. Since the stock will still be protected from overfishing, no negative biological impacts are expected from the adjustment to this management measure. In addition, the in-season adjustment mechanism will afford additional protection to the stock. For example, under the current management system, the annual specification for *Loligo* is determined a year in advance of the fishing year for which the specifications apply. Under the proposed alternative, the quota could be adjusted downward during the fishing season if it is determined to be necessary due to sudden changes (declines) in *Loligo* stock abundance. This will reduce the chance that overfishing can occur relative to the current system.

Since overfishing will be prevented, this will have a positive impact on the *Loligo* stock which, in turn, would be expected to positively affect the large number of species and stocks of marine mammals and predatory fish which prey on *Loligo* squid. Juvenile and adult *Loligo* are preyed upon by many pelagic and demersal fish species, as well as marine mammals and diving birds (Lange and Sissenwine 1980, Vovk and Khvichiya 1980, Summers 1983). Marine mammal predators include long-finned pilot whale, *Globicephala melas*, and common dolphin, *Delphinus delphis* (Waring *et al.* 1990, Overholtz and Waring 1991, Gannon *et al.* 1997). Fish predators include bluefish, sea bass, mackerel, cod, haddock, pollock, silver hake, red hake, sea raven, spiny dogfish, angel shark, goosefish, dogfish and flounder (Maurer 1975, Langton and Bowman 1977, Gosner 1978, Lange 1980). All of these species could be negatively impacted if the abundance of *Loligo* were to decline as a result of overfishing.

The Council chose this alternative as the preferred in an attempt to balance the need to end overfishing and rebuild overfished stocks with the need to minimize the economic burden placed on fishing communities during the rebuilding period. This alternative would allow the Council to adopt rebuilding horizons consistent with requirements of the Sustainable Fisheries Act (i.e, up to ten years). While the Council does not forsee utilizing rebuilding periods of up to the maximum of ten years, the strategy was adopted to retain the maximum flexibility allowable under the current statute for rebuilding the *Loligo* in stock future years. While it is difficult to quantify the risks associated with extended rebuilding periods, it can be stated that, in general, longer rebuilding periods pose greater risks to stock since they generally would allow for higher fishing mortality rates in the near term. However, yield would be expected to higher under these conditions which could help ameliorate some of the negative economic consequences for fishing communities during rebuilding. These trade-offs, including the associated risk analyses, will have to be evaluated on a case by case basis in the future.

5.1.3.2 Annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall

below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} in a time period of at least three years but not greater than five years

This measure modifies the overfishing definition for *Loligo* squid and allows for the in-season adjustment of the *Loligo* quota. The primary components of the overfishing definition that were required under the SFA and implemented under Amendment 8 (i.e,, the maximum fishing mortality rate threshold (F_{msy}) and the minimum biomass threshold (½ B_{msy})), remain unchanged. Under this measure, an annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} in a time period of at least three years but not greater than five years.

In addition to changes in the overfishing definition, the Council may specify Max OY, ABC, OY and DAH for up to three years. The Atlantic Mackerel Squid and Butterfish Monitoring Committee will meet in late spring to review available NEFSC survey data and develop recommendations about in-season adjustments to these specifications for consideration by the Atlantic Mackerel Squid and Butterfish Committee and the Council. Based on an evaluation of the most recent NEFSC spring and fall trawl survey data, the OY, DAH and ABC may be adjusted to be consistent with the control rule. Based on the recommendations of the Council, the Regional Administrator may make in-season adjustments, as appropriate based on the recommendations of the Council, through publication of a notice in the Federal Register of in-season adjustment action.

The *Loligo* fishery is managed pursuant to this FMP through an annual quota specification process. Annual quotas are specified based on the overfishing definition established in Amendment 8. Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management (FMP) was developed to bring the FMP into compliance with the Sustainable Fisheries Act (SFA). The SFA, which reauthorized and amended the Magnuson-Stevens Act, made a number of changes to the existing National Standards, as well as to definitions and other provisions in the Magnuson-Stevens Act, that caused the Guidelines to be significantly revised. The most significant changes were made to National Standard 1, which imposed new requirements concerning definitions of overfishing in fishery management plans. The overfishing definition for Loligo was revised in Amendment 8 to comply with the SFA as follows: overfishing for *Loligo* will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{max} is exceeded (F_{max} is a proxy for F_{msy}). When an estimate of F_{msy} becomes available, it will replace the current overfishing proxy of F_{max}. Annual quotas will be specified which correspond to a target fishing mortality rate. Under Amendment 8 , target F was defined as 75% of the F_{msy} when biomass is greater than B_{msy}, and decreases linearly to zero 50% of B_{MSY}. Maximum OY is specified as the catch associated with a fishing mortality rate of F_{max}. In addition, the biomass target is specified to equal B_{MSY}.

The new requirements of the SFA required the Council to take remedial action for 2000 to rebuild the stock to a level which will produce MSY (B_{msy}) given the status determination that *Loligo* was approaching an overfished state. The control rule in Amendment 8 specified that the target fishing mortality rate must be reduced to zero if biomass falls below 50% of B_{msy}. The target fishing mortality rate increases linearly to 75% of F_{msy} as biomass increases to B_{msy}. However, projections made in SAW 29 indicate that the control rule adopted in Amendment 8 appears to be overly conservative. Projections from SAW 29 indicated that the *Loligo* biomass could be rebuilt to levels approximating B_{msy} in three years if fishing mortality was reduced to the target mortality rate specified in Amendment 8 of 75% of F_{msy}. In determining the specification of ABC for the year 2000, the Council considered advice offered by SAW 29 which indicated that the control rule adopted in Amendment 8 was too conservative. Model projections presented in the most recent assessment demonstrated that the stock could be rebuilt in a relatively short period of time, even at fishing mortality rates approaching 75% of F_{msy}. Based on Monitoring Committee projections, the Council chose to specify ABC as the yield associated with 90% F_{msy} or 13,000 mt in 2000.

The most recent NEFSC survey data for *Loligo* squid indicate that abundance of this species has increased significantly since the most recent assessment was conducted (i.e, SAW-29). Estimates of biomass based on NEFSC fall 1999 and spring 2000 survey indices for *Loligo* indicate that the stock is currently at or near B_{msy}. In fact, the 1999 fall survey index was the sixth highest value observed in the time series since 1967 and the second highest since 1987. The 2000 spring survey index for *Loligo* was the tenth highest in the time series since 1968 and the fifth highest since 1987 (Lai, pers.comm). Based on the assumption that the stock will be at or near B_{msy} in 2001, the Council recommended that the 2001 quota be specified as the yield associated with 75% of F_{msy} . The yield associated with 75% of F_{msy} at B_{msy} is 17,000 mt based on projections in SAW-29 (NMFS 1999).

The Council is replacing the control rule because it was determined to be unnecessarily restrictive by SAW 29. For example, yield projections conducted since development of the overfishing control rule indicated that the *Loligo* stock could rebuild to B_{msy} in a relatively short period of time, even at fishing mortality rates approaching F_{msy}. In retrospect, the *Loligo* stock quickly rebounded to the B_{msy} level by 2000. If the Council had followed the control rule implemented in Amendment 8 for the 2000 fishery, the *Loligo* fishery would have been closed for the entire year.

Under this alternative, the basic elements of the overfishing definition required by the SFA, the overfishing threshold (F_{msy}) and minimum biomass threshold (½ B_{msy}) will be retained. Since the stock will still be protected from overfishing, no negative biological impacts are expected from the adjustment to this management measure. In addition, the in-season adjustment mechanism will afford additional protection to the stock. For example, under the current management system, the annual specification for *Loligo* is determined a year in advance of the fishing year for which the specifications apply. Under the proposed alternative, the quota could be adjusted downward during the fishing season if it is determined to be necessary due to sudden

changes (declines) in *Loligo* stock abundance. This will reduce the chance that overfishing can occur relative to the current system.

Since overfishing will be prevented, this will have a poisitive impact on the *Loligo* stock which, in turn, would be expected to positively affect the large number of species and stocks of marine mammals and predatory fish which prey on *Loligo* squid. Juvenile and adult *Loligo* are preyed upon by many pelagic and demersal fish species, as well as marine mammals and diving birds (Lange and Sissenwine 1980, Vovk and Khvichiya 1980, Summers 1983). Marine mammal predators include long-finned pilot whale, *Globicephala melas*, and common dolphin, *Delphinus delphis* (Waring *et al.* 1990, Overholtz and Waring 1991, Gannon *et al.* 1997). Fish predators include bluefish, sea bass, mackerel, cod, haddock, pollock, silver hake, red hake, sea raven, spiny dogfish, angel shark, goosefish, dogfish and flounder (Maurer 1975, Langton and Bowman 1977, Gosner 1978, Lange 1980). All of these species could be negatively impacted if the abundance of *Loligo* were to decline as a result of overfishing..

5.1.3.3 Annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} in a time period of at least five years but not greater than ten years.

This measure modifies the overfishing definition for *Loligo* squid and allows for the in-season adjustment of the *Loligo* quota. The primary components of the overfishing definition that were required under the SFA and implemented under Amendment 8 (i.e,, the maximum fishing mortality rate threshold (F_{msy}) and the minimum biomass threshold (½ B_{msy})), remain unchanged. Under this measure, an annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} in a time period of at least five years but not greater than ten years.

In addition to changes in the overfishing definition, the Council may specify Max OY, ABC, OY and DAH for up to three years. The Atlantic Mackerel Squid and Butterfish Monitoring Committee will meet in late spring to review available NEFSC survey data and develop recommendations about in-season adjustments to these specifications for consideration by the Atlantic Mackerel Squid and Butterfish Committee and the Council. Based on an evaluation of the most recent NEFSC spring and fall trawl survey data, the OY, DAH and ABC may be adjusted to be consistent with the control rule. Based on the recommendations of the Council, the Regional Administrator may make in-season adjustments, as appropriate based on the recommendations of the Council, through publication of a notice in the Federal Register of in-season adjustment action.

The *Loligo* fishery is managed pursuant to this FMP through an annual quota specification process. Annual quotas are specified based on the overfishing

definition established in Amendment 8. Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management (FMP) was developed to bring the FMP into compliance with the Sustainable Fisheries Act (SFA). The SFA, which reauthorized and amended the Magnuson-Stevens Act, made a number of changes to the existing National Standards, as well as to definitions and other provisions in the Magnuson-Stevens Act, that caused the Guidelines to be significantly revised. The most significant changes were made to National Standard 1, which imposed new requirements concerning definitions of overfishing in fishery management plans. The overfishing definition for Loligo was revised in Amendment 8 to comply with the SFA as follows: overfishing for *Loligo* will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{max} is exceeded (F_{max} is a proxy for F_{msy}). When an estimate of F_{msy} becomes available, it will replace the current overfishing proxy of F_{max}. Annual quotas will be specified which correspond to a target fishing mortality rate. Under Amendment 8 , target F was defined as 75% of the F_{msy} when biomass is greater than B_{msy}, and decreases linearly to zero 50% of B_{MSY}. Maximum OY is specified as the catch associated with a fishing mortality rate of F_{max}. In addition, the biomass target is specified to equal B_{MSY}.

The new requirements of the SFA required the Council to take remedial action for 2000 to rebuild the stock to a level which will produce MSY (B_{msy}) given the status determination that *Loligo* was approaching an overfished state. The control rule in Amendment 8 specified that the target fishing mortality rate must be reduced to zero if biomass falls below 50% of B_{msy}. The target fishing mortality rate increases linearly to 75% of F_{msy} as biomass increases to B_{msy}. However, projections made in SAW 29 indicate that the control rule adopted in Amendment 8 appears to be overly conservative. Projections from SAW 29 indicated that the *Loligo* biomass could be rebuilt to levels approximating B_{msy} in three years if fishing mortality was reduced to the target mortality rate specified in Amendment 8 of 75% of F_{msy}. In determining the specification of ABC for the year 2000, the Council considered advice offered by SAW 29 which indicated that the control rule adopted in Amendment 8 was too conservative. Model projections presented by the Monitoring Committee demonstrated that the stock could be rebuilt in a relatively short period of time. Based on these projections, the Council chose to specify ABC as the yield associated with 90% F_{msy} or 13,000 mt in 2000.

The most recent NEFSC survey data for *Loligo* squid indicate that abundance of this species has increased significantly since the most recent assessment was conducted (i.e, SAW-29). Estimates of biomass based on NEFSC fall 1999 and spring 2000 survey indices for *Loligo* indicate that the stock is currently at or near B_{msy}. In fact, the 1999 fall survey index was the sixth highest value observed in the time series since 1967 and the second highest since 1987. The 2000 spring survey index for *Loligo* was the tenth highest in the time series since 1968 and the fifth highest since 1987 (Lai, pers.comm). Based on the assumption that the stock will be at or near B_{msy} in 2001, the Council recommended that the 2001 quota be specified as the yield associated with 75% of F_{msy} . The yield associated with 75% of F_{msy} at B_{msy} is 17,000 mt based on projections in SAW-29 (NMFS 1999).

The Council is replacing the control rule because it was determined to be unnecessarily restrictive by SAW 29. For example, yield projections conducted since development of the overfishing control rule indicated that the *Loligo* stock could rebuild to B_{msy} in a relatively short period of time. In retrospect, the *Loligo* stock quickly rebounded to the B_{msy} level by 2000. If the Council had followed the control rule implemented in Amendment 8 for the 2000 fishery, the *Loligo* fishery would have been closed for the entire year.

Like the preferred alternative, this alternative preserves the basic elements of the overfishing definition required by the SFA (the overfishing threshold (F_{msy}) and minimum biomass threshold (½ B_{msy}) will be retained). If the stock is not protected from overfishing, some negative biological impacts could be expected from the implementation of this measure. If overfishing were not prevented, negative impacts on the *Loligo* stock could occur which, in turn, would be expected to negatively affect the large number of species and stocks of marine mammals and predatory fish which prey on *Loligo* squid. Juvenile and adult *Loligo* are preyed upon by many pelagic and demersal fish species, as well as marine mammals and diving birds (Lange and Sissenwine 1980, Vovk and Khvichiya 1980, Summers 1983). Marine mammal predators include long-finned pilot whale, *Globicephala melas*, and common dolphin, *Delphinus delphis* (Waring *et al.* 1990, Overholtz and Waring 1991, Gannon *et al.* 1997). Fish predators include bluefish, sea bass, mackerel, cod, haddock, pollock, silver hake, red hake, sea raven, spiny dogfish, angel shark, goosefish, dogfish and flounder (Maurer 1975, Langton and Bowman 1977, Gosner 1978, Lange 1980). All of these species could be negatively impacted if the abundance of *Loligo* were to decline as a result of overfishing.

5.1.3.4 Maintain current control rule for *Loligo* (no action/status quo).

Under this option, the overfishing definition and control rule adopted in Amendment 8 would remain unchanged. Overfishing for *Loligo* was defined in Amendment 8 to occur when the catch associated with a threshold fishing mortality rate of F_{msy} is exceeded. Annual quotas are specified which correspond to a target fishing mortality rate of 75 % of F_{max}. Target F is defined as 75% of the F_{msy} when biomass is greater than 80,000 mt, and decreases linearly to zero at 40,000 mt (½ of the B_{MSY} proxy). Relative to the preferred alternative with respect to the overfishing definition and control rule, there would not be any negative biological consequences expected from the no action alternative.

5.1.4 Allow for an exemption from the *Loligo* trip limit during periods of closure of the directed *Loligo* fishery for vessels engaged in the *Illex* fishery

5.1.4.1 Vessels possessing *Illex* squid moratorium permits would be permitted to possess *Loligo* taken seaward of the 50 fathom curve in an amount not to exceed 10% of the total weight of *Illex* on board during a period of closure of the *Loligo* fishery during the months of August or September.

The 2,500 pound trip limit for *Loligo* during directed *Loligo* fishery closures creates a compliance problem for *Illex* squid fishery vessels which

occasionally take higher levels of *Loligo* incidental to pursuit of *Illex* squid. During the months of June, July, August, and September otter trawl vessels participating in the directed fishery for *Illex* are be exempt from the *Loligo* minimum mesh requirements if they possess *Loligo*. For the purposes of this mesh exemption, the directed *Illex* fishery for this time period is defined as otter trawl fishing for *Illex* seaward of the 50 fathom depth contour. This mesh exemption was included Amendment 5 because of concerns raised by fishermen that a small bycatch of *Loligo* can be expected in the *Illex* fishery. Industry advisors testified that the *Loligo* bycatch is very small and that almost all of the *Illex* fishing during this period occurs outside of the 50 fathom depth contour.

Members of the directed *Illex* industry testified at Council meetings that there has been a recent shift of *Loligo* to offshore waters in certain years at or near the end of the period when the directed *Illex* fishery is prosecuted (i.e., August or September). They testified that the 2,500 *Loligo* trip limit during periods of closure of the directed *Loligo* fishery has caused compliance problems for vessels operating in the directed *Illex* fishery since the recent implementation of restrictive quotas in the *Loligo* fishery. No at sea observations or vessel trip report data are currently available to estimate the magnitude of this problem.

The framework measure proposed here would build on the current mesh exemption but would be limited to the months of August or September. Under this measure, vessels which possess *Illex* squid moratorium permits fishing east of the 50 fathom contour would be permitted to possess *Loligo* in an amount not to exceed 10% of the total weight of *Illex* on board during a period of closure of the *Loligo* fishery during the months of August or September.

Overall, since the annual quota is the chief mechanism used to control fishing mortality in the *Loligo* fishery, the *Illex* fishery exemption from the 2500 pound trip limit during periods of closure of the directed *Loligo* fishery during August or September is not expected to have any negative biological impacts on the *Loligo* stock. However, the bycatch allowance in the *Illex* fishery could result in an overage in the third quarter of the *Loligo* fishery and/or reduce the amount of *Loligo* available for quarter 4 relative to the status quo. To estimate the possible impact of the 10% *Illex* exemption under this option, landings data from 1999 was examined. This year was chosen because it is the last year for which a complete data set is available for which no closures of the *Loligo* fishery occurred. In August or September 1999 there were 34 trips which landed more than 25,000 lbs of *Illex* in the NMFS Dealer report data base. Trips less than 25,000 lbs were not included in the analysis because the effect on these trips would be the same under either the current 2,500 lb trip limit or the proposed 10% bycatch allowance (i.e., these trips would be limited to 2,500 lb of *Loligo* under either scenario). Of these 34 trips, there were 20 (or 59%) which landed greater than 2,500 lb of *Loligo*. The amount of *Loligo* landed on these trips ranged from 2,700 lb - 60,405 lbs. If the directed *Loligo* fishery had been closed on August 1 (i.e., directed *Loligo* fishery closed August or September of 1999), these trips would have landed 62,353 under the 2,500 lb trip limit. Under the 10% exemption

option, these trips would have been expected to land 182,790 lbs of *Loligo* (i.e., under the condition that the amount of *Loligo* landed would not exceed 10% of the *Illex* landed on that trip). Therefore, under the 10% allowance these trips would have landed an additional 120,500 lb of *Loligo* relative to operating under the 2,500 lb trip limit. This amount represents the additional landings that would result from the 10% bycatch allowance and come at the "expense" of the quarter 4 allocation.

Current regulations specify that the directed *Loligo* fishery is to be closed during the last quarter when 95% of the total quota for the year is taken. The fishery remains open for the remainder of the fishing year at the bycatch level of 2,500 lbs. Assuming that no quota overages occur during the first three quarters (i.e., assuming that 100% of the quota allocation for each quarter is taken but not exceeded), the directed fishery quota for quarter 4 would be 10,066,204 lb. Therefore, the additional *Loligo* taken during quarter 3 under the 10% *Illex* exemption would represent about 1.8% of the quarter 4 directed fishery quota if the directed *Loligo* fishery was closed on August 1, 2001 in quarter 3 (Table 30).

The most likely closure date of the directed *Loligo* fishery in quarter 3 (based on the 2001 specifications), was estimated based on the average weekly landings of *Loligo* for the period 1997-1999. This time frame was chosen because it is the most recent three year period during which no closure of the directed *Loligo* fishery occurred. Based on observed weekly landings during quarter 3 for the period 1997-1999, it was projected that the directed Loligo fishery would close at the end of week 37. Therefore, the projected closure date would be 19 September 2001 or the last two weeks of quarter 3. Assuming the directed *Loligo* fishery is closed on this date, the expected level of *Loligo* landings under the *Illex* exemption would be 40,620 pounds or about 0.4% of the directed fishery allocation in quarter 4 (Table 30). Based on the observed level of bycatch in 1999 and a projected closure during weeks weeks 38 and 39, this measure is not expected to increase the chance that an overage would occur relative to the annual quota. For example, based on the allocation of *Loligo* in 2001, the directed fishery is expected to close during quarter 4 at the end of week 49 (i.e., the fishery is expected to be closed the last three weeks of the year). The additional *Loligo* landings due to the *Illex* exemption under the scenario just described is not expected to change the week of closure. The additional landings under the closed fishery are expected to be about 181,000 lbs based on observed bycatch landings during the closure of quarter 4 in 2000 (the fishery averaged 60,353 lb per week from weeks 46-52. Since this level of *Loligo* bycatch is the most likely level expected under the 10% *Illex* exemption, this measure is not expected to result in any negative biological impacts for the *Loligo* stock due to a quota overage.

However, the worst case scenario under the 10% *lllex* exemption that can be constructed would be to assume that all trips that landed greater than 25,000 pounds of *Illex* during August or September would retain *Loligo* in the amount equal to 10% of the *Illex* landed. This analysis was based on unpublished NMFS dealer reports for trips that landed greater than 25,000 pounds of *Illex*

during August or September for the period 1997-1999. An estimate of the amount of *Loligo* expected to be landed under these conditions was obtained as the product of 0.1 and the average amount of *Illex* landed per week for the three year period 1997-1999. Assuming that the directed *Loligo* fishery is closed on August 1, 2001 and the worst case level of *Loligo* retention is realized, 1,228,287 lbs of *Loligo* would be the maximum amount expected under the 10% exemption rule (Table 31). The expected level of *Loligo* retention under these conditions is given by closure week in Table 31. As noted above, the actual projected closure date based on 1997-1999 *Loligo* landings by week would be expected to occur on or about September 19, 2001 (i.e, the directed fishery would be closed for weeks 38 and 39). Assuming this closure period and if the worst case level of *Loligo* retention is realized, 113,448 lbs of *Loligo* would be the maximum amount expected under the 10% exemption rule (Table 31). This would represent about 1.1% of the directed fishery allocation in quarter 4 (Table 31).

While the 10% *lllex* exemption would reduce the directed fishery in Q4 for *Loligo* by the amounts indicated, the additional amounts taken are not expected to cause an overage of the Q4 quota. During 2000, the directed *Loligo* fishery was closed at the end of the week 43. The observed level of landings under the 2500 pound trip limit in 2000 during weeks 44-52 averaged only about 72,000 pounds per week. When the directed fishery is closed in Q4, about 1.9 million pounds of bycatch quota will remain. This would allow for a season of 26 days at the bycatch level assuming a landing rate of 72,000 pounds per week. The observed level of average *Loligo* landings during weeks 40-49 based on 1997-1999 was about 1.0 million pounds of *Loligo* per week. The worst case scenario (10% *Loligo* landed on all *Illex* trips in August or September) would be expected to shorten the Q4 directed *Loligo* fishery by about 9 days. Therefore, even under the worst case scenario level of bycatch and a projected closure during weeks 38 and 39, this measure is not expected to increase the chance that an overage would occur relative to the annual quota. Therefore, this measure is not expected to result in any negative biological impacts for the *Loligo* stock due to a quota overage, even under the worst case scenario. It should be noted that the analyses presented above relative to predicted closure dates for the *Loligo* fishery were based on patterns of historical landings during the period 1997-1999. During this time period, the quota was allocated to the entire fishing year with no seasonal allocation of the quota. Since then, the *Loligo* quota has been divided into quarterly allocations, which is likely to change fishing behavior relative to the 1997-1999 period. As a result, the predicted closure date could differ depending on the nature of the alteration of fishing behavior.

5.1.4.2 Vessels possessing *Illex* squid moratorium permits would be permitted to possess *Loligo* in an amount not to exceed 20%of the total weight of *Illex* on board during a period of closure of the *Loligo* fishery during the months of June-September.

The 2,500 pound trip limit for *Loligo* during directed *Loligo* fishery closures creates a compliance problem for *Illex* squid fishery vessels which occasionally take higher levels of *Loligo* incidental to pursuit of *Illex*

squid. During the months of June, July, August, and September, otter trawl vessels participating in the directed fishery for *Illex* are be exempt from the *Loligo* minimum mesh requirements if they possess *Loligo*. For the purposes of this mesh exemption, the directed *Illex* fishery for this time period is defined as otter trawl fishing for *Illex* seaward of the 50 fathom depth contour. This mesh exemption was included Amendment 5 because of concerns raised by fishermen that a small bycatch of *Loligo* can be expected in the *Illex* fishery. Industry advisors testified that the *Loligo* bycatch is very small and that almost all of the *Illex* fishing during this period occurs outside of the 50 fathom depth contour. The framework measure proposed here would build on the current mesh exemption. Under this measure, vessels which possess *Illex* squid moratorium permits would be permitted to possess *Loligo* in an amount not to exceed 20% of the total weight of *Illex* on board during a period of closure of the *Loligo* fishery during the months of June-September.

Overall, since the annual quota is the chief mechanism used to control fishing mortality in the *Loligo* fishery, the *Illex* fishery exemption from the 2500 pound trip limit during periods of closure of the directed *Loligo* fishery during June-September is not expected to have any negative biological impacts on the *Loligo* stock. However, the bycatch allowance in the *Illex* fishery could result in an overage in the third quarter of the *Loligo* fishery and/or reduce the amount of *Loligo* available for quarter 4 relative to the status quo. Any additional landings that would result from the 20% bycatch allowance come at the “expense” of the quarter 4 allocation.

Current regulations specify that the directed *Loligo* fishery is to be closed during the last quarter when 95% of the total quota for the year is taken. The fishery remains open for the remainder of the fishing year at the bycatch level of 2,500 lbs. Assuming that no quota overages occur during the first three quarters (i.e., assuming that 100% of the quota allocation for each quarter is taken but not exceeded), the directed fishery quota for quarter 4 would be 10,066,204 lb.

The most likely closure date of the directed *Loligo* fishery in quarter 3 (based on the 2001 specifications), was estimated based on the average weekly landings of *Loligo* for the period 1997-1999. This time frame was chosen because it is the most recent three year period during which no closure of the directed *Loligo* fishery occurred. Based on observed weekly landings during quarter 3 for the period 1997-1999, it was projected that the directed *Loligo* fishery would likely close at the end of week 37. Therefore, the projected closure date would be 19 September 2001 or the last two weeks of quarter 3.

The worst case scenario under the 20% *lllex* exemption that can be constructed would be to assume that all trips that landed greater than 12,550 pounds of *Illex* during June through September would retain *Loligo* in the amount equal to 20% of the *Illex* landed. This analysis was based on unpublished NMFS dealer reports for trips that landed greater than 12,500 pounds of *Illex* during June and September for the period 1997-1999. An estimate of the amount of *Loligo* expected to be landed under these conditions was obtained as the product of 0.2 and the average amount of *Illex* landed per week for the three year period

1997-1999. Assuming that the directed *Loligo* fishery is closed on June 1, 2001 and the worst case level of *Loligo* retention is realized, 3,845,307 lbs of *Loligo* would be the maximum amount expected under the 20% exemption rule (Table 32). The expected level of *Loligo* retention under these conditions is given by closure week in Table 32. As noted above, the actual projected closure date based on 1997-1999 *Loligo* landings by week would be expected to occur on or about September 19, 2001 (i.e, the directed fishery would be closed for weeks 38 and 39). Assuming this closure period and if the worst case level of *Loligo* retention is realized under the 20% rule, 205,517 lbs of *Loligo* would be the maximum amount expected under the 20% exemption rule (Table 32). This would represent about 2.0% of the directed fishery allocation in quarter 4 (Table 32). Based on the worst case scenario level of bycatch (20%) and a projected closure during weeks 22-39, this measure would be expected to increase the chance that an overage would occur relative to the annual quota. Therefore, this measure could result in negative biological impacts for the *Loligo* stock due to a quota overage if the worst case scenario was realized.

5.1.4.3 No exemption from the 2,500 lb *Loligo* trip limit during a period of closure of the *Loligo* fishery (no action/status quo).

Under the no action alternative vessels fishing in the *Illex* fishery would not be exempt from the *Loligo* trip limit during periods when the directed *Loligo* fishery is closed and would be restricted to 2,500 lbs per trip. Overall, since the annual quota is the chief mechanism used to control fishing mortality in the *Loligo* fishery, the 2500 pound trip limit during periods of closure of the directed *Loligo* fishery r is not expected to have any negative biological impacts on the *Loligo* stock.

5.2 Economic and Social Impacts

5.2.1 Moratorium on entry to *Illex* fishery

5.2.1.1 Extend the moratorium on entry to the *Illex* fishery for an additional year (moratorium on entry to the *Illex* fishery would expire in 2003 unless extended in next Amendment) (Preferred Alternative).

Prior to the 1980's, the fishery for *Illex* in the US EEZ was prosecuted primarily by the foreign distant water fleets. With the implementation of the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan and it's subsequent Amendments, the fishery has become fully Americanized. At the same time that the domestic fishery was undergoing development, new biological data became available which indicated that *Illex* is an annual species. This resulted in downwardly revised estimates of the potential yield from this fishery. The simultaneous growth of the domestic fishery and reduction in estimates of sustainable yields resulted in the fishery moving towards a fully capitalized and exploited state. Hence, there was a moratorium on entry of additional commercial vessels into the *Illex* squid fisheries in the EEZ implemented as part Amendment 5.

Under the Amendment 5, a vessel was eligible for a moratorium permit in the *Illex* fishery if it met any of the following criteria: 1) The vessel had five landings (including at-sea joint venture transfers) of 5,000 pounds of *Illex* (that is, landed 5 trips of at least 5,000 pounds) between 13 August 1981 and 13 August 1993, or 2) The vessel is replacing a vessel of substantially similar harvesting capacity which involuntarily left the *Illex* squid fishery during the moratorium, and both the entering and replaced vessels are owned by the same person. "Substantially similar harvesting capacity" means the same or less GRT and vessel registered length for commercial vessels, or 3) the vessel was under construction for, or was being rerigged for, use in the directed fishery for *Illex* on 13 August 1993 and provided the vessel has landed the required amount of *Illex* for sale specified above (5 trips of at least 5,000 lbs) prior to December 31, 1994. For the purpose of this paragraph, "under construction" means that the keel had been laid or the vessel was under written agreement for construction or the vessel was under written contract for purchase. "Being rerigged" means physical alteration of the vessel or its gear had begun to transform the vessel into one capable of fishing commercially for *Illex*. 4) Vessels that are judged unseaworthy by the Coast Guard for reasons other than lack of maintenance may be replaced by a vessel with the same GRT and vessel registered length for commercial vessels 5) The moratorium terminates at the end of the fifth year following implementation unless extended by FMP Amendment.
As noted above, due to concerns that capacity might be insufficient to fully exploit the annual quota, a five year sunset provision was placed on the *Illex* moratorium when it was implemented as part of Amendment 5. The sunset provision for the moratorium entry into the *Illex* fishery, implemented in 1997, is set to expire in July 1, 2002.

One of the major concerns raised during the development of the original moratorium program in Amendment 5 was that the fleet which would qualify under the proposed *Illex* moratorium program would not be capable of taking the entire annual quota. In response to this concern, the Council placed the five year sunset provision on the *Illex* moratorium program. The intent of this measure was to allow time to determine if the harvest capacity of the fleet was sufficient to take all of the available annual quota. Since then, the *Illex* fleet has demonstrated that fleet capacity was more than sufficient to land the annual quota when the *Illex* fleet landed in excess of the annual quota in 1998. During 1998, a number of factors contributed to the record harvest of the domestic squid *Illex illecebrosus* and early closure of the fishery. These included relatively high abundance and availability of *Illex illecebrosus* to the US fleet combined with high world market price and demand resulting from a major decline in production of *Illex argentenius* in the Falkland Islands in the South Atlantic. As a result of these conditions, US production of *Illex* exceeded 23,000 mt in1998, thus demonstrating that US harvest capacity under the *Illex* moratorium program adopted in Amendment 5 was more than sufficient to land the long term sustainable level of harvest.
While more recent landings data are available to describe the *Illex* fishery, a discussion of the 1998 fishery is given here because it demonstrates that the harvest capacity of the Illex moratorium fleet is sufficient to land the long term level of sustainable yield for this resource. In addition, a discussion

of the data available at the time that Amendment 5 was being developed is also given to describe the context within which the Council made decisions relative to limiting access to the *Illex* fishery.

The most recent data available at the time that Amendment 5 was being developed indicated that there were 3,061 vessels with Federal commercial permits issued pursuant to the Atlantic Mackerel, Squid, and Butterfish FMP (based on 1993 NMFS data). The hold capacity of those vessels was determined to be approximately 50,000 mt. Based on unpublished 1993 NMFS weighout data for *Illex*, 18 out of 53 vessels (33%) which reported landing any *Illex* accounted for 99% of the total. Total US *Illex* landings were 18,012 mt in 1993. A total of 53 vessels made these landings in 438 trips during 1993. The average catch per trip was 90,662 lbs. The majority of vessels landed in excess of 50,000 lbs per trip. In terms of landings per year, the average vessel in the *Illex* fishery landed roughly 750,000 lbs in 1993. These data were significant in determining the need for entry limitation into the *Illex* fishery because they highlighted the nature of the vessels engaged in this fully-utilized fishery. Unlike the *Loligo* fishery, the *Illex* fleet and fishery are comprised of relatively large vessels which land substantial quantities of *Illex* per vessel. As a result, the Council concluded during the development of Amendment 5 that incremental entry of new effort into this fishery would quickly result in it’s over-capitalization and jeopardize both the stock and the fishery. This situation has not changed.

Discussion of the number of vessels that would qualify for the *Illex* squid moratorium was based on the Northeast Fishery Science Center weighout files. Under the preferred alternative qualifying criteria for an *Illex* moratorium permit in Amendment 5, 52 vessels were expected to qualify based on NMFS weighout data. However, the number of vessels which actually qualified for an *Illex* moratorium permit under Amendment 5 was much larger. In 2000, there were 77 vessels which possessed *Illex* moratorium permits and 1,704 vessels which possessed incidental catch permits. As noted above, analyses conducted for Amendment 5 estimated that approximately 52 vessels would qualify for *Illex* moratorium permits. This estimate was based on an analysis of NMFS weighout data which did not include landings taken as a result of joint venture activities during the 1980's. Vessels could qualify for an *Illex* moratorium permit if they demonstrated landing five trips of 5,000 pounds over a qualifying period which extended back to 1981 (landings made as a result of joint ventures were also eligible). As a result, a much larger number of vessels qualified for an *Illex* moratorium permit than was anticipated based on data and analyses considered during the development of Amendment 5 (i.e., as estimated based on weighout data alone). Hence, the harvest capacity of the vessels which qualified under the *Illex* moratorium program established in Amendment 5 substantially exceeds the level necessary to harvest the long term sustainable yield for *Illex*. This became apparent in 1998, when a total of 110 vessels landed 23,567 mt of *Illex* squid (i.e., the annual quota was exceeded). These vessels included two categories: vessels with moratorium permits and vessels with incidental catch permits. While there were 77 vessels which could have landed *Illex* in the directed fishery because they possessed moratorium permits, however 18 vessels accounted for more than 95%

of the *Illex* landings in 1998. Fishery performance and production in 1998 clearly indicated that the current *Illex* moratorium fleet possesses harvest capacity far in excess of what is necessary to harvest the long term potential yield from this fishery.

Failure to extend the moratorium would result in further overcapitalization of this sector of the fishing industry, which in turn would have negative economic consequences for the vessels and communities which depend upon the *Illex* resource. The distribution of vessels which possessed *Illex* moratorium permits by home port state is given in Table 12. Overall, New Jersey would appear to be the state most dependent on the *Illex* resource followed by New York, Massachusetts and Rhode Island. The size distribution of those vessels is given in Table 33. Additional entry into this fishery would be expected to proportionately reduce the landings and revenue of vessels currently operative within the moratorium fleet (see analyses contained in RIR Section). The only port dependent upon *Illex* for more than 10 % of total revenues in 1999 was North Kingstown, RI (12.7%). Therefore, the vessel owners, crew, dealers or processors and fishing communities associated with this port are expected to be affected the most by failure to extend the moratorium program for *Illex*. The extension of the moratorium under this framework option would maintain the status quo in the fishery at least until 2003. This will allow the Council more time to consider longer term measures for the *Illex* moratorium in the next amendment to the FMP. Vessels which took small quantities in the past will be able to continue to do so under the bycatch provisions of the FMP. However, further expansion of entry into the directed *Illex* fisheries will be controlled for at least one more year, thus overfishing and over-capitalization will be avoided.

5.2.1.2 Extend the moratorium on entry to the *Illex* fishery for an additional five years (moratorium on entry to the *Illex* fishery would expire in 2007 unless extended in future Amendment).

As noted above, Amendment 5 established a moratorium on new entry into the commercial fishery for *Illex* squid. The Council placed a five year sunset provision on the moratorium which is set to expire in July 2002. This measure would extend the *Illex* moratorium for an additional five years. Under this measure, only vessels which possess *Illex* moratorium permits during calendar year 2002 would be eligible for *Illex* moratorium permits under the moratorium extension. Under this alternative, the moratorium on entry to the *Illex* fishery would expire in 2007 unless extended in a future Amendment.

Prior to the 1980's, the fishery for *Illex* in the US EEZ was prosecuted primarily by the foreign distant water fleets. With the implementation of the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan and it's subsequent Amendments, the fishery has become fully Americanized. At the same time that the domestic fishery was undergoing development, new biological data became available which indicated that *Illex* is an annual species. This resulted in downwardly revised estimates of the potential yield from this fishery. The simultaneous growth of the domestic fishery and reduction in estimates of sustainable yields resulted in the fishery moving towards a fully capitalized and exploited state. Hence, there was a moratorium on entry of

additional commercial vessels into the *Illex* squid fisheries in the EEZ implemented as part Amendment 5.

Under the Amendment 5, a vessel was eligible for a moratorium permit in the *Illex* fishery if it met any of the following criteria: 1) The vessel had five landings (including at-sea joint venture transfers) of 5,000 pounds of *Illex* (that is, landed 5 trips of at least 5,000 pounds) between 13 August 1981 and 13 August 1993, or 2) The vessel is replacing a vessel of substantially similar harvesting capacity which involuntarily left the *Illex* squid fishery during the moratorium, and both the entering and replaced vessels are owned by the same person. "Substantially similar harvesting capacity" means the same or less GRT and vessel registered length for commercial vessels, or 3) the vessel was under construction for, or was being rerigged for, use in the directed fishery for *Illex* on 13 August 1993 and provided the vessel has landed the required amount of *Illex* for sale specified above (5 trips of at least 5,000 lbs) prior to December 31, 1994. For the purpose of this paragraph, "under construction" means that the keel had been laid or the vessel was under written agreement for construction or the vessel was under written contract for purchase. "Being rerigged" means physical alteration of the vessel or its gear had begun to transform the vessel into one capable of fishing commercially for *Illex*. 4) Vessels that are judged unseaworthy by the Coast Guard for reasons other than lack of maintenance may be replaced by a vessel with the same GRT and vessel registered length for commercial vessels 5) The moratorium terminates at the end of the fifth year following implementation unless extended by FMP Amendment.

As noted above, due to concerns that capacity might be insufficient to fully exploit the annual quota, a five year sunset provision was placed on the *Illex* moratorium when it was implemented as part of Amendment 5. The sunset provision for the moratorium entry into the *Illex* fishery, implemented in 1997, is set to expire in July 1, 2002.

One of the major concerns raised during the development of the original moratorium program in Amendment 5 was that the fleet which would qualify under the proposed *Illex* moratorium program would not be capable of taking the entire annual quota. In response to this concern, the Council placed the five year sunset provision on the *Illex* moratorium program. The intent of this measure was to allow time to determine if the harvest capacity of the fleet was sufficient to take all of the available annual quota. Since then, the *Illex* fleet has demonstrated that fleet capacity was more than sufficient to land the annual quota when the *Illex* fleet landed in excess of the annual quota in 1998. During 1998, a number of factors contributed to the record harvest of the domestic squid *Illex illecebrosus* and early closure of the fishery. These included relatively high abundance and availability of *Illex illecebrosus* to the US fleet combined with high world market price and demand resulting from a major decline in production of *Illex argentenius* in the Falkland Islands in the South Atlantic. As a result of these conditions, US production of *Illex* exceeded 23,000 mt in1998, thus demonstrating that US harvest capacity under the *Illex* moratorium program adopted in Amendment 5 was more than sufficient to land the long term sustainable level of harvest.

The most recent data available at the time that Amendment 5 was being developed indicated that there were 3,061 vessels with Federal commercial permits issued pursuant to the Atlantic Mackerel, Squid, and Butterfish FMP (based on 1993 NMFS data). The hold capacity of those vessels was determined to be approximately 50,000 mt. Based on unpublished 1993 NMFS weighout data for *Illex*, 18 out 53 vessels (33%) which reported landing any *Illex* accounted for 99% of the total. Total US *Illex* landings were 18,012 mt in 1993. A total of 53 vessels made these landings in 438 trips during 1993. The average catch per trip was 90,662 lbs. The majority of vessels landed in excess of 50,000 lbs per trip. In terms of landings per year, the average vessel in the *Illex* fishery landed roughly 750,000 lbs in 1993. These data were significant in determining the need for entry limitation into the Illex fishery because they highlighted the nature of the vessels engaged in this fully-utilized fishery. Unlike the *Loligo* fishery, the *Illex* fleet and fishery are comprised of relatively large vessels which land substantial quantities of *Illex* per vessel. As a result, the Council concluded during the development of Amendment 5 that incremental entry of new effort into this fishery would quickly result in it's over-capitalization and jeopardize both the stock and the fishery. This situation remains unchanged.

Discussion of the number of vessels that would qualify for the *Illex* squid moratorium was based on the Northeast Fishery Science Center weighout files. Under the preferred alternative qualifying criteria for an *Illex* moratorium permit in Amendment 5, 52 vessels were expected to qualify based on NMFS weighout data. However, the number of vessels which actually qualified for an *Illex* moratorium permit under Amendment 5 was much larger. In 2000, there were 77 vessels which possessed *Illex* moratorium permits and 1,704 vessels which possessed incidental catch permits. As noted above, analyses conducted for Amendment 5 estimated that approximately 52 vessels would qualify for *Illex* moratorium permits. This estimate was based on an analysis of NMFS weighout data which did not include landings taken as a result of joint venture activities during the 1980's. Vessels could qualify for an *Illex* moratorium permit if they demonstrated landing five trips of 5,000 pounds over a qualifying period which extended back to 1981 (landings made as a result of joint ventures were also eligible). As a result, a much larger number of vessels qualified for an *Illex* moratorium permit than was anticipated based on data and analyses considered during the development of Amendment 5 (i.e., as estimated based on weighout data alone). Hence, the harvest capacity of the vessels which qualified under the *Illex* moratorium program established in Amendment 5 substantially exceeds the level necessary to harvest the long term sustainable yield for *Illex*. This became apparent in 1998, when a total of 110 vessels landed 23,567 mt of *Illex* squid (i.e., the annual quota was exceeded). These vessels included two categories: vessels with moratorium permits and vessels with incidental catch permits. While there were 77 vessels which could have landed *Illex* in the directed fishery because they possessed moratorium permits, however 18 vessels accounted for more than 95% of the *Illex* landings in 1998. Fishery performance and production in 1998 clearly indicated that the current *Illex* moratorium fleet possesses harvest

capacity far in excess of what is necessary to harvest the long term potential yield of the fishery.

Failure to extend the moratorium would result in further overcapitalization of this sector the fishing industry, which in turn would have negative economic consequences for the vessels and communities which depend upon the *Illex* resource. The distribution of vessels which possessed *Illex* moratorium permits by home port state is given in Table 12. The size distribution of those vessels is given in Table 33. Overall, New Jersey would appear to be the state most dependent on the *Illex* resource followed by New York, Massachusetts and Rhode Island. Additional entry into this fishery would be expected to proportionately reduce the landings and revenue of vessels currently operative within the moratorium fleet (see analyses contained in the RIR Section of the RIR). Table 15 indicated that the only port dependent upon *Illex* for more than 10 % of total revenues in 1999 was North Kingstown, RI (12.7%). Therefore, the vessel owners, crew, dealers or processors and fishing communities associated with this port are expected to be affected the most by failure to extend the moratorium program for *Illex*.

The extension of the moratorium under this framework option would maintain the status quo in the fishery at least until 2007. This will allow the Council more time to consider longer term measures for the *Illex* moratorium in future amendments to the FMP. Vessels which took small quantities in the past will be able to continue to do so under the bycatch provisions of the FMP. However, further expansion of entry into the directed *Illex* fisheries will be controlled for at least five additional years, thus overfishing and over-capitalization will be avoided.

5.2.1.3 Allow the moratorium on entry to the *Illex* fishery to expire in 2002 (no action)

Under this option, the *Illex* moratorium would expire in July of 2002 and the fishery would revert to open access conditions. As noted above, the *Illex* moratorium fleet demonstrated the capacity to harvest the long term sustainable level of harvest as defined under the SFA in 1998. The key questions relative to extension of this moratorium hinge on the likely effects of allowing the *Illex* fishery to revert to open access.

The development of excess fishing capacity in US marine fisheries, especially since the passage of the Magnuson Act, has been identified as the single most important problem currently facing the US fishing industry (NMFS 1996; NRC 1999). Most US fisheries can be characterized as overcapitalized, with too many vessels, too much gear and too much time spent at sea harvesting fish at too high a cost to both harvesters and society. Adding significantly to the problem is the fact that the increase in fishing capacity in the US has been accompanied by a dramatic increase in technological advances (NMFS 1996). The US commercial fishery has developed from a fleet of primarily sailing vessels in the 1800's to a modern fleet of vessels which has resulted in an enormous increase in fishing power throughout the 20th century. This increase in fishing vessel capacity and efficiency has resulted in over-exploitation and economic losses throughout most US marine fisheries.

The net economic benefits that could be gained by ending the open access problem in US fisheries are significant. Managing single-species fisheries with a conservative, risk averse approach should be the first step in achieving sustainable marine fisheries (NRC 1999). The NRC (1999) recommended that a moderate level of exploitation might be a better goal for fisheries management than full exploitation since the latter has almost universally resulted in over-exploitation of marine resources. The NRC (1999) concluded "At the core of today's overcapacity problem is the lack of, or ineffective, definition of fishing rights in most fisheries. Therefore, the committee recommends for many fisheries a management approach that includes the development and use of methods of allocation of exclusive shares of the fish resource or privileges and responsibilities (as opposed to open competition) and the elimination of subsidies that encourage overcapacity. A flexible and adaptive approach is essential, and careful attention must be given to equity issues associated with such approaches." In addition, the NRC (1999) strongly recommended that managers and policy makers should focus on developing or encouraging socioeconomic and other management measures that discourage overcapacity and that reward the conservative and efficient use of marine fishery resources.

Analyses presented above clearly indicate that *Illex* fishery is fully exploited and additional capacity in the fishery is both unnecessary and undesirable. Excess fishing capacity in the Northeast region of the US, if transferred into the *Illex* fishery, would easily result in overcapitalization of the fishery and over-exploitation of the resource. Based on the recommendation of the NRC (1999), the Council determined that the *Illex* moratorium should be extended to prevent the development of overcapacity in this fishery. Failure to extend the moratorium would result in further overcapitalization of this sector the fishing industry, which in turn would have negative economic consequences for the vessels and communities which depend upon the *Illex* resource. The distribution of vessels which possessed *Illex* moratorium permits by home port state is given in Table 12. The size distribution of those vessels is given in Table 33. Overall, New Jersey would appear to be the state most dependent on the *Illex* resource followed by New York, Massachusetts and Rhode Island. Additional entry into this fishery would be expected to proportionately reduce the landings and revenue of vessels currently operative within the moratorium fleet (see analyses contained in the RIR Section of the RIR). Table 15 indicated that the only port dependent upon *Illex* for more than 10 % of total revenues in 1999 was North Kingstown, RI (12.7%). Therefore, the vessel owners, crew, dealers or processors and fishing communities associated with this port are expected to be affected the most by failure to extend the moratorium program for *Illex*.

5.2.2 Timeliness of Quota Specifications for Atlantic mackerel, *Loligo* and *Illex* squid and Butterfish

5.2.2.1 If annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, the previous year's specifications shall apply until the final rule for new specifications is implemented (excluding TALFF specifications) (Preferred Alternative)

Under this measure, if annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid are not published by the NMFS prior to the start of the fishing year, the previous year's specifications shall apply until the final rule implementing the new quota specifications is implemented. As noted above, this measure does not apply to TALFF specifications.

The Council proposes as part this framework action that in the case that annual specifications for mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications shall apply (excluding TALFF specifications). The primary reason for this action is that in recent years, publication of the final rule implementing the annual specifications for Atlantic mackerel, squid and butterfish has not occurred until after the start of the fishing year. For example, the final rule implementing the quota specifications for Atlantic mackerel, squid and butterfish for 2000 was not published until March of 2000. Similarly, the final rule implementing the quota specifications for Atlantic mackerel, squid and butterfish for 2001 was not published until March 2, of 2001. Because the specifications were not in place by the start of the fishing season, the fishery for *Loligo* could not be regulated for the first several months of the fishery. The Council set the 2000 quota specifications for *Loligo* squid based on the SAW 29 projections which resulted in an ABC equal to the yield associated with 90% F_{msy} or 13,000 mt. Management advice from SAW 29 made special note of the fact that yield from this fishery should be distributed throughout the fishing year. Given that the permitted *Loligo* fleet historically had demonstrated the ability to land Loligo in excess of the quota specified for 2000, the Council recommended that the annual quota be sub-divided into three quota period or trimesters. The 2000 quota was allocated to each period based on the proportion of landings occurring in each trimester from 1994-1998. Based on the seasonal distribution of landings during this time period, the quota for January-April was 5,460 mt (42% of the total), the quota for May-August was 2,340 mt (18% of the total), and the quota for September-December was 5200 mt (40% of the total). The directed fishery during the first two trimester periods was to be closed when 90% of the amount allocated to the period was landed and then a trip limit of 2,500 pounds would remain in effect until the quota period ends. Any underages from trimesters one and two were to be applied to the next trimester and overages were to be deducted from trimester three. The directed fishery was closed in the third trimester when 95% of the annual quota was taken. The fishery operated at the 2,500 trip limit level for most of the third quota period.

Since the 2000 specifications were not published until late in the first trimester of 2000, the fishery could not be closed when 90% of the quota allocated to trimester one was landed and an overage resulted. Quota overages in the *Loligo* fishery are deducted from subsequent quota period within the same fishing year. In the worst case scenario, failure to publish the annual specifications until very late in the fishing year (or not at all) would result in unregulated fishing. The inability to control landings in the fishery can be expected to greatly increase the chance that a quota overage might occur. This would have a negative economic and social impacts on participants in the *Loligo* fishery in subsequent quota periods. This situation will continue under the no action alternative. Table 11 indicated

that there were 10 ports dependent upon *Loligo* for more than 10% of total revenue in 1999. Those highly dependent upon *Loligo* squid (50% or more of total revenue due to *Loligo*) included Other Essex, NJ (81.9%) and Falmouth, MA (50%). Therefore, the vessel owners, crew, dealers or processors and fishing communities associated with these ports are expected to be affected the most by the failure to publish the annual specifications until late in the fishing year.

In the case of Atlantic mackerel, industry members testified that delays in publishing the annual quota specifications has had a negative impact on possible Joint Venture activities for Atlantic mackerel, due to timing of the winter Atlantic mackerel fishery and the uncertainty about the upcoming year's JV specifications. To help alleviate this situation, the Council proposes under this alternative, that if the annual specifications for mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications will apply (excluding TALFF specifications). The only specification for Atlantic mackerel that would be significantly impacted by this measure would be the JV specification. Under current rules, if annual specifications are not published prior to the beginning of the fishing year, JV landings are not permitted. Under the proposed measure, JV operations could occur based on the previous years JV specification. For example, the 2001 Atlantic mackerel, squid and butterfish specifications were recently published on March 2, 2001 (the fishing year began on January 1, 2001). As a result, no JV activity could have occurred until March 2, 2001. Under the preferred alternative, the 2000 JV specification of 20,000 mt would have applied and JV activities could have been conducted under this provision. As result, JV landings of up to 20,000 mt in addition to recent levels of US domestic production could have conferred economic and social benefits to the domestic Atlantic mackerel fleet. This could not occur, however, if no action is taken.
Table 7 indicated that there were no ports dependent upon Atlantic mackerel for more than 10% of total revenue in 1999. Those ports most dependent upon Atlantic mackerel included North Kingstown, Ri (9.7%) and Cape May, NJ (9.3%). Therefore, the vessel owners, crew, dealers or processors and fishing communities associated with these ports are expected to be affected the most by the failure to publish the annual specifications until late in the fishing year.

Another possibility which could arise under the preferred alternative would be the situation where the Council and NMFS propose to significantly reduce or eliminate the JVP specification in the upcoming fishing year. The Council discussed this possibility and intends to disapprove JVP applications when this situation arises.

Quota monitoring and subsequent regulation of fishing mortality in the *Illex* and butterfish fisheries have not been negatively affected by the delays in publishing the annual specifications. In the case of *Illex*, this is because the directed fishery does not occur until June. For example, only about 1.4% of the 1999 *Illex* landings were taken in the first quarter (Table 29). In the case of butterfish, the fishery has landed only about 30-35% of ABC in recent years. As a result, the no action alternative is not expected to have any

negative economic or social impacts relative to either of these fisheries based on the dates on which the specifications have been published in recent years.

5.2.2.2 If annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, the Atlantic mackerel, *Loligo* and *Illex* squid and Butterfish fisheries operate without specifications and Joint Ventures cannot be conducted until the final rule for new specifications is implemented (no action/status quo)

Under this measure, if annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid are not published by the NMFS prior to the start of the fishing year, the fishery opens without quota specifications. Under these conditions, no JV is specified for Atlantic mackerel for the new fishing year and therefore no mackerel JV operations can be conducted until the final rule implementing the new quota specifications is published.

The Council proposes in the preferred alternative of this framework action that in the case that annual specifications for mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications shall apply (excluding TALFF specifications). The primary reason for this action is that in recent years, publication of the final rule implementing the annual specifications for Atlantic mackerel, squid and butterfish has not occurred until after the start of the fishing year. For example, the final rule implementing the quota specifications for Atlantic mackerel, squid and butterfish for 2000 was not published until March of 2000. Because the specifications were not in place by the start of the fishing season, the fishery for *Loligo* could not be regulated for the first several months of the fishery. The Council set the 2000 quota specifications for *Loligo* squid based on the SAW 29 projections which resulted in an ABC equal to the yield associated with 90% F_{msy} or 13,000 mt. Management advice from SAW 29 made special note of the fact that yield from this fishery should be distributed throughout the fishing year. Given that the permitted *Loligo* fleet historically had demonstrated the ability to land Loligo in excess of the quota specified for 2000, the Council recommended that the annual quota be sub-divided into three quota period or trimesters. The 2000 quota was allocated to each period based on the proportion of landings occurring in each trimester from 1994-1998. Based on the seasonal distribution of landings during this time period, the quota for January-April was 5,460 mt (42% of the total), the quota for May-August was 2,340 mt (18% of the total), and the quota for September-December was 5200 mt (40% of the total). The directed fishery during the first two trimester periods was to be closed when 90% of the amount allocated to the period was landed and then a trip limit of 2,500 pounds would remain in effect until the quota period ends. Any underages from trimesters one and two were to be applied to the next trimester and overages were to be deducted from trimester three. The directed fishery was closed in the third trimester when 95% of the annual quota was taken. The fishery operated at the 2,500 trip limit level for most of the third quota period.

Since the 2000 specifications were not published until late in the first trimester of 2000, the fishery could not be closed when 90% of the quota

allocated to trimester one was landed and an overage resulted. Quota overages in the *Loligo* fishery are deducted from subsequent quota periods within the same fishing year. In the worst case scenario, failure to publish the annual specifications until very late in the fishing year (or not at all) would result in unregulated fishing. The inability to control landings in the fishery can be expected to greatly increase the chance that a quota overage might occur. This would have a negative economic and social impacts on participants in the *Loligo* fishery in subsequent quota periods. Table 11 indicated that there were 10 ports dependent upon *Loligo* for more than 10% of total revenue in 1999. Those highly dependent upon *Loligo* squid (50% or more of total revenue due to *Loligo*) included Other Essex, NJ (81.9%) and Falmouth, MA (50%). Therefore, the vessel owners, crew, dealers or processors and fishing communities associated with these ports are expected to be affected the most by the failure to publish the annual specifications until late in the fishing year.

In the case of Atlantic mackerel, industry members testified that delays in publishing the annual quota specifications has had a negative impact on possible Joint Venture activities for Atlantic mackerel, due to timing of the winter Atlantic mackerel fishery and the uncertainty about the upcoming year's JV specifications. To help alleviate this situation, the Council proposes under this alternative, that if the annual specifications for mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications will apply (excluding TALFF specifications). The only specification for Atlantic mackerel that would be significantly impacted by this measure would be the JV specification. Under current rules, if annual specifications are not published prior to the beginning of the fishing year, JV landings are not permitted. Under the proposed measure, JV operations could occur based on the previous years JV specification. For example, the 2001 Atlantic mackerel, squid and butterfish specifications were recently published on March 2, 2001(the fishing year began on January 1, 2001). As a result, no JV activity could have occurred until March 2, 2001. Under the proposed measure, the 2000 JV specification of 20,000 mt would have applied and JV activities could have been conducted under this provision. As result, JV landings of up to 20,000 mt in addition to recent levels of US domestic production could have conferred economic and social benefits to the domestic Atlantic mackerel fleet. Table 7 indicated that there were no ports dependent upon Atlantic mackerel for more than 10% of total revenue in 1999. Those ports most dependent upon Atlantic mackerel included North Kingstown, RI (9.7%) and Cape May, NJ (9.3%). Therefore, the vessel owners, crew, dealers or processors and fishing communities associated with these ports are expected to be affected the most by the failure to publish the annual specifications until late in the fishing year.

Quota monitoring and subsequent regulation of fishing mortality in the *Illex* and butterfish fisheries have not been negatively affected by the delays in publishing the annual specifications. As a result, this measure is not expected to have any economic or social impacts relative to either of these fisheries based on the dates on which the specifications have been published in recent years.

5.2.2.3 If annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, a set of default specifications shall apply for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish fisheries until the final rule for new specifications is implemented

Under this measure, if annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid are not published by the NMFS prior to the start of the fishing year, the fishery opens under a set of default quota specifications. Under this option quotas would be specified which correspond to the three year average of quota specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish for the period 1999-2001, except for TALFF which be set equal to zero under the default measures. Based on the specifications for those three years, the default specifications would as those outlined in Table 34.

The primary reason for this action is that in recent years, publication of the final rule implementing the annual specifications for Atlantic mackerel, squid and butterfish has not occurred until after the start of the fishing year. For example, the final rule implementing the quota specifications for Atlantic mackerel, squid and butterfish for 2000 was not published until March of 2000. Similarly, the final rule implementing the quota specifications for Atlantic mackerel, squid and butterfish for 2001 was not published until March 2, of 2001. Because the specifications were not in place by the start of the fishing season, the fishery for *Loligo* could not be regulated for the first several months of the fishery. The Council set the 2000 quota specifications for *Loligo* squid based on the SAW 29 projections which resulted in an ABC equal to the yield associated with 90% F_{msy} or 13,000 mt. Management advice from SAW 29 made special note of the fact that yield from this fishery should be distributed throughout the fishing year. Given that the permitted *Loligo* fleet historically had demonstrated the ability to land Loligo in excess of the quota specified for 2000, the Council recommended that the annual quota be sub-divided into three quota period or trimesters. The 2000 quota was allocated to each period based on the proportion of landings occurring in each trimester from 1994-1998. Based on the seasonal distribution of landings during this time period, the quota for January-April was 5,460 mt (42% of the total), the quota for May-August was 2,340 mt (18% of the total), and the quota for September-December was 5200 mt (40% of the total). The directed fishery during the first two trimester periods was to be closed when 90% of the amount allocated to the period was landed and then a trip limit of 2,500 pounds would remain in effect until the quota period ends. Any underages from trimesters one and two were to be applied to the next trimester and overages were to be deducted from trimester three. The directed fishery was closed in the third trimester when 95% of the annual quota was taken. The fishery operated at the 2,500 trip limit level for most of the third quota period.

Since the 2000 specifications were not published until late in the first trimester of 2000, the fishery could not be closed when 90% of the quota allocated to trimester one was landed and an overage resulted. Quota overages in the *Loligo* fishery are deducted from subsequent quota period within the same fishing year. In the worst case scenario, failure to publish the annual

specifications until very late in the fishing year (or not at all) would result in unregulated fishing. The inability to control landings in the fishery can be expected to greatly increase the chance that a quota overage might occur. This would have a negative economic and social impacts on participants in the *Loligo* fishery in subsequent quota periods. Table 11 indicated that there were 10 ports dependent upon *Loligo* for more than 10% of total revenue in 1999. Those highly dependent upon *Loligo* squid (50% or more of total revenue due to *Loligo*) included Other Essex, NJ (81.9%) and Falmouth, MA (50%). Therefore, the vessel owners, crew, dealers or processors and fishing communities associated with these ports are expected to be affected the most by the failure to publish the annual specifications until late in the fishing year.

In the case of Atlantic mackerel, industry members testified that delays in publishing the annual quota specifications has had a negative impact on possible Joint Venture activities for Atlantic mackerel, due to timing of the winter Atlantic mackerel fishery and the uncertainty about the upcoming year's JV specifications. To help alleviate this situation, the Council proposes under this alternative, that if the annual specifications for mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications will apply (excluding TALFF specifications). The only specification for Atlantic mackerel that would be significantly impacted by this measure would be the JV specification. Under current rules, if annual specifications are not published prior to the beginning of the fishing year, JV landings are not permitted. Under the proposed measure, JV operations could occur based on the previous years JV specification. For example, the 2001 Atlantic mackerel, squid and butterfish specifications were recently published on March 2, 2001(the fishing year began on January 1, 2001). As a result, no JV activity could have occurred until March 2, 2001. Under the proposed measure, the 2000 JV specification of 20,000 mt would have applied and JV activities could have been conducted under this provision. As result, JV landings of up to 13,300 mt, in addition to recent levels of US domestic production, could have conferred economic and social benefits to the domestic Atlantic mackerel fleet. Table 7 indicated that there were no ports dependent upon Atlantic mackerel for more than 10% of total revenue in 1999. Those ports most dependent upon Atlantic mackerel included North Kingstown, RI (9.7%) and Cape May, NJ (9.3%). Therefore, the vessel owners, crew, dealers or processors and fishing communities associated with these ports are expected to be affected the most by the failure to publish the annual specifications until late in the fishing year.

Another possibility which could arise under this alternative would be the situation where the Council and NMFS propose to significantly reduce or eliminate the JVP specification in the upcoming fishing year. The Council discussed this possibility and intends to disapprove JVP applications when this situation arises.

Quota monitoring and subsequent regulation of fishing mortality in the *Illex* and butterfish fisheries have not been negatively affected by the delays in publishing the annual specifications. As a result, this measure is not expected to have any economic or social impacts relative to either of these

fisheries based on the dates on which the specifications have been published in recent years.

5.2.2.4 If annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, the fisheries for these species will be closed until the final rule for new specifications is implemented

Under this measure, if the annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, the fisheries for these species will be closed until the final rule for new specifications is published. In other words, the landing of all four species in the management unit would be prohibited until the final for new specifications is published.

This measure would have significant negative economic and social consequences for vessels operating in the Atlantic mackerel, *Loligo* and and butterfish fisheries because landings of these species would be prohibited until the final rule for new specifications is published and significant landings occur early in the fishing year. Based on the recent publication date of the annual specifications for Atlantic mackerel, squid and butterfish, these fisheries would most likely be closed during the months of January and February under this alternative. The likely negative effects of this measure would be the loss of revenue associated with the landings of Atlantic mackerel, Loligo and butterfish during the months of January and February. During 1999, the value of the January and February landings of each species, respectively, was $1.7 million, $5.2 million, and $.0.9 million. The total value of the landings of these three species during the first two months of 1999 represent about 20% of the annual revenue generated for all three species based on 1999 landings data. Table 35 indicated that there were 11 ports dependent upon Atlantic mackerel, *Loligo*, *Illex*, and butterfish for more than 10% of total revenue in 1999. Those highly dependent upon Atlantic mackerel, *Loligo*, *Illex*, and butterfish (50% or more of total revenue due to *Loligo*) included Other Essex, NJ (87.9%) North Kingstown, RI (74.3%) and Falmouth MA (50%). Therefore, the vessel owners, crew, dealers or processors and fishing communities associated with these ports are expected to be affected the most if the fisheries were closed due to failure to publish the annual specifications until late in the fishing year.

5.2.2.5 If annual specifications for Atlantic mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications shall apply until the final rule for new specifications is implemented (excluding TALFF specifications)

Under this measure, if annual specifications for Atlantic mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications shall apply until the final rule implementing the new quota specifications are published. As noted above, this measure does not apply to TALFF specifications.

In the case of Atlantic mackerel, industry members testified that delays in publishing the annual quota specifications has had a negative impact on possible Joint Venture activities for Atlantic mackerel, due to timing of the winter Atlantic mackerel fishery and the uncertainty about the upcoming year's JV specifications. To help alleviate this situation, the Council proposes under this alternative, that if the annual specifications for mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications will apply (excluding TALFF specifications). The only specification for Atlantic mackerel that would be significantly impacted by this measure would be the JV specification. Under current rules, if annual specifications are not published prior to the beginning of the fishing year, JV landings are not permitted. Under the proposed measure, JV operations could occur based on the previous years JV specification. For example, the 2001 Atlantic mackerel, squid and butterfish specifications were recently published on March 2, 2001 (the fishing year began on January 1, 2001). As a result, no JV activity could have occurred until March 2, 2001. Under the preferred alternative, the 2000 JV specification of 20,000 mt would have applied and JV activities could have been conducted under this provision. As result, JV landings of up to 20,000 mt in addition to recent levels of US domestic production could have conferred economic and social benefits to the domestic Atlantic mackerel fleet. This could not occur, however, if no action is taken.
Table 7 indicated that there were no ports dependent upon Atlantic mackerel for more than 10% of total revenue in 1999. Those ports most dependent upon Atlantic mackerel included North Kingstown, RI (9.7%) and Cape May, NJ (9.3%). Therefore, the vessel owners, crew, dealers or processors and fishing communities associated with these ports are expected to be affected the most by the failure to publish the annual specifications until late in the fishing year.

Another possibility which could arise under this alternative would be the situation where the Council and NMFS propose to significantly reduce or eliminate the JVP specification in the upcoming fishing year. The Council discussed this possibility and intends to disapprove JVP applications when this situation arises.

5.2.2.6 If annual specifications for Atlantic mackerel are not published by the NMFS prior to the start of the fishing year, a set of default specifications shall apply for Atlantic mackerel until the final rule for new specifications is implemented (excluding TALFF specifications)

Under this measure, if annual specifications for Atlantic mackerel are not published by the NMFS prior to the start of the fishing year, the fishery opens under a set of default quota specifications. Under this option quotas would be specified which correspond to the three year average of quota specifications for Atlantic mackerel for the period 1999-2001, except for TALFF which be set equal to zero under the default measures.

In the case of Atlantic mackerel, industry members testified that delays in publishing the annual quota specifications has had a negative impact on possible Joint Venture activities for Atlantic mackerel, due to timing of the winter Atlantic mackerel fishery and the uncertainty about the upcoming year's

JV specifications. To help alleviate this situation, the Council proposes under this alternative, that if the annual specifications for mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications will apply (excluding TALFF specifications). The only specification for Atlantic mackerel that would be significantly impacted by this measure would be the JV specification. Under current rules, if annual specifications are not published prior to the beginning of the fishing year, JV landings are not permitted. Under the proposed measure, JV operations could occur based on the previous years JV specification. For example, the 2001 Atlantic mackerel, squid and butterfish specifications were recently published on March 2, 2001(the fishing year began on January 1, 2001). As a result, no JV activity could have occurred until March 2, 2001. Under the proposed measure, the 2000 JV specification of 20,000 mt would have applied and JV activities could have been conducted under this provision. As result, JV landings of up to 13,300 mt, in addition to recent levels of US domestic production, could have conferred economic and social benefits to the domestic Atlantic mackerel fleet. Table 7 indicated that there were no ports dependent upon Atlantic mackerel for more than 10% of total revenue in 1999. Those ports most dependent upon Atlantic mackerel included North Kingstown, RI (9.7%) and Cape May, NJ (9.3%). Therefore, the vessel owners, crew, dealers or processors and fishing communities associated with these ports are expected to be affected the most by the failure to publish the annual specifications until late in the fishing year.

Another possibility which could arise under this alternative would be the situation where the Council and NMFS propose to significantly reduce or eliminate the JVP specification in the upcoming fishing year. The Council discussed this possibility and intends to disapprove JVP applications when this situation arises.

5.2.3 *Loligo* overfishing definition and control rule

5.2.3.1 Annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} consistent with requirements of Section 304e of the Magnuson-Stevens Act. In addition, Max OY, ABC, OY, and DAH may be specified for a period of up to three years. (Preferred Alternative)

This measure modifies the control rule for *Loligo* squid and allows for the in-season adjustment of the annual *Loligo* quota. The primary components of the overfishing definition that were required under the SFA and implemented under Amendment 8 (i.e,, the maximum fishing mortality rate threshold (F_{msy}) and the minimum biomass threshold (½ B_{msy})), remain unchanged. Under this measure, an annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} in a time period

consistent with Section 304 e of the Magnuson-Stevens Act. This section of the Act specifies that an overfished stock shall be rebuilt in a time period as short as possible, but not to exceed ten years.

In addition to changes in the overfishing definition, the Council may specify Max OY, ABC, OY and DAH for up to three years. The Atlantic Mackerel Squid and Butterfish Monitoring Committee will meet in late spring to review available NEFSC survey data and develop recommendations about in-season adjustments to these specifications for consideration by the Atlantic Mackerel Squid and Butterfish Committee and the Council. Based on an evaluation of the most recent NEFSC spring and fall trawl survey data, the OY, DAH and ABC may be adjusted to be consistent with the control rule. Based on the recommendations of the Council, the Regional Administrator may make in-season adjustments, as appropriate based on the recommendations of the Council, through publication of a notice in the Federal Register of in-season adjustment action.

The *Loligo* fishery is managed pursuant to this FMP through an annual quota specification process. Annual quotas are specified based on the overfishing definition established in Amendment 8. Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management (FMP) was developed to bring the FMP into compliance with the Sustainable Fisheries Act (SFA). The SFA, which reauthorized and amended the Magnuson-Stevens Act, made a number of changes to the existing National Standards, as well as to definitions and other provisions in the Magnuson-Stevens Act, that caused the Guidelines to be significantly revised. The most significant changes were made to National Standard 1, which imposed new requirements concerning definitions of overfishing in fishery management plans. The overfishing definition for Loligo was revised in Amendment 8 to comply with the SFA as follows: overfishing for *Loligo* will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{max} is exceeded (F_{max} is a proxy for F_{msy}). When an estimate of F_{msy} becomes available, it will replace the current overfishing proxy of F_{max}. Annual quotas will be specified which correspond to a target fishing mortality rate. Under Amendment 8 , target F was defined as 75% of the F_{msy} when biomass is greater than B_{msy}, and decreases linearly to zero 50% of B_{MSY}. Maximum OY is specified as the catch associated with a fishing mortality rate of F_{max}. In addition, the biomass target is specified to equal B_{MSY}.

The new requirements of the SFA required the Council to take remedial action for 2000 to rebuild the stock to a level which will produce MSY (B_{msy}) given the status determination that *Loligo* was approaching an overfished state. The control rule in Amendment 8 specified that the target fishing mortality rate must be reduced to zero if biomass falls below 50% of B_{msy}. The target fishing mortality rate increases linearly to 75% of F_{msy} as biomass increases to B_{msy}. However, projections made in SAW 29 indicate that the control rule adopted in Amendment 8 appears to be overly conservative. Projections from SAW 29 indicated that the *Loligo* biomass could be rebuilt to levels approximating B_{msy} in three years if fishing mortality was reduced to the target mortality rate specified in Amendment 8 of 75% of F_{msy}. In determining the specification of ABC for the year 2000, the Council considered advice offered by SAW 29 which

indicated that the control rule adopted in Amendment 8 was too conservative. Model projections presented in the most recent assessment demonstrated that the stock could be rebuilt in a relatively short period of time (even at fishing mortality rates as high as 75% $F_{msy)}$). Based on projections conducted by the Atlantic Mackerel, Squid and Butterfish Monitoring Committee, the Council chose to specify ABC as the yield associated with 90% F_{msy} or 13,000 mt in 2000.

The most recent NEFSC survey data for *Loligo* squid indicate that abundance of this species has increased significantly since the most recent assessment was conducted (i.e, SAW-29). Estimates of biomass based on NEFSC fall 1999 and spring 2000 survey indices for *Loligo* indicate that the stock is currently at or near B_{msy}. In fact, the 1999 fall survey index was the sixth highest value observed in the time series since 1967 and the second highest since 1987. The 2000 spring survey index for *Loligo* was the tenth highest in the time series since 1968 and the fifth highest since 1987 (Lai, pers.comm). Based on the assumption that the stock will be at or near B_{msy} in 2001, the Council recommended that the 2001 quota be specified as the yield associated with 75% of F_{msy} . The yield associated with 75% of F_{msy} at B_{msy} is 17,000 mt based on projections in SAW-29 (NMFS 1999).

The Council is replacing the control rule because it was determined to be unnecessarily restrictive by SAW 29. For example, yield projections conducted since development of the control rule indicated that the *Loligo* stock could rebuild to B_{msy} in a relatively short period of time. In retrospect, the *Loligo* stock quickly rebounded to the B_{msy} level by 2000. If the Council had followed the control rule implemented in Amendment 8 for the 2000 fishery, the *Loligo* fishery would have been closed for the entire year.

Under this alternative, the basic elements of the overfishing definition required by the SFA, the overfishing threshold (F_{msy}) and minimum biomass threshold (½ B_{msy}) will be retained. Since the stock will still be protected from overfishing, no negative biological impacts are expected from the adjustment to this management measure. In addition, the in-season adjustment mechanism will a afford additional protection to the stock. For example, under the current management system, the annual specification for *Loligo* is determined a year in advance of the fishing year for which the specifications apply. Under the proposed alternative, the quota could be adjusted downward during the fishing season if it is determined to be necessary due to sudden changes (declines) in *Loligo* stock abundance. The converse is also true. That is, if the stock is found to be larger than anticipated the annual quota can be adjusted upward to allow for increased yield from the fishery and yet maintain a sustainable level of harvest within the guidelines of the SFA. Thus, this measure will confer positive economic and social benefits in the short term by allowing for in-season increases in yield during years of high abundance. In the longer term, the control rule will reduce the chance of overfishing by allowing for decreases in yield and fishing mortality when stock abundance is lower than anticipated.

The Council chose this alternative as the preferred in an attempt to balance the need to end overfishing and rebuild overfished stocks with the need to

minimize the economic burden placed on fishing communities during the rebuilding period. This alternative would allow the Council to adopt rebuilding horizons consistent with requirements of the Sustainable Fisheries Act (i.e, up to ten years). While the Council does not forsee utilizing rebuilding periods of up to the maximum of ten years, the strategy was adopted to retain the maximum flexibility allowable under the current statute for rebuilding the *Loligo* in stock future years. While it is difficult to quantify the risks associated with extended rebuilding periods, it can be stated that, in general, longer rebuilding periods pose greater risks to stock since they generally would allow for higher fishing mortality rates in the near term. However, yield would be expected to higher under these conditions which could help ameliorate some of the negative economic consequences for fishing communities during rebuilding. These trade-offs, including the associated risk analyses, will have to be evaluated on a case by case basis in the future.

Table 11 indicated that there were 10 ports dependent upon *Loligo* for more than 10% of total revenue in 1999. Those highly dependent upon *Loligo* squid (50% or more of total revenue due to *Loligo*) included Other Essex, NJ (81.9%) and Falmouth, MA (50%). Therefore, the vessel owners, crew, dealers or processors and fishing communities associated with these ports are expected to be affected the most by the failure to implement this option.

5.2.3.2 Annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} in a time period of at least three years but not greater than five years.

This measure modifies the overfishing definition for *Loligo* squid and allows for the in-season adjustment of the *Loligo* quota. The primary components of the overfishing definition that were required under the SFA and implemented under Amendment 8 (i.e,, the maximum fishing mortality rate threshold (F_{msy}) and the minimum biomass threshold (½ B_{msy})), remain unchanged. Under this measure, an annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} in a time period of at least three years but not greater than five years.

The Atlantic Mackerel Squid and Butterfish Monitoring Committee will meet in late spring to review available NEFSC survey data and develop recommendations about in-season adjustments to these specifications for consideration by the Atlantic Mackerel Squid and Butterfish Committee and the Council. Based on an evaluation of the most recent NEFSC spring and fall trawl survey data, the OY, DAH and ABC may be adjusted to be consistent with the control rule. Based on the recommendations of the Council, the Regional Administrator may make in-season adjustments, as appropriate based on the recommendations of the Council, through publication of a notice in the Federal Register of in-season adjustment action.

The *Loligo* fishery is managed pursuant to this FMP through an annual quota specification process. Annual quotas are specified based on the overfishing definition established in Amendment 8. Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management (FMP) was developed to bring the FMP into compliance with the Sustainable Fisheries Act (SFA). The SFA, which reauthorized and amended the Magnuson-Stevens Act, made a number of changes to the existing National Standards, as well as to definitions and other provisions in the Magnuson-Stevens Act, that caused the Guidelines to be significantly revised. The most significant changes were made to National Standard 1, which imposed new requirements concerning definitions of overfishing in fishery management plans. The overfishing definition for Loligo was revised in Amendment 8 to comply with the SFA as follows: overfishing for *Loligo* will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{max} is exceeded (F_{max} is a proxy for F_{msy}). When an estimate of F_{msy} becomes available, it will replace the current overfishing proxy of F_{max}. Annual quotas will be specified which correspond to a target fishing mortality rate. Under Amendment 8 , target F was defined as 75% of the F_{msy} when biomass is greater than B_{msy}, and decreases linearly to zero 50% of B_{MSY}. Maximum OY is specified as the catch associated with a fishing mortality rate of F_{max}. In addition, the biomass target is specified to equal B_{MSY}.

The new requirements of the SFA required the Council to take remedial action for 2000 to rebuild the stock to a level which will produce MSY (B_{msy}) given the status determination that *Loligo* was approaching an overfished state. The control rule in Amendment 8 specified that the target fishing mortality rate must be reduced to zero if biomass falls below 50% of B_{msy}. The target fishing mortality rate increases linearly to 75% of F_{msy} as biomass increases to B_{msy}. However, projections made in SAW 29 indicate that the control rule adopted in Amendment 8 appears to be overly conservative. Projections from SAW 29 indicated that the *Loligo* biomass could be rebuilt to levels approximating B_{msy} in three years if fishing mortality was reduced to the target mortality rate specified in Amendment 8 of 75% of F_{msy}. In determining the specification of ABC for the year 2000, the Council considered advice offered by SAW 29 which indicated that the control rule adopted in Amendment 8 was too conservative. Model projections presented by the Atlantic Mackerel, Squid and Butterfish Monitoring Committee demonstrated that the stock could be rebuilt in a relatively short period of time. Based on those projections, the Council chose to specify ABC as the yield associated with 90% F_{msy} or 13,000 mt in 2000.

The most recent NEFSC survey data for *Loligo* squid indicate that abundance of this species has increased significantly since the most recent assessment was conducted (i.e, SAW-29). Estimates of biomass based on NEFSC fall 1999 and spring 2000 survey indices for *Loligo* indicate that the stock is currently at or near B_{msy}. In fact, the 1999 fall survey index was the sixth highest value observed in the time series since 1967 and the second highest since 1987. The 2000 spring survey index for *Loligo* was the tenth highest in the time series since 1968 and the fifth highest since 1987 (Lai, pers.comm). Based on the assumption that the stock will be at or near B_{msy} in 2001, the Council

recommended that the 2001 quota be specified as the yield associated with 75% of F_{msy} . The yield associated with 75% of F_{msy} at B_{msy} is 17,000 mt based on projections in SAW-29 (NMFS 1999).

The Council is replacing the control rule because it was determined to be unnecessarily restrictive by SAW 29. For example, yield projections conducted since development of the control rule indicated that the *Loligo* stock could rebuild to B_{msy} in a relatively short period of time. In retrospect, the *Loligo* stock quickly rebounded to the B_{msy} level by 2000. If the Council had followed the control rule implemented in Amendment 8 for the 2000 fishery, the *Loligo* fishery would have been closed for the entire year.

Under this alternative, the basic elements of the overfishing definition required by the SFA, the overfishing threshold (F_{msy}) and minimum biomass threshold (½ B_{msy}) will be retained. Since the stock will still be protected from overfishing, no negative biological impacts are expected from the adjustment to this management measure. In addition, the in-season adjustment mechanism will a afford additional protection to the stock. For example, under the current management system, the annual specification for *Loligo* is determined a year in advance of the fishing year for which the specifications apply. Under the proposed alternative, the quota could be adjusted downward during the fishing season if it is determined to be necessary due to sudden changes (declines) in *Loligo* stock abundance. The converse is also true. That is, if the stock is found to be larger than anticipated the annual quota can be adjusted upward to allow for increased yield from the fishery and yet maintain a sustainable level of harvest within the guidelines of the SFA. Thus, this measure will confer positive economic and social benefits in the short term by allowing for in-season increases in yield during years of high abundance.

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5.2.3.3 Annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} in a time period of at least five years but not greater than ten years

This measure modifies the overfishing definition for *Loligo* squid and allows for the in-season adjustment of the *Loligo* quota. The primary components of the overfishing definition that were required under the SFA and implemented under Amendment 8 (i.e,, the maximum fishing mortality rate threshold (F_{msy}) and the minimum biomass threshold (½ B_{msy})), remain unchanged. Under this measure, an annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum

biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} in a time period of at least five years but not greater than ten years.

The Atlantic Mackerel Squid and Butterfish Monitoring Committee will meet in late spring to review available NEFSC survey data and develop recommendations about in-season adjustments to these specifications for consideration by the Atlantic Mackerel Squid and Butterfish Committee and the Council. Based on an evaluation of the most recent NEFSC spring and fall trawl survey data, the OY, DAH and ABC may be adjusted to be consistent with the control rule. Based on the recommendations of the Council, the Regional Administrator may make in-season adjustments, as appropriate based on the recommendations of the Council, through publication of a notice in the Federal Register of in-season adjustment action.

The *Loligo* fishery is managed pursuant to this FMP through an annual quota specification process. Annual quotas are specified based on the overfishing definition established in Amendment 8. Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management (FMP) was developed to bring the FMP into compliance with the Sustainable Fisheries Act (SFA). The SFA, which reauthorized and amended the Magnuson-Stevens Act, made a number of changes to the existing National Standards, as well as to definitions and other provisions in the Magnuson-Stevens Act, that caused the Guidelines to be significantly revised. The most significant changes were made to National Standard 1, which imposed new requirements concerning definitions of overfishing in fishery management plans. The overfishing definition for Loligo was revised in Amendment 8 to comply with the SFA as follows: overfishing for *Loligo* will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{max} is exceeded (F_{max} is a proxy for F_{msy}). When an estimate of F_{msy} becomes available, it will replace the current overfishing proxy of F_{max}. Annual quotas will be specified which correspond to a target fishing mortality rate. Under Amendment 8 , target F was defined as 75% of the F_{msy} when biomass is greater than B_{msy}, and decreases linearly to zero 50% of B_{MSY}. Maximum OY is specified as the catch associated with a fishing mortality rate of F_{max}. In addition, the biomass target is specified to equal B_{MSY}.

The new requirements of the SFA required the Council to take remedial action for 2000 to rebuild the stock to a level which will produce MSY (B_{msy}) given the status determination that *Loligo* was approaching an overfished state. The control rule in Amendment 8 specified that the target fishing mortality rate must be reduced to zero if biomass falls below 50% of B_{msy}. The target fishing mortality rate increases linearly to 75% of F_{msy} as biomass increases to B_{msy}. However, projections made in SAW 29 indicate that the control rule adopted in Amendment 8 appears to be overly conservative. Projections from SAW 29 indicated that the *Loligo* biomass could be rebuilt to levels approximating B_{msy} in three years if fishing mortality was reduced to the target mortality rate specified in Amendment 8 of 75% of F_{msy}. In determining the specification of ABC for the year 2000, the Council considered advice offered by SAW 29 which indicated that the control rule adopted in Amendment 8 was too conservative.

The Council chose to specify ABC as the yield associated with 90% F_{msy} or 13,000 mt in 2000.

The most recent NEFSC survey data for *Loligo* squid indicate that abundance of this species has increased significantly since the most recent assessment was conducted (i.e, SAW-29). Estimates of biomass based on NEFSC fall 1999 and spring 2000 survey indices for *Loligo* indicate that the stock is currently at or near B_{msy}. In fact, the 1999 fall survey index was the sixth highest value observed in the time series since 1967 and the second highest since 1987. The 2000 spring survey index for *Loligo* was the tenth highest in the time series since 1968 and the fifth highest since 1987 (Lai, pers.comm). Based on the assumption that the stock will be at or near B_{msy} in 2001, the Council recommended that the 2001 quota be specified as the yield associated with 75% of F_{msy} . The yield associated with 75% of F_{msy} at B_{msy} is 17,000 mt based on projections in SAW-29 (NMFS 1999).

The Council is replacing the control rule because it was determined to be unnecessarily restrictive by SAW 29. For example, yield projections conducted since development of the control rule indicated that the *Loligo* stock could rebuild to B_{msy} in a relatively short period of time, even at fishing mortality rates approaching F_{msy}. In retrospect, the *Loligo* stock quickly rebounded to the B_{msy} level by 2000. If the Council had followed the control rule implemented in Amendment 8 for the 2000 fishery, the *Loligo* fishery would have been closed for the entire year.

Under this alternative, the basic elements of the overfishing definition required by the SFA, the overfishing threshold (F_{msy}) and minimum biomass threshold (½ B_{msy}) will be retained. Since the stock will still be protected from overfishing, no negative biological impacts are expected from the adjustment to this management measure. In addition, the in-season adjustment mechanism will a afford additional protection to the stock. For example, under the current management system, the annual specification for *Loligo* is determined a year in advance of the fishing year for which the specifications apply. Under the proposed alternative, the quota could be adjusted downward during the fishing season if it is determined to be necessary due to sudden changes (declines) in *Loligo* stock abundance. The converse is also true. That is, if the stock is found to be larger than anticipated the annual quota can be adjusted upward to allow for increased yield from the fishery and yet maintain a sustainable level of harvest within the guidelines of the SFA. Thus, this measure will confer positive economic and social benefits in the short term by allowing for in-season increases in yield during years of high abundance. In the longer term, the control rule will reduce the chance of overfishing by allowing for decreases in yield and fishing mortality when stock abundance is lower than anticipated.

Like the preferred alternative, this alternative preserves the basic elements of the overfishing definition required by the SFA (the overfishing threshold (F_{msy}) and minimum biomass threshold (½ B_{msy}) will be retained). If the stock is not protected from overfishing, some negative economic and social impacts could be expected. Table 11 indicated that there were 10 ports dependent upon *Loligo* for more than 10% of total revenue in 1999. Those highly dependent

upon *Loligo* squid (50% or more of total revenue due to *Loligo*) included Other Essex, NJ (81.9%) and Falmouth, MA (50%). Therefore, the vessel owners, crew, dealers or processors and fishing communities associated with these ports are expected to be affected the most by the risk of overfishing.

5.2.3.4 Maintain current control rule for *Loligo* (no action/status quo)

Under this option, the overfishing definition and control rule adopted in Amendment 8 would remain unchanged. Overfishing for *Loligo* was defined in Amendment 8 to occur when the catch associated with a threshold fishing mortality rate of F_{msy} is exceeded. Annual quotas are specified which correspond to a target fishing mortality rate of 75 % of F_{max}. Target F is defined as 75% of the F_{msy} when biomass is greater than 80,000 mt, and decreases linearly to zero at 40,000 mt (½ of the B_{MSY} proxy). Based on the new requirements of the SFA required the Council to take remedial action for 2000 to rebuild the stock to a level which will produce MSY (B_{msy}) given the status determination that *Loligo* was approaching an overfished state. The control rule in Amendment 8 specified that the target fishing mortality rate must be reduced to zero if biomass falls below 50% of B_{msy}. The target fishing mortality rate increases linearly to 75% of F_{msy} as biomass increases to B_{msy}. However, projections made in SAW 29 indicate that the control rule adopted in Amendment 8 appears to be overly conservative. Projections from SAW 29 indicated that the *Loligo* biomass could be rebuilt to levels approximating B_{msy} in three years if fishing mortality was reduced to the target mortality rate specified in Amendment 8 of 75% of F_{msy}. In determining the specification of ABC for the year 2000, the Council considered advice offered by SAW 29 which indicated that the control rule adopted in Amendment 8 was too conservative. Model projections presented in the most recent assessment demonstrated that the stock could be rebuilt in a relatively short period of time. The Council chose to specify ABC as the yield associated with 90% F_{msy} or 13,000 mt in 2000.

The most recent NEFSC survey data for *Loligo* squid indicate that abundance of this species has increased significantly since the most recent assessment was conducted (i.e, SAW-29). Estimates of biomass based on NEFSC fall 1999 and spring 2000 survey indices for *Loligo* indicate that the stock is currently at or near B_{msy}. In fact, the 1999 fall survey index was the sixth highest value observed in the time series since 1967 and the second highest since 1987. The 2000 spring survey index for *Loligo* was the tenth highest in the time series since 1968 and the fifth highest since 1987 (Lai, pers.comm). Based on the assumption that the stock will be at or near B_{msy} in 2001, the Council recommended that the 2001 quota be specified as the yield associated with 75% of F_{msy} . The yield associated with 75% of F_{msy} at B_{msy} is 17,000 mt based on projections in SAW-29 (NMFS 1999).

The Council proposes to replace the control rule as described in the preferred alternative, because it was determined to be unnecessarily restrictive by SAW 29. For example, yield projections conducted since development of the control rule indicated that the *Loligo* stock could rebuild to B_{msy} in a relatively short period of time. In retrospect, the *Loligo* stock quickly rebounded to the B_{msy} level by 2000. If the Council had followed the control rule

implemented in Amendment 8 for the 2000 fishery, the *Loligo* fishery would have been closed for the entire year. Thus failure to replace the control rule could have unwarranted negative economic and social consequences. The best example is fishing year 2000. If the Council had followed the control rule, the fishery would have been closed and a significant source of revenue for the fisheries fleet in northeastern US would have been lost. Table 11 indicated that there were 10 ports dependent upon *Loligo* for more than 10% of total revenue in 1999. Those highly dependent upon *Loligo* squid (50% or more of total revenue due to *Loligo*) included Other Essex, NJ (81.9%) and Falmouth, MA (50%). Therefore, the vessel owners, crew, dealers or processors and fishing communities associated with these ports are expected to be affected the most the no action alternative.

5.2.4 Allow for an exemption from the *Loligo* trip limit during periods of closure of the directed *Loligo* fishery for vessels engaged in the *Illex* fishery

5.2.4.1 Vessels possessing *Illex* squid moratorium permits would be permitted to possess *Loligo* taken seaward of the 50 fathom curve in an amount not to exceed 10% of the total weight of *Illex* on board during a period of closure of the *Loligo* fishery during the months of August or September.

The 2,500 pound trip limit for *Loligo* during directed *Loligo* fishery closures creates a compliance problem for *Illex* squid fishery vessels which occasionally take higher levels of *Loligo* incidental to pursuit of *Illex* squid. During the months of June, July, August, and September otter trawl vessels participating in the directed fishery for *Illex* are be exempt from the *Loligo* minimum mesh requirements if they possess *Loligo*. For the purposes of this mesh exemption, the directed *Illex* fishery for this time period is defined as otter trawl fishing for *Illex* seaward of the 50 fathom depth contour. This mesh exemption was included Amendment 5 because of concerns raised by fishermen that a small bycatch of *Loligo* can be expected in the *Illex* fishery. Industry advisors testified that the *Loligo* bycatch is very small and that almost all of the *Illex* fishing during this period occurs outside of the 50 fathom depth contour. The framework measure proposed here would build on the current mesh exemption but would be limited to the months of August or September. Under this measure, vessels which possess *Illex* squid moratorium permits fishing east of the 50 fathom contour would be permitted to possess *Loligo* in an amount not to exceed 10% of the total weight of *Illex* on board during a period of closure of the *Loligo* fishery during the months of August or September.

Overall, since the annual quota is the chief mechanism used to control fishing mortality in the *Loligo* fishery, the *Illex* fishery exemption from the 2500 pound trip limit during periods of closure of the directed *Loligo* fishery during August or September is not expected to have any negative biological impacts on the *Loligo* stock. However, the bycatch allowance in the *Illex* fishery could result in an overage in the third quarter of the *Loligo* fishery and/or reduce the amount of *Loligo* available for quarter 4 relative to the status quo. To estimate the possible impact of the 10% *Illex* exemption under

this option, landings data from 1999 was examined. This year was chosen because it is the last year for which a complete data set is available for which no closures of the *Loligo* fishery occurred. In August or September 1999 there were 34 trips which landed more than 25,000 lbs of *Illex* in the NMFS Dealer report data base. Trips less than 25,000 lbs were not included in the analysis because the effect on these trips would be the same under either the current 2,500 lb trip limit or the proposed 10% bycatch allowance (i.e., these trips would be limited to 2,500 lb of *Loligo* under either scenario). Of these 34 trips, there were 20 (or 59%) which landed greater than 2,500 lb of *Loligo*. The amount of *Loligo* landed on these trips ranged from 2,700 lb - 60,405 lbs. If the directed *Loligo* fishery had been closed on August 1 (i.e., directed *Loligo* fishery closed August or September of 1999), these trips would have landed 62,353 under the 2,500 lb trip limit. Under the 10% exemption option, these trips would have been expected to land 182,790 lbs of *Loligo* (i.e., under the condition that the amount of *Loligo* landed would not exceed 10% of the *Illex* landed on that trip). Therefore, under the 10% allowance these trips would have landed an additional 120,500 lb of *Loligo* relative to operating under the 2,500 lb trip limit. This amount represents the additional landings that would result from the 10% bycatch allowance and come at the “expense” of the quarter 4 allocation.

Current regulations specify that the directed *Loligo* fishery is to be closed during the last quarter when 95% of the total quota for the year is taken. The fishery remains open for the remainder of the fishing year at the bycatch level of 2,500 lbs. Assuming that no quota overages occur during the first three quarters (i.e., assuming that 100% of the quota allocation for each quarter is taken but not exceeded), the directed fishery quota for quarter 4 would be 10,066,204 lb. Therefore, the additional *Loligo* taken during quarter 3 due to the 10% *Illex* exemption would represent about 1.8% of the quarter 4 directed fishery quota if the directed *Loligo* fishery was closed on August 1, 2001 in quarter 3 (Table 30).

The most likely closure date of the directed *Loligo* fishery in quarter 3 (based on the 2001 specifications), was estimated based on the average weekly landings of *Loligo* for the period 1997-1999. This time frame was chosen because it is the most recent three year period during which no closure of the directed *Loligo* fishery occurred. Based on observed weekly landings during quarter 3 for the period 1997-1999, it was projected that the directed *Loligo* fishery would close at the end of week 37. Therefore, the projected closure date would be 19 September 2001 or the last two weeks of quarter 3. Assuming the directed *Loligo* fishery is closed on this date, the expected level of *Loligo* landings under the *Illex* exemption would be 40,620 pounds or about 0.4% of the directed fishery allocation in quarter 4 (Table 30). Based on the observed level of bycatch in 1999 and a projected closure during weeks weeks 38 and 39, this measure is not expected to increase the chance that an overage would occur relative to the annual quota. This level of *Loligo* bycatch is the most likely level expected under the 10% *Illex* exemption. Therefore, this measure is not expected to result in any negative economic or social impacts due to a quota overage.

However, the worst case scenario under the 10% *lllex* exemption that can be constructed would be to assume that all trips that landed greater than 25,000 pounds of *Illex* during August or September would retain *Loligo* in the amount equal to 10% of the *Illex* landed. This analysis was based on unpublished NMFS dealer reports for trips that landed greater than 25,000 pounds of *Illex* during August or September for the period 1997-1999. An estimate of the amount of *Loligo* expected to be landed under these conditions was obtained as the product of 0.1 and the average amount of *Illex* landed per week for the three year period 1997-1999. Assuming that the directed *Loligo* fishery is closed on August 1, 2001 and the worst case level of Loligo retention is realized, 1,228,287 lbs of *Loligo* would be the maximum amount expected under the 10% exemption rule (Table 31). The expected level of *Loligo* retention under these conditions is given by closure week in Table 31. As noted above, the actual projected closure date based on 1997-1999 *Loligo* landings by week would be expected to occur on or about September 19, 2001 (i.e, the directed fishery would be closed for weeks 38 and 39). Assuming this closure period and if the worst case level of *Loligo* retention is realized, 113,448 lbs of *Loligo* would be the maximum amount expected under the 10% exemption rule (Table 31). This would represent about 1.1% of the directed fishery allocation in quarter 4 (Table 31). Based on the worst case scenario level of bycatch and a projected closure during weeks 38 and 39, this measure is not expected to increase the chance that an overage would occur relative to the annual quota. Therefore, this measure is not expected to result in any negative economic or social impacts to vessel owners and crew, dealers or processors, and fishing communities due to a quota overage, even under the worst case senario assuming a closure during the last two weeks of quarter 3.

5.2.4.2 Vessels possessing *Illex* squid moratorium permits would be permitted to possess *Loligo* in an amount not to exceed 20%of the total weight of *Illex* on board during a period of closure of the *Loligo* fishery during the months of June-September.

The 2,500 pound trip limit for *Loligo* during directed *Loligo* fishery closures creates a compliance problem for *Illex* squid fishery vessels which occasionally take higher levels of *Loligo* incidental to pursuit of *Illex* squid. During the months of June, July, August, and September, otter trawl vessels participating in the directed fishery for *Illex* are be exempt from the *Loligo* minimum mesh requirements if they possess *Loligo*. For the purposes of this mesh exemption, the directed *Illex* fishery for this time period is defined as otter trawl fishing for *Illex* seaward of the 50 fathom depth contour. This mesh exemption was included Amendment 5 because of concerns raised by fishermen that a small bycatch of *Loligo* can be expected in the *Illex* fishery. Industry advisors testified that the *Loligo* bycatch is very small and that almost all of the *Illex* fishing during this period occurs outside of the 50 fathom depth contour. The framework measure proposed here would build on the current mesh exemption. Under this measure, vessels which possess *Illex* squid moratorium permits would be permitted to possess *Loligo* in an amount not to exceed 20% of the total weight of *Illex* on board during a period of closure of the *Loligo* fishery during the months of June-September.

Overall, since the annual quota is the chief mechanism used to control fishing mortality in the *Loligo* fishery, the *Illex* fishery exemption from the 2500 pound trip limit during periods of closure of the directed *Loligo* fishery during June-September is not expected to have any negative biological impacts on the *Loligo* stock. However, the bycatch allowance in the *Illex* fishery could result in an overage in the third quarter of the *Loligo* fishery and/or reduce the amount of *Loligo* available for quarter 4 relative to the status quo. Any additional landings that would result from the 20% bycatch allowance come at the "expense" of the quarter 4 allocation.

Current regulations specify that the directed *Loligo* fishery is to be closed during the last quarter when 95% of the total quota for the year is taken. The fishery remains open for the remainder of the fishing year at the bycatch level of 2,500 lbs. Assuming that no quota overages occur during the first three quarters (i.e., assuming that 100% of the quota allocation for each quarter is taken but not exceeded), the directed fishery quota for quarter 4 would be 10,066,204 lb.

The most likely closure date of the directed *Loligo* fishery in quarter 3 (based on the 2001 specifications), was estimated based on the average weekly landings of *Loligo* for the period 1997-1999. This time frame was chosen because it is the most recent three year period during which no closure of the directed *Loligo* fishery occurred. Based on observed weekly landings during quarter 3 for the period 1997-1999, it was projected that the directed *Loligo* fishery would likely close at the end of week 37. Therefore, the projected closure date would be 19 September 2001 or the last two weeks of quarter 3.

The worst case scenario under the 20% *lllex* exemption that can be constructed would be to assume that all trips that landed greater than 12,550 pounds of *Illex* during June through September would retain *Loligo* in the amount equal to 20% of the *Illex* landed. This analysis was based on unpublished NMFS dealer reports for trips that landed greater than 12,500 pounds of *Illex* during June and September for the period 1997-1999. An estimate of the amount of *Loligo* expected to be landed under these conditions was obtained as the product of 0.2 and the average amount of *Illex* landed per week for the three year period 1997-1999. Assuming that the directed *Loligo* fishery is closed on June 1, 2001 and the worst case level of *Loligo* retention is realized, 3,845,307 lbs of *Loligo* would be the maximum amount expected under the 20% exemption rule (Table 32). The expected level of *Loligo* retention under these conditions is given by closure week in Table 32. As noted above, the actual projected closure date based on 1997-1999 *Loligo* landings by week would be expected to occur on or about September 19, 2001 (i.e, the directed fishery would be closed for weeks 38 and 39). Assuming this closure period and if the worst case level of *Loligo* retention is realized under the 20% rule, 205,517 lbs of *Loligo* would be the maximum amount expected under the 20% exemption rule (Table 32). This would represent about 2.0% of the directed fishery allocation in quarter 4 (Table 32). Based on the worst case scenario level of bycatch (20%) and a projected closure during weeks 22-39, this measure would be expected to increase the chance that an overage would occur relative to the annual quota. Therefore, this measure could result in negative economic and

social impacts due to a quota overage if the worst case scenario was realized. Table 11 indicated that there were 10 ports dependent upon *Loligo* for more than 10% of total revenue in 1999. Those highly dependent upon *Loligo* squid (50% or more of total revenue due to *Loligo*) included Other Essex, NJ (81.9%) and Falmouth, MA (50%). Therefore, the vessel owners, crew, dealers or processors and fishing communities associated with these ports are expected to be affected the most if a quota overage occurred under this option.

5.2.4.3 No exemption from the 2,500 lb *Loligo* trip limit during a period of closure of the *Loligo* fishery (no action/status quo).

Under the no action alternative vessels fishing in the *Illex* fishery would not be exempt from the *Loligo* trip limit during periods when the directed *Loligo* fishery is closed and would be restricted to 2,500 lbs per trip. Overall, since the annual quota is the chief mechanism used to control fishing mortality in the *Loligo* fishery, the 2500 pound trip limit during periods of closure of the directed *Loligo* fishery is not expected to have any negative economic or social impacts on the vessel owners and crew, dealers or processors, and fishing communities dependent upon *Illex* and *Loligo* squid due to quota overages. The *Illex* fleet will be forced to discard the amount of *Loligo* taken in excess of 2,500 lb per trip. These unavoidable discards represent biological and economic waste since most if not all of the discarded *Loligo* will be dead.

5.3 Endangered Species and Other Marine Mammals

There are numerous species which inhabit 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 remainder are protected by the provisions of the MMPA. Marine mammals include the northern right whale, humpback whale, fin whale, minke whale, harbor porpoise, white-sided dolphin, bottlenose dolphin, common dolphin, harp seal, harbor seal and gray seal. The status of these and other marine mammal populations inhabiting the Northwest Atlantic has been discussed in detail in the U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments. Initial assessments were presented in Blaylock, *et al.* (1995) and are updated in Waring *et al.* (1999).

The protected species found in New England and Mid-Atlantic waters are listed below.

Endangered: Right whale *(Eubalaena glacialis),* Humpback whale *(Megaptera novaeangliae),* Fin whale *(Balaenoptera physalus),* Sperm whale *(Physeter macrocephalus),* Blue whale *(Balaenoptera musculus),* Sei whale *(Balaenoptera borealis),* Kemp's ridley *(Lepidochelys kempi),* Leatherback turtle *(Dermochelys coriacea),* Green sea turtle *(Chelonia mydas)* Shortnose sturgeon *(Acipenser brevirostrum).*

Threatened: Loggerhead turtle *(Caretta caretta)*

Species Proposed for ESA listing: Harbor porpoise: *(Phocoena phocoena).*

Other marine mammals: Other species of marine mammals likely to occur in the management unit include the minke whale *(Balaenoptera acutorostrata),* white-sided dolphin *(Lagenorhynchus acutus),* white-beaked dolphin *(Lagenorhynchus albirostris),* bottlenose dolphin *(Tursiops truncatus),* [coastal stock listed as depleted under the MMPA], pilot whale *(Globicephala melaena),* Risso's dolphin *(Grampus griseus),* common dolphin *(Dephinis delphis),* spotted dolphin (Stenella spp.), striped dolphin *(Stenella coeruleoalba),* killer whale *(Orcinus orca),* beluga whale *(Delphinapterus leucas),* Northern bottlenose whale *(Hyperoodon ampullatus),* goosebeaked whale *(Ziphius cavirostris)* and beaked whale (Mesoplodon spp.). Pinnipeds species include harbor *(Phoca vitulina)* and gray seals *(Halichoerus grypus)* and less commonly, hooded *(Cystophora cristata)* harp *(Pagophilus groenlandicus)* and ringed seals *(Phoca hispida).*

5.3.1 Protected Species of Particular Concern

5.3.1.1 North Atlantic Right Whale

The northern right whale was listed as endangered throughout it’s range on June 2, 1970 under the ESA. The current population is considered to be at a low level and the species remains designated as endangered (Waring *et al.* 1999). A Recovery plan has been published and is in effect (NMFS 1991). This is a strategic stock because the average annual fishery-related mortality and serious injury from all fisheries exceeds the Potential Biological Removal (PBR).

North Atlantic right whales range from wintering and calving grounds in coastal waters of the southeastern US to summer feeding grounds, nursery and presumed mating grounds in New England and northward to the Bay of Fundy and Scotian shelf (Waring et al. 1999). Approximately half of the species’ geographic range is within the area in which the summer flounder fishery is prosecuted. In the management area as a whole, right whales are present throughout most months of the year, but are most abundant between February and June. The species uses mid-Atlantic waters as a migratory pathway from the winter calving grounds off the coast of Florida to spring and summer nursery/feeding areas in the Gulf of Maine.

NMFS designated right whale critical habitat on June 3, 1994 (59 FR 28793). Portions of the critical habitat within the action area include the waters of Cape Cod Bay and the Great South Channel off the coast of Massachusetts, where the species is concentrated at different times of the year.

The western North Atlantic population of right whales was estimated to be 295 individuals in 1992 (Waring *et al.* 1999). The current population growth rate of 2.5% as reported by Knowlton et al. (1994) suggests the stock may be showing signs of slow recovery. However, considerable uncertainty exists about the true size of the current stock (Waring *et al.* 1999).

5.3.1.2 Humpback Whale

The humpback whale was listed as endangered throughout it’s range on June 2, 1970. This species is the fourth most numerically depleted large cetacean worldwide. In the western North Atlantic humpback whales feed during the spring through fall over a range which includes the eastern coast of the US (including the Gulf of Maine) northward to include waters adjacent to Newfoundland/Labrador and western Greenland (Waring *et al.* 1999). During the winter, the principal range for the North Atlantic population is around the Greater and Lesser Antilles in the Caribbean (Waring *et al.* 1999).

About half of the species' geographic range is within the management area of the summer flounder FMP. As noted above, humpback whales feed in the northwestern Atlantic during the summer months and migrate to calving and mating areas in the Caribbean. Five separate feeding areas are utilized in northern waters after their return; the Gulf of Maine (which is within the management unit of this FMP) is one of those feeding areas. As with right whales, humpback whales also use the Mid-Atlantic as a migratory pathway. Since 1989, observations of juvenile humpbacks in that area have been increasing during the winter months, peaking January through March (Swingle *et al.,* 1993). It is believed that non-reproductive animals may be establishing a winter feeding area in the Mid-Atlantic since they are not participating in reproductive behavior in the Caribbean. It is assumed that humpbacks are more widely distributed in the management area than right whales. They feed on a number of species of small schooling fishes, including sand lance and Atlantic herring.

The most recent status and trends of the for the Western North Atlantic stock of humpback whales are given by Waring *et al.* (1999). The current rate of increase of the North Atlantic humpback whale population has been estimated at 9.0% (CV=0.25) by Katona and Beard (1990) and at 6.5% by Barlow and Clapham (1997). The minimum population estimate for the North Atlantic humpback whale population is 10,019 animals, and the best estimate of abundance is 10,600 animals (CV=0.07; Waring *et al.* 1999).

5.3.1.3 Fin Whale

The fin whale was listed as endangered throughout it’s range on June 2, 1970 under the ESA. The fin whale is ubiquitous in the North Atlantic and occurs from the Gulf of Mexico and Mediterranean Sea northward to the edges of the arctic ice pack (Waring et al.1999). The overall pattern of fin whale movement is complex, consisting of a less obvious north-south pattern of migration than that of right and humpback whales. However, based on acoustic recordings from hydrophone arrays, Clark (1995) reported a general southward "flow pattern” of fin whales in the fall from the Labrador/Newfoundland region, south past Bermuda, and into the West Indies. The overall distribution may be based on prey availability, and fin whales are found throughout the management area for this FMP in most months of the year. This species preys opportunistically on both invertebrates and fish (Watkins et al. 1984). As with humpback whales, they feed by filtering large volumes of water

for the associated prey. Fin whales are larger and faster than humpback and right whales and are less concentrated in nearshore environments.

Hain *et al.* (1992) estimated that about 5,000 fin whales inhabit the northeastern United States continental shelf waters. Shipboard surveys of the northern Gulf of Maine and lower Bay of Fundy targeting harbor porpoise for abundance estimation provided an imprecise estimate of 2,700 (CV=0.59) fin whales (Waring *et al.* 1999).

5.3.1.4 Loggerhead Sea Turtle

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). In the management unit of this FMP they are most common on the open ocean in the northern Gulf of Maine, particularly where associated with warmer water fronts formed from the Gulf Stream. The species is also found in entrances to bays and sounds and within bays and estuaries, particularly in the Mid-Atlantic.

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 leave 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 1998) 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 (TEWG 1998). 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 analysis also indicated the northern subpopulation of loggerheads may be experiencing a significant decline (2.5% - 3.2% for various beaches). A recovery goal of 12,800 nests has been assumed for the Northern Subpopulation, but current nests number around 6,200 (TEWG 1998). Since the number of nests have 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.

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.

Sea sampling data from the sink gillnet fisheries, Northeast otter trawl fishery, and Southeast shrimp and summer flounder bottom trawl fisheries indicate incidental takes of loggerhead turtles. Loggerheads are also known to interact with the lobster pot fishery. The degree of interaction between loggerheads and the summer flounder recreational fishery is unknown. However, by analogy with other fisheries (i.e., South Atlantic) interactions are expected to be minimal.

5.3.1.5 Leatherback Sea Turtle

The leatherback sea turtle was listed as “endangered” under the ESA on June 2, 1970. The leatherback is the largest living sea turtle and ranges farther than any other sea turtle species, exhibiting broad thermal tolerances (NMFS& USFWS 1995). Leatherback turtles feed primarily on cnidarians (medusae, siphonophores) and tunicates (salps, pyrosomas) and are often found in association with jellyfish. These turtles are found throughout the management unit of this FMP. While they are predominantly pelagic, they occur annually in Cape Cod Bay and Narragansett Bay primarily during the fall. Leatherback turtles appear to be the most susceptible to entanglement in lobster gear and longline gear compared to the other sea turtles commonly found in the management unit. This may be the result of attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface.

Nest counts are the only reliable population information available for leatherback turtles. Recent declines have been seen in the number of leatherbacks nesting worldwide (NMFS & USFWS 1995). The status review notes that it is unclear whether this observation is due to natural fluctuations or whether the population is at serious risk. It is unknown whether leatherback populations are stable, increasing, or declining, but it is certain that some nesting populations (e.g, St. John and St. Thomas, U.S. Virgin Islands) have been extirpated (NMFS 1998).

Sea sampling data from the southeast shrimp fishery indicate recorded takes of leatherback turtles. As noted above, leatherbacks are also known to interact

with the lobster pot fishery. However, by analogy with other fisheries (i.e., South Atlantic) interactions are expected to be minimal.

5.3.1.6 Kemp's Ridley Sea Turtle

The Kemp's ridley is probably the most endangered of the world's sea turtle species. The only major nesting site for ridleys is a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963). Estimates of the adult population reached a low of 1,050 in 1985, but increased to 3,000 individuals in 1997. First-time nesting adults have increased from 6% to 28% from 1981 to 1989, and from 23% to 41% from 1990 to 1994, indicating that the ridley population may be in the early stages of growth (TEWG 1998).

Juvenile Kemp's ridleys inhabit northeastern US coastal waters where they forage and grow in shallow coastal during the summer months. Juvenile ridleys migrate southward with autumnal cooling and are found predominantly in shallow coastal embayments along the Gulf Coast during the late fall and winter months.

Ridleys found in mid-Atlantic waters are primarily post-pelagic juveniles averaging 40 cm in carapace length, and weighing less than 20 kg (NMFS 1998). After loggerheads, they are the second most abundant sea turtle in Virginia and Maryland waters, arriving in there during May and June and then emigrating to more southerly waters from September to November (NMFS 1998). In the Chesapeake Bay, ridleys frequently forage in shallow embayments, particularly in areas supporting submerged aquatic vegetation (Lutcavage and Musick 1985; NMFS 1998). The juvenile population in Chesapeake Bay is estimated to be 211 to 1,083 turtles (NMFS 1998).

The model presented by Crouse *et al.* (1987) illustrates the importance of subadults to the stability of loggerhead populations and may have important implications for Kemp's ridleys. The vast majority of ridleys identified along the Atlantic Coast have been juveniles and subadults. Sources of mortality in this area include incidental takes in fishing gear, pollution and marine habitat degradation, and other man-induced and natural causes. Loss of individuals in the Atlantic, therefore, may impede recovery of the Kemp's ridley sea turtle population.

Sea sampling data from the northeast otter trawl fishery and southeast shrimp and summer flounder bottom trawl fisheries has recorded takes of Kemp's ridley turtles. However, by analogy with other fisheries (i.e., South Atlantic) interactions are expected to be minimal.

5.3.1.7 Green Sea Turtle

Green sea turtles are more tropical in distribution than loggerheads, and are generally found in waters between the northern and southern 20°C isotherms (NMFS 1998). In the wester Atlantic region, the summer developmental habitat encompasses estuarine and coastal waters as far north as Long Island Sound, Chesapeake Bay, and the North Carolina sounds, and south throughout the tropics (NMFS 1998). Most of the individuals reported in U.S. waters are

immature (NMFS 1998). Green sea turtles found north of Florida during the summer must return to southern waters in autumn or risk the adverse effects of cold temperatures.

There is evidence that green turtle nesting has been on the increase during the past decade. For example, increased nesting has been observed along the Atlantic coast of Florida on beaches where only loggerhead nesting was observed in the past (NMFS 1998). Recent population estimates for the western Atlantic area are not available. Green turtles are threatened by incidental captures in fisheries, pollution and marine habitat degradation, destruction/disturbance of nesting beaches, and other sources of man-induced and natural mortality.

Juvenile green sea turtles occupy pelagic habitats after leaving the nesting beach. At approximately 20 to 25 cm carapace length, juveniles leave pelagic habitats, and enter benthic foraging areas, shifting to a chiefly herbivorous diet (NMFS 1998). Post-pelagic green turtles feed primarily on sea grasses and benthic algae, but also consume jellyfish, salps, and sponges. Known feeding habitats along U.S. coasts of the western Atlantic include shallow lagoons and embayments in Florida, and similar shallow inshore areas elsewhere (NMFS 1998).

Sea sampling data from the scallop dredge fishery and southeast shrimp and summer flounder bottom trawl fisheries have recorded incidental takes of green turtles. However, by analogy with other fisheries (i.e., South Atlantic) interactions are expected to be minimal.

5.3.1.8 Shortnose Sturgeon

Shortnose sturgeon occur in large rivers along the western Atlantic coast from the St. Johns River, Florida (possibly extirpated from this system), to the Saint John River in New Brunswick, Canada. The species is anadromous in the southern portion of its range *(i.e.,* south of Chesapeake Bay), while northern populations are amphidromous (NMFS 1998). Population sizes vary across the species' range with the smallest populations occurring in the Cape Fear and Merrimack Rivers and the largest populations in the Saint John and Hudson Rivers (Dadswell 1979; NMFS 1998).

Shortnose sturgeon are benthic and mainly inhabit the deep channel sections of large rivers. They feed on a variety of benthic and epibenthic invertebrates including molluscs, crustaceans (arnphipods, chironomids, isopods), and oligochaete worms (Vladykov and Greeley 1963; Dadswell 1979). Shortnose sturgeon are long-lived (30 years) and mature at relatively old ages. In northern areas, males reach maturity at 5-10 years, while females reach sexual maturity between 7 and 13 years.

In the northern part of their range, shortnose sturgeon exhibit three distinct movement patterns that are associated with spawning, feeding, and overwintering periods. In spring, as water temperatures rise above 8° C, pre-spawning shortnose sturgeon move from overwintering grounds to spawning

areas. Spawning occurs from mid/late April to mid/late May. Post-spawned sturgeon migrate downstream to feed throughout the summer.

As water temperatures decline below 8° C again in the fall, shortnose sturgeon move to overwintering concentration areas and exhibit little movement until water temperatures rise again in spring (NMFS 1998). Young-of-the-year shortnose sturgeon are believed to move downstream after hatching (NMFS 1998) but remain within freshwater habitats. Older juveniles tend to move downstream in fall and winter as water temperatures decline and the salt wedge recedes. Juveniles move upstream in spring and feed mostly in freshwater reaches during summer.

Shortnose sturgeon spawn in freshwater sections of rivers, typically below the first impassable barrier on the river *(e.g.,* dam). Spawning occurs over channel habitats containing gravel, rubble, or rock-cobble substrates (NMFS 1998). Additional environmental conditions associated with spawning activity include decreasing river discharge following the peak spring freshet, water temperatures ranging from 9 -12 C, and bottom water velocities of 0.4 - 0.7 m/sec (NMFS 1998).

5.3.1.9 Seabirds

Most of the following information about seabirds is taken from the Mid-Atlantic Regional Marine Research Program (1994) and Peterson (1963). Fulmars occur as far south as Virginia in late winter and early spring. Shearwaters, storm petrels (both Leach's and Wilson's), jaegers, skuas, and some terns pass through this region in their annual migrations. Gannets and phalaropes occur in the Mid-Atlantic during winter months. Nine species of gulls breed in eastern North America and occur in shelf waters off the northeastern US. These gulls include: glaucous, Iceland, great black-backed, herring, laughing, ring-billed, Bonaparte's and Sabine's gulls, and black-legged caduceus. Royal and sandwich terns are coastal inhabitants from Chesapeake Bay south to the Gulf of Mexico. The Roseate tern is listed as endangered under the ESA, while the Least tern is considered threatened (Safina pers. comm.). In addition, the bald eagle is listed as threatened under the ESA and is a bird of aquatic ecosystems.

Like marine mammals, seabirds are vulnerable to entanglement in commercial and recreational fishing gear. The interaction has not been quantified in the recreational fishery, but impacts are not considered significant. Human activities such as coastal development, habitat degradation and destruction, and the presence of organochlorine contaminants are considered the major threats to some seabird populations. Endangered, threatened or otherwise protected bird species, including the roseate tern and piping plover, are unlikely to be impacted by the gear types employed in these fisheries.

The proposed action and alternatives are not expected to have any adverse impacts on endangered or threatened species or marine mammal populations.

5.3.2 Fishery Classification under Section 114 of Marine Mammal Protection Act

Under section 114 of the MMPA , the NMFS must publish and annually update the List of Fisheries (LOF), which places all US commercial fisheries in one of three categories based on the level of incidental serious injury and mortality of marine mammals in each fishery (arranging them according to a two tiered classification system). The categorization of a fishery in the LOF determines whether participants in that fishery may be required to comply with certain provisions of the MMPA, such as registration, observer coverage, and take reduction plan requirements. The classification criteria consists of a two tiered, stock-specific approach that first addresses the total impact of all fisheries on each marine mammal stock (Tier 1) and then addresses the impact of the individual fisheries on each stock (Tier 2). If the total annual mortality and serious injury of all fisheries that interact with a stock is less than 10% of the 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. Under Tier 2, individual fisheries are subject to the following categorization:

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

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

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 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.

The Atlantic Squid, Mackerel, Butterfish Trawl Fishery is currently listed as a Category II fishery in of the final List of Fisheries for 2000 for the taking of marine mammals by commercial fishing operations under section 114 of the Marine Mammal Protection Act (MMPA) of 1972. However, the NMFS proposes to elevate the classification of this fishery to Category I in the proposed List of Fisheries for 2001. This proposed change resulted from a Tier 1 evaluation of NMFS Sea Sampling data which demonstrated that the Atlantic Squid, Mackerel, Butterfish Trawl Fishery incidentally injured and killed the following marine mammal species and stocks during 1996-1998: common dolphin (WNA stock), white-sided dolphin (WNA stock) and Globicephala sp. (includes long-finned and short-finned pilot whales) (WNA stock). Based on data presented in the draft 2000 Stock Assessment Report (SAR), annual serious

injury and mortality across all fisheries for pilot whale, common dolphin and white sided dolphin stocks exceed s 10% of the PBR (78, 184, and 107 respectively). Therefore, the Atlantic Squid, Mackerel, Butterfish Trawl Fishery is subject to Tier 2 analysis. The 2000 draft SAR analyses estimated an annual average mortality of 43 pilot whales and 367 common dolphins per year in this fishery, which is greater than 50% of PBR for each species. Therefore, the NMFS proposes to elevate this fishery Category I in the 2001 LOF. If this fishery becomes a Category I fishery in the final rule, it will receive a high priority with respect to observer coverage and consideration for measures under future Take Reduction Plans for these species.

5.4 Finding of No Significant Impacts

National Oceanic and Atmospheric Administration Order (NAO) 216-6 (revised May 20, 1999) provides nine criteria for determining the significance of the impacts of a proposed action. These criteria are discussed below:

1. Can the proposed action be reasonably expected to jeopardize the sustainability of any target species that may be affected by the action?

None of the proposed measures in Framework 2 are expected to jeopardize the sustainability of any target species affected by the action. Under the FMP, overfishing of Atlantic mackerel, Illex and Loligo squid, and butterfish is prevented by the establishment of annual fishing quotas consistent with harvesting at optimum levels. None of the proposed measures modify the underlying quota management program, therefore sustainability is unaffected.

2. Can the proposed action be reasonably expected to allow substantial damage to the ocean and coastal habitats and/or EFH as defined under the Magnuson-Stevens Act and identified in FMPs?

The area affected by the proposed action in the Atlantic mackerel, squid, and butterfish fisheries has been identified as EFH for the above mentioned species as well as tilefish, summer flounder, scup, black sea bass, and species associated with the Northeast multispecies FMP. The action in the context of the fisheries as a whole has the potential to have an adverse impact on EFH. However, because the adverse impact on EFH is not substantial, NMFS conducted an abbreviated EFH consultation pursuant to 50 CFR 600.920(h) and an EFH Assessment that incorporates all of the information required in 50 CFR 600.920(g)(2), that was prepared and included in the Framework document. In a memorandum dated June 26, 2001, the Northeast Regional Office Habitat Conservation Division noted that management measures already in place should control any redirection of effort created by Framework 2 and no new EFH Conservation Recommendations were provided.

3. Can the proposed action be reasonably expected to have a substantial adverse impact on public health or safety?

The proposed action is not expected to have a substantial adverse impact on public health or safety. None of the measures alters the manner in which the industry conducts fishing activities for the target species, therefore, there

is no change in fishing behavior that would affect safety. None of the measures has any impact on public health.

4. Can the proposed action be reasonably expected to have an adverse impact on endangered or threatened species, marine mammals, or critical habitat of these species?

The proposed measures continue for a year an existing category of vessel permit, modify catch allowances, and revise the annual specifications process. None of the measures alters fishing methods or activities. Therefore, this action is not expected to affect endangered or threatened species or critical habitat in any manner not considered in previous consultations on the fisheries. It has been determined that fishing activities conducted under this rule will have no adverse impacts on marine mammals. The proposed measures merely continue for a year an existing category of vessel permit, modify catch allowances, and revise the annual specifications process. None of the measures alters fishing methods or activities.

5. Can the proposed action be reasonably expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species?

The proposed action is not expected to result in cumulative effects on target or non-target species. The proposed measures merely continue for a year an existing category of vessel permit, modify catch allowances, and revise the annual specifications process. None of the measures alters fishing methods or activities.

6. Can the proposed action be reasonably expected to jeopardize the sustainability of any non-target species?

The proposed action is not expected to jeopardize the sustainability of any non-target species. The proposed measures merely continue for a year an existing category of vessel permit, modify catch allowances, and revise the annual specifications process. None of the measures alters fishing methods or activities.

7. Can the proposed action be expected to have a substantial impact on biodiversity and ecosystem function within the affected area (e.g., benthic productivity, predator-prey relationships, etc.)?

The proposed action is not expected to have a substantial impact on biodiversity and ecosystem function within the affected area because the proposed action measures merely continue for a year an existing category of vessel permit, modifies catch allowances, and revises the annual specifications process.

8. Are significant social or economic impacts interrelated with significant natural or physical environmental effects?

As discussed in Section 5.0 of this EA, the proposed action is not expected to result in significant social or economic impacts, or significant natural or

physical environmental effects not already analyzed. Therefore, there are no significant social or economic impacts interrelated with significant natural or physical environmental impacts. This action alleviates social and economic impacts resulting from the default measures.

9. To what degree are the effects on the quality of the human environment expected to be highly controversial?

The measures contained in this action are not expected to be highly controversial. The proposed measures merely continue for a year an existing category of vessel permit, modify catch allowances, and revise the annual specifications process. Extending the Illex squid moratorium for an additional year was initially expected to be somewhat controversial. Vessel owners from New England who did not qualify for a limited access Illex squid permit under Amendment 5, but who had hoped to gain additional access to the Illex squid fishery if the moratorium was lifted, may be concerned. Conversely, failing to extend the Illex moratorium would also be controversial. However, no public comments were received on the proposed rule so it is not controversial.

FONSI Statement

Having reviewed the environmental assessment and the available information relating to the Squid, Mackerel, Butterfish Framework Adjustment 2, I have determined that there will be no significant adverse environmental impact resulting from the action and that preparation of an environmental impact statement on the action is not required by Section 102(2)(c) of the National Environmental Policy Act or its implementing regulations.

Assistant Administrator for
Fisheries, NOAA_____
Date_____

6.0 Regulatory Impact Review and Review of Impacts Relative to the Regulatory Flexibility Analysis

6.1 INTRODUCTION

The National Marine Fisheries Service (NMFS) requires the preparation of a Regulatory Impact Review (RIR) for all regulatory actions that either implement a new Fishery Management Plan (FMP) or significantly amend an existing plan or regulation. The RIR is part of the process of preparing and reviewing FMPs and provides a comprehensive review of the changes in net economic benefits to society associated with proposed regulatory actions. The analysis also provides a review of the problems and policy objectives prompting the regulatory proposals and an evaluation of the major alternatives that could be used to solve the problems. The purpose of the analysis is to ensure that the regulatory agency systematically and comprehensively considers all available alternatives so that the public welfare can be enhanced in the most efficient and cost-effective way.

The RIR addresses many items in the regulatory philosophy and principles of Executive Order (E.O.) 12866. The RIR also serves as the basis for determining whether any proposed regulation is a "significant regulatory action" under certain criteria provided in E.O. 12866.

6.1.1 Management Objectives

The objectives of the FMP are:

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

6.2 METHODOLOGY AND FRAMEWORK FOR ANALYSIS

The basic approach adopted in this RIR is an assessment of management measures from the standpoint of determining the resulting changes in costs and benefits to society. The
effects of actions were analyzed by employing quantitative approaches to the extent possible. Otherwise, qualitative analyses were conducted.

For each alternative, potential impacts on several areas of interest are discussed. The objective of this analysis is to describe clearly and concisely the economic effects of the various alternatives. The types of effects that should be considered include the following changes in landings,

prices, consumer and producer benefits, harvesting costs, enforcement costs, and distributional effects. Due to the lack of an empirical model for these fisheries and knowledge of elasticities of supply and demand, a qualitative approach to the economic assessment was adopted. Nevertheless, quantitative measures are provided whenever possible.

A more detailed description of the economic concepts involved can be found in "Guidelines for Economic Analysis of Fishery Management Actions" (USDC 2000), as only a brief summary of key concepts will be presented here.

Benefit-cost analysis is conducted to evaluate the net social benefit arising from changes in consumer and producer surpluses that are expected to occur upon implementation of a regulatory action. Total Consumer Surplus (CS) is the difference between the amounts consumers are willing to pay for products or services and the amounts they actually pay. Thus CS represents net benefits to consumers. When the information necessary to plot the supply and demand curves for a particular commodity is available, consumer surplus is represented by the area that is below the demand curve and above the market clearing price where the two curves intersect. Since an empirical model describing the elasticities of supply and demand for these species is not available, it was assumed that the price for these species was determine by the market clearance price market or the interaction of the supply and demand curves. These prices were the base prices used to determine potential changes in prices due to changes in landings.

Net benefit to producers is producer surplus (PS). Total PS is the difference between the amounts producers actually receive for providing goods and services and the economic cost producers bear to do so. Graphically, it is the area above the supply curve and below the market clearing price where supply and demand intersect. Economic costs are measured by the opportunity cost of all resources including the raw materials, physical and human capital used in the process of supplying these goods and services to consumers.

One of the more visible costs to society of fisheries regulation is that of enforcement. From a budgetary perspective, the cost of enforcement is equivalent to the total public expenditure devoted to enforcement. However, the economic cost of enforcement is measured by the opportunity cost of devoting resources to enforcement vis à vis some other public or private use and/or by the opportunity cost of diverting enforcement resources from one fishery to another. The distributive effects detailed below describe any changes in the distribution or allocation of benefits and/or costs among the various components of the fishery and associated infrastructure as a result of the proposed actions.

6.3 IMPACTS OF PROPOSED ACTIONS AND ALTERNATIVES

6.3.1 Moratorium on entry to *Illex* fishery

6.3.1.1 Extend the moratorium on entry to the *Illex* fishery for an additional year (moratorium on entry to the *Illex* fishery would expire in 2003 unless extended in next Amendment) (Preferred Alternative).

Prior to the 1980's, the fishery for *Illex* in the US EEZ was prosecuted primarily by the foreign distant water fleets. With the implementation of the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan and it's subsequent Amendments, the fishery has become fully Americanized. At the same time that the domestic fishery was undergoing development, new biological data became available which indicated that *Illex* is an annual species. This resulted in downwardly revised estimates of the potential yield from this fishery. The simultaneous growth of the domestic fishery and reduction in estimates of sustainable yields resulted in the fishery moving towards a fully capitalized and exploited state. Hence, there was a moratorium on entry of additional commercial vessels into the *Illex* squid fisheries in the EEZ implemented as part Amendment 5.

As noted above, due to concerns that capacity might be insufficient to fully exploit the annual quota, a five year sunset provision was placed on the *Illex* moratorium when it was implemented as part of Amendment 5. The sunset provision for the moratorium entry into the *Illex* fishery, implemented in 1997, is set to expire in July 1, 2002.

Failure to extend the moratorium would result in further overcapitalization of this sector of the fishing industry, which in turn would have negative economic consequences for the vessels and communities which depend upon the *Illex* resource. The distribution of vessels which possessed *Illex* moratorium permits by home port state is given in Table 12. Overall, New Jersey would appear to be the state most dependent on the Illex resource followed by New York, Massachusetts and Rhode Island. Additional entry into this fishery would be expected to proportionately reduce the landings and revenue of vessels currently operative within the moratorium fleet (see analyses contained in RIR Section).

The extension of the moratorium under this framework option would maintain the status quo in the fishery at least until 2003. This will allow the Council more time to consider longer term measures for the *Illex* moratorium in the next amendment to the FMP. Vessels which took small quantities in the past will be able to continue to do so under the bycatch provisions of the FMP. However, further expansion of entry into the directed *Illex* fisheries will be controlled for at least one more year , thus overfishing and over-capitalization will be avoided.

Due to a lack of an empirical model for these fisheries and knowledge of elasticities of supply and demand, a qualitative approach to the economic assessment was adopted. Nevertheless, quantitative measures are provided whenever possible.

Landings

The landings in the *Illex* fishery are controlled by an annual quota. The extension of the moratorium has no effect on the annual quota specification and therefore, is expected to have no effect on the level of annual landings of *Illex*.

Prices

Given that the proposed extension of the *Illex* moratorium is not expected to change the level of future *Illex* landings and that *Illex* prices are a function of numerous factors including world supply and demand, it is assumed that there will not be a change in the price for this species as result of the proposed framework action.

Consumer Surplus

Assuming *Illex* prices will not be affected under the scenario constructed above, there will be no corresponding change in consumer surplus associated with this fishery.

Harvest Costs

No changes to harvest costs are expected as a result of the proposed moratorium extension.

Producer surplus

Assuming *Illex* prices will not be affected under the scenario constructed above, there will be no corresponding change in producer surplus associated with this fishery.

Enforcement Costs

The proposed extension of the moratorium is not expected to change enforcement costs.

Distributive Effects

There are no changes to the quota allocation process for *Illex*. As such, no distributional effects are identified for this fishery under the moratorium extension.

Summary of Impacts

The harvest capacity of the vessels which qualified under the *Illex* moratorium program established in Amendment 8 substantially exceeds the level necessary to harvest the long term sustainable yield for *Illex*. The extension of the moratorium under this framework option would maintain the status quo in the fishery at least until 2003. This will allow the Council more time to consider longer term measures for the *Illex* moratorium in future amendments to the FMP. Vessels which took small quantities in the past will be able to continue to do so under the bycatch provisions of the FMP. However, further expansion of entry into the directed *Illex* fisheries will be controlled for at least an additional year, thus overfishing and over-capitalization will be avoided.

6.3.1.2 Extend the moratorium on entry to the *Illex* fishery for an additional five years (moratorium on entry to the *Illex* fishery would expire in 2007 unless extended in future Amendment).

As noted above, Amendment 5 established a moratorium on new entry into the commercial fishery for *Illex* squid. The Council placed a five year sunset provision on the moratorium which is set to expire in July 2002. This measure would extend the *Illex* moratorium for an additional five years. Under this measure, only vessels which possess *Illex* moratorium permits during calendar year 2002 would be eligible for *Illex* moratorium permits under the moratorium extension. Under this alternative, the moratorium on entry to the *Illex* fishery would expire in 2007 unless extended in a future Amendment.

Due to a lack of an empirical model for these fisheries and knowledge of elasticities of supply and demand, a qualitative approach to the economic assessment was adopted. Nevertheless, quantitative measures are provided whenever possible.

Landings

The landings in the *Illex* fishery are controlled by an annual quota. The extension of the moratorium has no effect on the annual quota specification and therefore, is expected to have no effect on the level of annual landings of *Illex*.

Prices

Given that the proposed extension of the *Illex* moratorium is not expected to change the level of future *Illex* landings and that *Illex* prices are a function of numerous factors including world supply and demand, it is assumed that there will not be a change in the price for this species as result of the proposed framework action.

Consumer Surplus

Assuming *Illex* prices will not be affected under the scenario constructed above, there will be no corresponding change in consumer surplus associated with this fishery.

Harvest Costs

No changes to harvest costs are expected as a result of the proposed moratorium extension.

Producer surplus

Assuming *Illex* prices will not be affected under the scenario constructed above, there will be no corresponding change in producer surplus associated with this fishery.

Enforcement Costs

The proposed extension of the moratorium is not expected to change enforcement costs.

Distributive Effects

There are no changes to the quota allocation process for *Illex*. As such, no distributional effects are identified for this fishery under the moratorium extension.

Summary of Impacts

The harvest capacity of the vessels which qualified under the *Illex* moratorium program established in Amendment 8 substantially exceeds the level necessary to harvest the long term sustainable yield for *Illex*. The extension of the moratorium under this framework option would maintain the status quo in the fishery at least until 2007. This will allow the Council more time to consider longer term measures for the *Illex* moratorium in future amendments to the FMP. Vessels which took small quantities in the past will be able to continue to do so under the incidental catch provisions of the FMP. However, further expansion of entry into the directed *Illex* fisheries will be controlled for at least five additional years, thus overfishing and over-capitalization will be avoided.

6.3.1.3 Allow the moratorium on entry to the *Illex* fishery to expire in 2002 (no action)

Under this option, the *Illex* moratorium would expire in July of 2002 and the fishery would revert to open access conditions. As noted above, the *Illex* moratorium fleet demonstrated the capacity to harvest the long term sustainable level of harvest as defined under the SFA. The key questions relative to extension of this moratorium hinge on the likely effects of allowing the *Illex* fishery to revert to open access.

Due to a lack of an empirical model for these fisheries and knowledge of elasticities of supply and demand, a qualitative approach to the economic assessment was adopted. Nevertheless, quantitative measures are provided whenever possible.

Landings

The landings in the *Illex* fishery are controlled by an annual quota. However, failure to extend the *Illex* moratorium could lead to a dramatic increase in fishing effort. This could lead to the annual quota specification being exceeded. Therefore, failure to extend the moratorium could be expected to result in an increase in the level of landings of *Illex*.

Prices

Since failure to extend the *Illex* moratorium could increase the level of future *Illex* landings, there could be a minor local effect on price for the

species. However, given that *Illex* prices are a function of numerous factors including world supply and demand, it is can be assumed that, overall, there will not be a change in the price for this species as result of the failure to extend the moratorium.

Consumer Surplus

Assuming *Illex* prices will not be affected under the scenario constructed above, there will be no corresponding change in consumer surplus associated with this fishery.

Harvest Costs

Failure to extend the *Illex* moratorium could lead to derby style fishing which clearly could increase harvest costs.

Producer surplus

Assuming *Illex* prices will not be affected under the scenario constructed above, there will be no corresponding change in producer surplus associated with this fishery.

Enforcement Costs

Failure to extend the *Illex* moratorium could lead to increased enforcement costs.

Distributive Effects

Failure to extend the *Illex* moratorium could lead to severe distributive effects in the fishery. These changes in the allocation of *Illex* are discussed in subsequent sections of the RIR.

Summary of Impacts

The development of excess fishing capacity in US marine fisheries, especially since the passage of the Magnuson Act, has been identified as the single most important problem currently facing the US fishing industry (NMFS 1996; NRC 1999). Most US fisheries can be characterized as overcapitalized, with too many vessels, too much gear and too much time spent at sea harvesting fish at too high a cost to both harvesters and society. Adding significantly to the problem is the fact that the increase in fishing capacity in the US has been accompanied by a dramatic increase in technological advances (NMFS 1996). The US commercial fishery has developed from a fleet of primarily sailing vessels in the 1800's to a modern fleet of vessels which has resulted in an enormous increase in fishing power throughout the 20th century. This increase in fishing vessel capacity and efficiency has resulted in over-exploitation and economic losses throughout most US marine fisheries.
The net economic benefits that could be gained by ending the open access problem in US fisheries are significant. Managing single-species fisheries with a conservative, risk averse approach should be the first step in

achieving sustainable marine fisheries (NRC 1999). The NRC (1999) recommended that a moderate level of exploitation might be a better goal for fisheries management than full exploitation since the latter has almost universally resulted in over-exploitation of marine resources. The NRC (1999) concluded "At the core of today's overcapacity problem is the lack of, or ineffective, definition of fishing rights in most fisheries. Therefore, the committee recommends for many fisheries a management approach that includes the development and use of methods of allocation of exclusive shares of the fish resource or privileges and responsibilities (as opposed to open competition) and the elimination of subsidies that encourage overcapacity. A flexible and adaptive approach is essential, and careful attention must be given to equity issues associated with such approaches." In addition, the NRC (1999) strongly recommended that managers and policy makers should focus on developing or encouraging socioeconomic and other management measures that discourage overcapacity and that reward the conservative and efficient use of marine fishery resources.

Analyses presented above clearly indicate that *Illex* fishery is fully exploited and additional capacity in the fishery is both unnecessary and undesirable. Excess fishing capacity in the Northeast region of the US, if transferred into the *Illex* fishery, would easily result in overcapitalization of the fishery and over-exploitation of the resource. Based on the recommendation of the NRC (1999), the Council determined that the *Illex* moratorium should be extended to prevent the development of overcapacity in this fishery.

6.3.2 Timeliness of Quota Specifications for Atlantic mackerel, *Loligo* and *Illex* squid and Butterfish

6.3.2.1 If annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, the previous year's specifications shall apply until the final rule for new specifications is implemented (excluding TALFF specifications) (Preferred Alternative)

Under this measure, if annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid are not published by the NMFS prior to the start of the fishing year, the previous year's specifications shall apply until the final rule implementing the new quota specifications is published. As noted above, this measure does not apply to TALFF specifications.

Due to a lack of an empirical model for these fisheries and knowledge of elasticities of supply and demand, a qualitative approach to the economic assessment was adopted. Nevertheless, quantitative measures are provided whenever possible.

Landings

The landings in these fisheries are controlled by an annual quota. For *Loligo*, *Illex* and butterfish this measure is not expected to have any effect on landings. However, there could be an increase in the landings of Atlantic

mackerel due to an increase in JV activity under this alternative.

Prices

Since this measure could increase the level of Atlantic mackerel landings, there could be a minor local effects on price for the species. However, given that Atlantic mackerel prices are a function of numerous factors including world supply and demand, it is can be assumed that, overall, there will not be a change in the price for this species as result of increased JV activity.

Consumer Surplus

Assuming prices will not be affected under the scenario constructed above, there will be no corresponding change in consumer surplus associated with these fisheries.

Harvest Costs

No change in harvest costs are expected under this alternative.

Producer surplus

Assuming prices will not be affected under the scenario constructed above, there will be no corresponding change in producer surplus associated with these fisheries.

Enforcement Costs

No change in enforcement costs are expected under this alternative.

Distributive Effects

There are no distributive effects anticipated from this measure.

Summary of Impacts

The Council proposes as part this framework action that in the case that annual specifications for mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications shall apply (excluding TALFF specifications). The primary reason for this action is that in recent years, publication of the final rule implementing the annual specifications for Atlantic mackerel, squid and butterfish has not occurred until after the start of the fishing year. For example, the final rule implementing the quota specifications for Atlantic mackerel, squid and butterfish for 2000 was not published until March of 2000. Similarly, the final rule implementing the quota specifications for Atlantic mackerel, squid and butterfish for 2001 was not published until March 2, of 2001. Because the specifications were not in place by the start of the fishing season, the fishery for *Loligo* could not be regulated for the first several months of the fishery. Since the 2000 specifications were not published until late in the first trimester of 2000, the *Loligo* fishery could not be closed when 90% of

the quota allocated to trimester one was landed and an overage resulted. Quota overages in the *Loligo* fishery are deducted from subsequent quota period within the same fishing year. In the worst case scenario, failure to publish the annual specifications until very late in the fishing year (or not at all) would result in unregulated fishing. The inability to control landings in the fishery can be expected to greatly increase the chance that a quota overage might occur. This would have a negative economic and social impacts on participants in the *Loligo* fishery in subsequent quota periods. This situation will continue unless this action is taken.

In the case of Atlantic mackerel, industry members testified that delays in publishing the annual quota specifications has had a negative impact on possible Joint Venture activities for Atlantic mackerel, due to timing of the winter Atlantic mackerel fishery and the uncertainty about the upcoming year's JV specifications. To help alleviate this situation, the Council proposes under this alternative, that if the annual specifications for mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications will apply (excluding TALFF specifications). The only specification for Atlantic mackerel that would be significantly impacted by this measure would be the JV specification. Under current rules, if annual specifications are not published prior to the beginning of the fishing year, JV landings are not permitted. Under the proposed measure, JV operations could occur based on the previous years JV specification. For example, the 2001 Atlantic mackerel, squid and butterfish specifications were recently published on March 2, 2001 (the fishing year began on January 1, 2001). As a result, no JV activity could have occurred until March 2, 2001. Under the preferred alternative, the 2000 JV specification of 20,000 mt would have applied and JV activities could have been conducted under this provision. As result, JV landings of up to 20,000 mt in addition to recent levels of US domestic production could have conferred economic and social benefits to the domestic Atlantic mackerel fleet. This could not occur, however, if no action is taken.

6.3.2.2 If annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, the Atlantic mackerel, *Loligo* and *Illex* squid and Butterfish fisheries operate without specifications and Joint Ventures cannot be conducted until the final rule for new specifications is implemented (no action)

Under this measure, if annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid are not published by the NMFS prior to the start of the fishing year, the fishery opens without quota specifications. Under these conditions, no JV is specified for Atlantic mackerel for the new fishing year and therefore no mackerel JV operations can be conducted until the final rule implementing the new quota specifications is published.

Due to a lack of an empirical model for these fisheries and knowledge of elasticities of supply and demand, a qualitative approach to the economic assessment was adopted. Nevertheless, quantitative measures are provided whenever possible.

Landings

The landings in these fisheries are controlled by an annual quota. Since this option represents the status quo, no changes in landings are expected.

Prices

Given that no change in the level of future landings are expected, there will be no change in the price for these species.

Consumer Surplus

Assuming prices will not be affected under the scenario constructed above, there will be no corresponding change in consumer surplus associated with these fisheries.

Harvest Costs

No changes to harvest costs are expected.

Producer surplus

Assuming prices will not be affected under the scenario constructed above, there will be no corresponding change in producer surplus associated with these fisheries.

Enforcement Costs

No change in enforcement costs is expected.

Distributive Effects

There are no changes to the quota allocation process for these species under the no action alternative. Therefore, no distributional effects are identified.

Summary of Impacts

Since the 2000 specifications were not published until late in the first trimester of 2000, the *Loligo* fishery could not be closed when 90% of the quota allocated to trimester one was landed and an overage resulted. Quota overages in the *Loligo* fishery are deducted from subsequent quota periods within the same fishing year. In the worst case scenario, failure to publish the annual specifications until very late in the fishing year (or not at all) would result in unregulated fishing. The inability to control landings in the fishery can be expected to greatly increase the chance that a quota overage might occur. This would have a negative economic and social impacts on participants in the *Loligo* fishery in subsequent quota periods.

In the case of Atlantic mackerel, industry members testified that delays in publishing the annual quota specifications has had a negative impact on

possible Joint Venture activities for Atlantic mackerel, due to timing of the winter Atlantic mackerel fishery and the uncertainty about the upcoming year's JV specifications. To help alleviate this situation, the Council proposes under this alternative, that if the annual specifications for mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications will apply (excluding TALFF specifications). The only specification for Atlantic mackerel that would be significantly impacted by this measure would be the JV specification. Under current rules, if annual specifications are not published prior to the beginning of the fishing year, JV landings are not permitted. Under the proposed measure, JV operations could occur based on the previous years JV specification. For example, the 2001 Atlantic mackerel, squid and butterfish specifications were recently published on March 2, 2001(the fishing year began on January 1, 2001). As a result, no JV activity could have occurred until March 2, 2001. Under the proposed measure, the 2000 JV specification of 20,000 mt would have applied and JV activities could have been conducted under this provision. As result, JV landings of up to 20,000 mt in addition to recent levels of US domestic production could have conferred positive economic and social benefits to the domestic Atlantic mackerel fleet.

Quota monitoring and subsequent regulation of fishing mortality in the *Illex* and butterfish fisheries have not been negatively affected by the delays in publishing the annual specifications. As a result, this measure is not expected to have any economic or social impacts relative to either of these fisheries based on the dates on which the specifications have been published in recent years.

6.3.2.3 If annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, a set of default specifications shall apply for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish fisheries until the final rule for new specifications is implemented

Under this measure, if annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid are not published by the NMFS prior to the start of the fishing year, the fishery opens under a set of default quota specifications. Under this option quotas would be specified which correspond to the three year average of quota specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish for the period 1999-2001, except for TALFF which be set equal to zero under the default measures. Based on the specifications for those three years, the default specifications would as those outlined in Table 34.

Due to a lack of an empirical model for these fisheries and knowledge of elasticities of supply and demand, a qualitative approach to the economic assessment was adopted. Nevertheless, quantitative measures are provided whenever possible.

Landings

The landings in these fisheries are controlled by an annual quota. Since this

option represents the average of the most recent three years annual specifications, no changes in landings are expected due to the use of a default set of quota specifications.

Prices

Given that no change in the level of future landings are expected, there will be no change in the price for these species.

Consumer Surplus

Assuming prices will not be affected under the scenario constructed above, there will be no corresponding change in consumer surplus associated with these fisheries.

Harvest Costs

No changes to harvest costs are expected.

Producer surplus

Assuming prices will not be affected under the scenario constructed above, there will be no corresponding change in producer surplus associated with these fisheries.

Enforcement Costs

No change in enforcement costs is expected.

Distributive Effects

There are no changes to the quota allocation process for these species under the no action alternative. Therefore, no distributive effects are identified.

Summary of Impacts

The primary reason for this action is that in recent years, publication of the final rule implementing the annual specifications for Atlantic mackerel, squid and butterfish has not occurred until after the start of the fishing year. For example, the final rule implementing the quota specifications for Atlantic mackerel, squid and butterfish for 2000 was not published until March of 2000. Similarly, the final rule implementing the quota specifications for Atlantic mackerel, squid and butterfish for 2001 was not published until March 2, of 2001. Because the specifications were not in place by the start of the fishing season, the fishery for *Loligo* could not be regulated for the first several months of the fishery. The Council set the 2000 quota specifications for *Loligo* squid based on the SAW 29 projections which resulted in an ABC equal to the yield associated with 90% F_{msy} or 13,000 mt. Management advice from SAW 29 made special note of the fact that yield from this fishery should be distributed throughout the fishing year. Given that the permitted *Loligo* fleet historically had demonstrated the ability to land Loligo in excess of

the quota specified for 2000, the Council recommended that the annual quota be sub-divided into three quota period or trimesters. The 2000 quota was allocated to each period based on the proportion of landings occurring in each trimester from 1994-1998. Based on the seasonal distribution of landings during this time period, the quota for January-April was 5,460 mt (42% of the total), the quota for May-August was 2,340 mt (18% of the total), and the quota for September-December was 5200 mt (40% of the total). The directed fishery during the first two trimester periods was to be closed when 90% of the amount allocated to the period was landed and then a trip limit of 2,500 pounds would remain in effect until the quota period ends. Any underages from trimesters one and two were to be applied to the next trimester and overages were to be deducted from trimester three. The directed fishery was closed in the third trimester when 95% of the annual quota was taken. The fishery operated at the 2,500 trip limit level for most of the third quota period.

Since the 2000 specifications were not published until late in the first trimester of 2000, the fishery could not be closed when 90% of the quota allocated to trimester one was landed and an overage resulted. Quota overages in the *Loligo* fishery are deducted from subsequent quota period within the same fishing year. In the worst case scenario, failure to publish the annual specifications until very late in the fishing year (or not at all) would result in unregulated fishing. The inability to control landings in the fishery can be expected to greatly increase the chance that a quota overage might occur. This would have a negative economic and social impacts on participants in the *Loligo* fishery in subsequent quota periods.

In the case of Atlantic mackerel, industry members testified that delays in publishing the annual quota specifications has had a negative impact on possible Joint Venture activities for Atlantic mackerel, due to timing of the winter Atlantic mackerel fishery and the uncertainty about the upcoming year's JV specifications. To help alleviate this situation, the Council proposes under this alternative, that if the annual specifications for mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications will apply (excluding TALFF specifications). The only specification for Atlantic mackerel that would be significantly impacted by this measure would be the JV specification. Under current rules, if annual specifications are not published prior to the beginning of the fishing year, JV landings are not permitted. Under the proposed measure, JV operations could occur based on the previous years JV specification. For example, the 2001 Atlantic mackerel, squid and butterfish specifications were recently published on March 2, 2001(the fishing year began on January 1, 2001). As a result, no JV activity could have occurred until March 2, 2001. Under the proposed measure, the 2000 JV specification of 20,000 mt would have applied and JV activities could have been conducted under this provision. As result, JV landings of up to 13,300 mt, in addition to recent levels of US domestic production, could have conferred economic and social benefits to the domestic Atlantic mackerel fleet.

6.3.2.4 If annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, the fisheries for these species will be closed until the final

rule for new specifications is implemented

Under this measure, if the annual specifications for Atlantic mackerel, *Loligo* and *Illex* squid and butterfish are not published by the NMFS prior to the start of the fishing year, the fisheries for these species will be closed until the final rule for new specifications is published. In other words, the landing of all four species in the management unit would be prohibited until the final for new specifications is published.

Due to a lack of an empirical model for these fisheries and knowledge of elasticities of supply and demand, a qualitative approach to the economic assessment was adopted. Nevertheless, quantitative measures are provided whenever possible.

Landings

The annual landings in these fisheries would be expected to decline under this alternative. The amount of the decline would depend upon when the final rule implementing new quota specifications was published. Based on the most recent year (2001), the fisheries could be expected to be closed for the first two months of the fishing year.

Prices

Given that landings are expected to decline under this alternative, an increase in the price for these species would be anticipated.

Consumer Surplus

Assuming prices will increase under the scenario constructed above, the consumer surplus associated with these fisheries is expected to decrease under this alternative.

Harvest Costs

Since fishermen would be forced to concentrate their fishing effort during the open period of the fishing year (last 10 months), harvest costs are expected to increase under this alternative.

Producer surplus

Assuming prices will increase under the scenario constructed above, producer surplus associated with these fisheries would be expected to increase.

Enforcement Costs

Because a closure of the fishery would need to be enforced during the first two months of the year, enforcement costs are expected to increase under this alternative.

Distributive Effects

There are could be substantial distributive effects due to this alternative because the quota would be re-allocated to the later parts of the fishing year.

Summary of Impacts

This measure would have significant negative economic consequences for vessels operating in the Atlantic mackerel, *Loligo* and butterfish fisheries because landings of these four species would be prohibited until the final rule for new specifications is published and significant landings occur early in the fishing year. Based on the recent publication date of the annual specifications for Atlantic mackerel, squid and butterfish, these fisheries would most likely be closed during the months of January and February under this alternative. The likely negative effects of this measure would be the loss of revenue associated with the landings of Atlantic mackerel, *Loligo* and butterfish during the months of January and February. During 1999, the value of the January and February landings of each species, respectively, was $1.7 million, $5.2 million, and $.0.9 million. The total value of the landings of these three species during the first two months of 1999 represent about 20% of the annual revenue generated for all three species based on 1999 landings data. This measure would be expected to have little or no economic impact on the *Illex* fishery.

6.3.2.5 If annual specifications for Atlantic mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications shall apply, until the final rule for new specifications is implemented (excluding TALFF specifications)

Under this measure, if annual specifications for Atlantic mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications shall apply until the final rule implementing the new quota specifications are published. As noted above, this measure does not apply to TALFF specifications.

Due to a lack of an empirical model for these fisheries and knowledge of elasticities of supply and demand, a qualitative approach to the economic assessment was adopted. Nevertheless, quantitative measures are provided whenever possible.

Landings

There could be an increase in the landings of Atlantic mackerel due to an increase in JV activity under this alternative.

Prices

Since this measure could increase the level of Atlantic mackerel landings, there could be a minor local effect on price for the species. However, given that Atlantic mackerel prices are a function of numerous factors including world supply and demand, it is can be assumed that, overall, there will not be a change in the price for this species as result of increased JV activity.

Consumer Surplus

Assuming prices will not be affected under the scenario constructed above, there will be no corresponding change in consumer surplus associated with the Atlantic mackerel fishery.

Harvest Costs

No change in harvest costs are expected under this alternative.

Producer surplus

Assuming prices will not be affected under the scenario constructed above, there will be no corresponding change in producer surplus associated with the Atlantic mackerel fishery.

Enforcement Costs

No change in enforcement costs are expected under this alternative.

Distributive Effects

There are no distributive effects anticipated from this measure.

Summary of Impacts

In the case of Atlantic mackerel, industry members testified that delays in publishing the annual quota specifications has had a negative impact on possible Joint Venture activities for Atlantic mackerel, due to timing of the winter Atlantic mackerel fishery and the uncertainty about the upcoming year's JV specifications. To help alleviate this situation, the Council proposes under this alternative, that if the annual specifications for mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications will apply (excluding TALFF specifications). The only specification for Atlantic mackerel that would be significantly impacted by this measure would be the JV specification. Under current rules, if annual specifications are not published prior to the beginning of the fishing year, JV landings are not permitted. Under the proposed measure, JV operations could occur based on the previous years JV specification. For example, the 2001 Atlantic mackerel, squid and butterfish specifications were recently published on March 2, 2001 (the fishing year began on January 1, 2001). As a result, no JV activity could have occurred until March 2, 2001. Under the preferred alternative, the 2000 JV specification of 20,000 mt would have applied and JV activities could have been conducted under this provision. As result, JV landings of up to 20,000 mt in addition to recent levels of US domestic production could have conferred economic and social benefits to the domestic Atlantic mackerel fleet. This could not occur, however, if no action is taken.

6.3.2.6 If annual specifications for Atlantic mackerel are not published by the NMFS prior to the start of the fishing year, a set of default

specifications shall apply for Atlantic mackerel until the final rule for new specifications is implemented (excluding TALFF specifications)

Under this measure, if annual specifications for Atlantic mackerel are not published by the NMFS prior to the start of the fishing year, the fishery opens under a set of default quota specifications. Under this option, quotas would be specified which correspond to the three year average of quota specifications for Atlantic mackerel for the period 1999-2001, except for TALFF which be set equal to zero under the default measures.

Due to a lack of an empirical model for these fisheries and knowledge of elasticities of supply and demand, a qualitative approach to the economic assessment was adopted. Nevertheless, quantitative measures are provided whenever possible.

Landings

There could be an increase in the landings of Atlantic mackerel due to an increase in JV activity under this alternative.

Prices

Since this measure could increase the level of Atlantic mackerel landings, there could be a minor local effect on price for the species. However, given that Atlantic mackerel prices are a function of numerous factors including world supply and demand, it is can be assumed that, overall, there will not be a change in the price for this species as result of increased JV activity.

Consumer Surplus

Assuming prices will not be affected under the scenario constructed above, there will be no corresponding change in consumer surplus associated with the Atlantic mackerel fishery.

Harvest Costs

No change in harvest costs are expected under this alternative.

Producer surplus

Assuming prices will not be affected under the scenario constructed above, there will be no corresponding change in producer surplus associated with the Atlantic mackerel fishery.

Enforcement Costs

No change in enforcement costs are expected under this alternative.

Distributive Effects

There are no distributive effects anticipated from this measure.

Summary of Impacts

In the case of Atlantic mackerel, industry members testified that delays in publishing the annual quota specifications has had a negative impact on possible Joint Venture activities for Atlantic mackerel, due to timing of the winter Atlantic mackerel fishery and the uncertainty about the upcoming year's JV specifications. To help alleviate this situation, the Council proposes under this alternative, that if the annual specifications for mackerel are not published by the NMFS prior to the start of the fishing year, the previous year's specifications will apply (excluding TALFF specifications). The only specification for Atlantic mackerel that would be significantly impacted by this measure would be the JV specification. Under current rules, if annual specifications are not published prior to the beginning of the fishing year, JV landings are not permitted. Under the proposed measure, JV operations could occur based on the previous years JV specification. For example, the 2001 Atlantic mackerel, squid and butterfish specifications were recently published on March 2, 2001(the fishing year began on January 1, 2001). As a result, no JV activity could have occurred until March 2, 2001. Under the proposed measure, the 2000 JV specification of 20,000 mt would have applied and JV activities could have been conducted under this provision. As result, JV landings of up to 13,300 mt, in addition to recent levels of US domestic production, could have conferred positive economic l benefits to the domestic Atlantic mackerel fleet.

6.3.3*Loligo* control rule

6.3.3.1 Annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} consistent with requirements of Section 304e of the Magnuson-Stevens Act. In addition, Max OY, ABC, OY, and DAH may be specified for a period of up to three years. (Preferred Alternative)

This measure modifies the control rule for *Loligo* squid and allows for the in-season adjustment of the annual *Loligo* quota. The primary components of the overfishing definition that were required under the SFA and implemented under Amendment 8 (i.e,, the maximum fishing mortality rate threshold (F_{msy}) and the minimum biomass threshold (½ B_{msy})), remain unchanged. Under this measure, an annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} in a time period consistent with Section 304 e of the Magnuson-Stevens Act. This section of the Act specifies that an overfished stock shall be rebuilt in a time period as short as possible, but not to exceed ten years.

In addition to changes in the overfishing definition, the Council may specify Max OY, ABC, OY and DAH for up to three years. The Atlantic Mackerel Squid

and Butterfish Monitoring Committee will meet in late spring to review available NEFSC survey data and develop recommendations about in-season adjustments to these specifications for consideration by the Atlantic Mackerel Squid and Butterfish Committee and the Council. Based on an evaluation of the most recent NEFSC spring and fall trawl survey data, the OY, DAH and ABC may be adjusted to be consistent with the control rule. Based on the recommendations of the Council, the Regional Administrator may make in-season adjustments, as appropriate based on the recommendations of the Council, through publication of a notice in the Federal Register of in-season adjustment action.

Due to a lack of an empirical model for these fisheries and knowledge of elasticities of supply and demand, a qualitative approach to the economic assessment was adopted. Nevertheless, quantitative measures are provided whenever possible.

Landings

Overall, there could be an increase in the landings of *Loligo* under this alternative since the target fishing mortality is slightly higher than under the current control rule. However, the in-season adjustment mechanism could also reduce landings through an in-season reduction in the annual quota if stock conditions decline based on updated stock assessment information. Therefore, it is concluded that no net change in *Loligo* landings will result from this measure.

Prices

Since this measure could increase or decrease the level of *Loligo* landings, it can be assumed that, overall, there will not be a change in the price for this species.

Consumer Surplus

Assuming prices will not be affected under the scenario constructed above, there will be no corresponding change in consumer surplus associated with the *Loligo* fishery.

Harvest Costs

No change in harvest costs are expected under this alternative.

Producer surplus

Assuming prices will not be affected under the scenario constructed above, there will be no corresponding change in producer surplus associated with the *Loligo* fishery.

Enforcement Costs

No change in enforcement costs are expected under this alternative.

Distributive Effects

There are no distributive effects anticipated from this measure.

Summary of Impacts

The *Loligo* fishery is managed pursuant to this FMP through an annual quota specification process. Annual quotas are specified based on the overfishing definition established in Amendment 8. Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management (FMP) was developed to bring the FMP into compliance with the Sustainable Fisheries Act (SFA). The SFA, which reauthorized and amended the Magnuson-Stevens Act, made a number of changes to the existing National Standards, as well as to definitions and other provisions in the Magnuson-Stevens Act, that caused the Guidelines to be significantly revised. The most significant changes were made to National Standard 1, which imposed new requirements concerning definitions of overfishing in fishery management plans. The overfishing definition for Loligo was revised in Amendment 8 to comply with the SFA as follows: overfishing for *Loligo* will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{max} is exceeded (F_{max} is a proxy for F_{msy}). When an estimate of F_{msy} becomes available, it will replace the current overfishing proxy of F_{max}. Annual quotas will be specified which correspond to a target fishing mortality rate. Under Amendment 8 , target F was defined as 75% of the F_{msy} when biomass is greater than B_{msy}, and decreases linearly to zero 50% of B_{MSY}. Maximum OY is specified as the catch associated with a fishing mortality rate of F_{max}. In addition, the biomass target is specified to equal B_{MSY}.

The new requirements of the SFA required the Council to take remedial action for 2000 to rebuild the stock to a level which will produce MSY (B_{msy}) given the status determination that *Loligo* was approaching an overfished state. The control rule in Amendment 8 specified that the target fishing mortality rate must be reduced to zero if biomass falls below 50% of B_{msy}. The target fishing mortality rate increases linearly to 75% of F_{msy} as biomass increases to B_{msy}. However, projections made in SAW 29 indicate that the control rule adopted in Amendment 8 appears to be overly conservative. Projections from SAW 29 indicated that the *Loligo* biomass could be rebuilt to levels approximating B_{msy} in three years if fishing mortality was reduced to the target mortality rate specified in Amendment 8 of 75% of F_{msy}. In determining the specification of ABC for the year 2000, the Council considered advice offered by SAW 29 which indicated that the control rule adopted in Amendment 8 was too conservative. The Council chose to specify ABC as the yield associated with 90% F_{msy} or 13,000 mt in 2000.

The most recent NEFSC survey data for *Loligo* squid indicate that abundance of this species has increased significantly since the most recent assessment was conducted (i.e, SAW-29). Estimates of biomass based on NEFSC fall 1999 and spring 2000 survey indices for *Loligo* indicate that the stock is currently at or near B_{msy}. In fact, the 1999 fall survey index was the sixth highest value observed in the time series since 1967 and the second highest since 1987. The

2000 spring survey index for *Loligo* was the tenth highest in the time series since 1968 and the fifth highest since 1987 (Lai, pers.comm). Based on the assumption that the stock will be at or near B_{msy} in 2001, the Council recommended that the 2001 quota be specified as the yield associated with 75% of F_{msy} . The yield associated with 75% of F_{msy} at B_{msy} is 17,000 mt based on projections in SAW-29 (NMFS 1999).

The Council proposes to replace the control rule because it was determined to be unnecessarily restrictive by SAW 29. For example, yield projections conducted since development of the control rule indicated that the *Loligo* stock could rebuild to B_{msy} in a relatively short period of time. In retrospect, the *Loligo* stock quickly rebounded to the B_{msy} level by 2000. If the Council had followed the control rule implemented in Amendment 8 for the 2000 fishery, the *Loligo* fishery would have been closed for the entire year.

Under this alternative, the basic elements of the overfishing definition required by the SFA, the overfishing threshold (F_{msy}) and minimum biomass threshold (½ B_{msy}) will be retained. Since the stock will still be protected from overfishing, no negative biological impacts are expected from the adjustment to this management measure. In addition, the in-season adjustment mechanism will a afford additional protection to the stock. For example, under the current management system, the annual specification for *Loligo* is determined a year in advance of the fishing year for which the specifications apply. Under the proposed alternative, the quota could be adjusted downward during the fishing season if it is determined to be necessary to sudden changes (declines) in *Loligo* stock abundance. The converse is also true. That is, if the stock is found to be larger than anticipated the annual quota can be adjusted upward to allow for increased yield from the fishery and yet maintain a sustainable level of harvest within the guidelines of the SFA. Thus, this measure will confer positive economic and social benefits in the short term by allowing for in-season increases in yield during years of high abundance. In the longer term, the control rule will reduce the chance of overfishing by allowing for decreases in yield and fishing mortality when stock abundance is lower than anticipated.

6.3.3.2 Annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} in a time period of at least three years but not greater than five years.

This measure modifies the overfishing definition for *Loligo* squid and allows for the in-season adjustment of the *Loligo* quota. The primary components of the overfishing definition that were required under the SFA and implemented under Amendment 8 (i.e,, the maximum fishing mortality rate threshold (F_{msy}) and the minimum biomass threshold (½ B_{msy})), remain unchanged. Under this measure, an annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing

mortality shall be implemented to insure that stock is rebuilt to B_{msy} in a time period of at least three years but not greater than five years.

The Atlantic Mackerel Squid and Butterfish Monitoring Committee will meet in late spring to review available NEFSC survey data and develop recommendations about in-season adjustments to these specifications for consideration by the Atlantic Mackerel Squid and Butterfish Committee and the Council. Based on an evaluation of the most recent NEFSC spring and fall trawl survey data, the OY, DAH and ABC may be adjusted to be consistent with the control rule. Based on the recommendations of the Council, the Regional Administrator may make in-season adjustments, as appropriate based on the recommendations of the Council, through publication of a notice in the Federal Register of in-season adjustment action.

Due to a lack of an empirical model for these fisheries and knowledge of elasticities of supply and demand, a qualitative approach to the economic assessment was adopted. Nevertheless, quantitative measures are provided whenever possible.

Landings

Overall, there could be an increase in the landings of *Loligo* under this alternative since the target fishing mortality is slightly higher than under the current control rule. However, the in-season adjustment mechanism could also reduce landings through an in-season reduction in the annual quota if stock conditions decline based on updated stock assessment information. Therefore, it is concluded that no net change in *Loligo* landings will result from this measure.

Prices

Since this measure could increase or decrease the level of *Loligo* landings, it can be assumed that, overall, there will not be a change in the price for this species.

Consumer Surplus

Assuming prices will not be affected under the scenario constructed above, there will be no corresponding change in consumer surplus associated with the *Loligo* fishery.

Harvest Costs

No change in harvest costs are expected under this alternative.

Producer surplus

Assuming prices will not be affected under the scenario constructed above, there will be no corresponding change in producer surplus associated with the *Loligo* fishery.

Enforcement Costs

No change in enforcement costs are expected under this alternative.

Distributive Effects

There are no distributive effects anticipated from this measure.

Summary of Impacts

The ***Loligo*** fishery is managed pursuant to this FMP through an annual quota specification process. Annual quotas are specified based on the overfishing definition established in Amendment 8. Amendment 8 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management (FMP) was developed to bring the FMP into compliance with the Sustainable Fisheries Act (SFA). The SFA, which reauthorized and amended the Magnuson-Stevens Act, made a number of changes to the existing National Standards, as well as to definitions and other provisions in the Magnuson-Stevens Act, that caused the Guidelines to be significantly revised. The most significant changes were made to National Standard 1, which imposed new requirements concerning definitions of overfishing in fishery management plans. The overfishing definition for Loligo was revised in Amendment 8 to comply with the SFA as follows: overfishing for ***Loligo*** will be defined to occur when the catch associated with a threshold fishing mortality rate of F_{max} is exceeded (F_{max} is a proxy for F_{msy}). When an estimate of F_{msy} becomes available, it will replace the current overfishing proxy of F_{max}. Annual quotas will be specified which correspond to a target fishing mortality rate. Under Amendment 8 , target F was defined as 75% of the F_{msy} when biomass is greater than B_{msy}, and decreases linearly to zero 50% of B_{MSY}. Maximum OY is specified as the catch associated with a fishing mortality rate of F_{max}. In addition, the biomass target is specified to equal B_{MSY}.

The new requirements of the SFA required the Council to take remedial action for 2000 to rebuild the stock to a level which will produce MSY (B_{msy}) given the status determination that ***Loligo*** was approaching an overfished state. The control rule in Amendment 8 specified that the target fishing mortality rate must be reduced to zero if biomass falls below 50% of B_{msy}. The target fishing mortality rate increases linearly to 75% of F_{msy} as biomass increases to B_{msy}. However, projections made in SAW 29 indicate that the control rule adopted in Amendment 8 appears to be overly conservative. Projections from SAW 29 indicated that the ***Loligo*** biomass could be rebuilt to levels approximating B_{msy} in three years if fishing mortality was reduced to the target mortality rate specified in Amendment 8 of 75% of F_{msy}. The Council chose to specify ABC as the yield associated with 90% F_{msy} or 13,000 mt in 2000.

The most recent NEFSC survey data for ***Loligo*** squid indicate that abundance of this species has increased significantly since the most recent assessment was conducted (i.e, SAW-29). Estimates of biomass based on NEFSC fall 1999 and spring 2000 survey indices for ***Loligo*** indicate that the stock is currently at or near B_{msy}. In fact, the 1999 fall survey index was the sixth highest value observed in the time series since 1967 and the second highest since 1987. The

2000 spring survey index for *Loligo* was the tenth highest in the time series since 1968 and the fifth highest since 1987 (Lai, pers.comm). Based on the assumption that the stock will be at or near B_{msy} in 2001, the Council recommended that the 2001 quota be specified as the yield associated with 75% of F_{msy} . The yield associated with 75% of F_{msy} at B_{msy} is 17,000 mt based on projections in SAW-29 (NMFS 1999).

The Council proposes to replace the control rule because it was determined to be unnecessarily restrictive by SAW 29. For example, yield projections conducted since development of the control rule indicated that the *Loligo* stock could rebuild to B_{msy} in a relatively short period of time, even at fishing mortality rates approaching F_{msy}. In retrospect, the *Loligo* stock quickly rebounded to the B_{msy} level by 2000. If the Council had followed the control rule implemented in Amendment 8 for the 2000 fishery, the *Loligo* fishery would have been closed for the entire year.

Under this alternative, the basic elements of the overfishing definition required by the SFA, the overfishing threshold (F_{msy}) and minimum biomass threshold (½ B_{msy}) will be retained. Since the stock will still be protected from overfishing, no negative biological impacts are expected from the adjustment to this management measure. In addition, the in-season adjustment mechanism will a afford additional protection to the stock. For example, under the current management system, the annual specification for *Loligo* is determined a year in advance of the fishing year for which the specifications apply. Under the proposed alternative, the quota could be adjusted downward during the fishing season if it is determined to be necessary to sudden changes (declines) in *Loligo* stock abundance. The converse is also true. That is, if the stock is found to be larger than anticipated the annual quota can be adjusted upward to allow for increased yield from the fishery and yet maintain a sustainable level of harvest within the guidelines of the SFA. Thus, this measure will confer positive economic and social benefits in the short term by allowing for in-season increases in yield during years of high abundance. In the longer term, the control rule will reduce the chance of overfishing by allowing for decreases in yield and fishing mortality when stock abundance is lower than anticipated.

6.3.3.3 Annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} in a time period of at least five years but not greater than ten years.

This measure modifies the overfishing definition for *Loligo* squid and allows for the in-season adjustment of the *Loligo* quota. The primary components of the overfishing definition that were required under the SFA and implemented under Amendment 8 (i.e,, the maximum fishing mortality rate threshold (F_{msy}) and the minimum biomass threshold (½ B_{msy})), remain unchanged. Under this measure, an annual quota associated with a target fishing mortality rate of up to 90% F_{msy} will be specified if stock biomass is greater than the minimum biomass threshold (½ B_{msy}). If stock biomass falls below, or is expected to

fall below the minimum biomass threshold (½ B_{msy}), measures to control fishing mortality shall be implemented to insure that stock is rebuilt to B_{msy} in a time period of at least five years but not greater than ten years.

The Atlantic Mackerel Squid and Butterfish Monitoring Committee will meet in late spring to review available NEFSC survey data and develop recommendations about in-season adjustments to these specifications for consideration by the Atlantic Mackerel Squid and Butterfish Committee and the Council. Based on an evaluation of the most recent NEFSC spring and fall trawl survey data, the OY, DAH and ABC may be adjusted to be consistent with the control rule. Based on the recommendations of the Council, the Regional Administrator may make in-season adjustments, as appropriate based on the recommendations of the Council, through publication of a notice in the Federal Register of in-season adjustment action.

Due to a lack of an empirical model for these fisheries and knowledge of elasticities of supply and demand, a qualitative approach to the economic assessment was adopted. Nevertheless, quantitative measures are provided whenever possible.

Landings

Overall, there could be an increase in the landings of *Loligo* under this alternative since the target fishing mortality is slightly higher than under the current control rule. However, the in-season adjustment mechanism could also reduce landings through an in-season reduction in the annual quota if stock conditions decline based on updated stock assessment information. Therefore, it is concluded that no net change in *Loligo* landings will result from this measure.

Prices

Since this measure could increase or decrease the level of *Loligo* landings, it can be assumed that, overall, there will not be a change in the price for this species.

Consumer Surplus

Assuming prices will not be affected under the scenario constructed above, there will be no corresponding change in consumer surplus associated with the *Loligo* fishery.

Harvest Costs

No change in harvest costs are expected under this alternative.

Producer surplus

Assuming prices will not be affected under the scenario constructed above, there will be no corresponding change in producer surplus associated with the *Loligo* fishery.

Enforcement Costs

No change in enforcement costs are expected under this alternative.

Distributive Effects

There are no distributive effects anticipated from this measure.

Summary of Impacts

The Council is proposing to replace the control rule because it was determined to be unnecessarily restrictive by SAW 29. For example, yield projections conducted since development of the control rule indicated that the *Loligo* stock could rebuild to B_{msy} . In retrospect, the *Loligo* stock quickly rebounded to the B_{msy} level by 2000. If the Council had followed the control rule implemented in Amendment 8 for the 2000 fishery, the *Loligo* fishery would have been closed for the entire year.

Under this alternative, the basic elements of the overfishing definition required by the SFA, the overfishing threshold (F_{msy}) and minimum biomass threshold (½ B_{msy}) will be retained. Since the stock will still be protected from overfishing, no negative biological impacts are expected from the adjustment to this management measure. In addition, the in-season adjustment mechanism will a afford additional protection to the stock. For example, under the current management system, the annual specification for *Loligo* is determined a year in advance of the fishing year for which the specifications apply. Under the proposed alternative, the quota could be adjusted downward during the fishing season if it is determined to be necessary to sudden changes (declines) in *Loligo* stock abundance. The converse is also true. That is, if the stock is found to larger than anticipated the annual quota can be adjusted upward to allow for increased yield from the fishery and yet maintain a sustainable level of harvest within the guidelines of the SFA. Thus, this measure will confer positive economic and social benefits in the short term by allowing for in-season increases in yield during years of high abundance. In the longer term, the control rule will reduce the chance of overfishing by allowing for decreases in yield and fishing mortality when stock abundance is lower than anticipated.

Like the preferred alternative, this alternative preserves the basic elements of the overfishing definition required by the SFA (the overfishing threshold (F_{msy}) and minimum biomass threshold (½ B_{msy}) will be retained). If the stock is not protected from overfishing, some negative economic impacts could be expected from the implementation of this measure.

6.3.3.4 Maintain current control rule for *Loligo* (no action).

Under this option, the overfishing definition and control rule adopted in Amendment 8 would remain unchanged. Overfishing for *Loligo* was defined in Amendment 8 to occur when the catch associated with a threshold fishing mortality rate of F_{msy} is exceeded. Annual quotas are specified which correspond to a target fishing mortality rate of 75 % of F_{max}. Target F is

defined as 75% of the F_{msy} when biomass is greater than 80,000 mt, and decreases linearly to zero at 40,000 mt (½ of the B_{MSY} proxy).

Due to a lack of an empirical model for these fisheries and knowledge of elasticities of supply and demand, a qualitative approach to the economic assessment was adopted. Nevertheless, quantitative measures are provided whenever possible.

Landings

Overall, there could be a decrease in the landings of *Loligo* under this alternative since the fishing morality target fishing is lower than under the preferred alternative, especially if biomass falls below the threshold and the fishery had to be closed the entire fishing year.

Prices

Since this measure would decrease the level of *Loligo* landings, it can be assumed that the price for this species would increase.

Consumer Surplus

Assuming prices would increase under the scenario constructed above, there will be a corresponding decrease in consumer surplus associated with the *Loligo* fishery.

Harvest Costs

No change in harvest costs are expected under this alternative.

Producer surplus

Assuming prices would increase under the scenario constructed above, there would be a corresponding increase in producer surplus associated with the *Loligo* fishery.

Enforcement Costs

No change in enforcement costs are expected under this alternative.

Distributive Effects

There are no distributive effects anticipated from this measure.

Summary of Impacts

The Council proposes to replace the control rule as described in the preferred alternative, because it was determined to be unnecessarily restrictive by SAW 29. For example, yield projections conducted since development of the control rule indicated that the *Loligo* stock could rebuild to B_{msy} in a relatively

short period of time, even at fishing mortality rates approaching F_{msy}. In retrospect, the *Loligo* stock quickly rebounded to the B_{msy} level by 2000. If the Council had followed the control rule implemented in Amendment 8 for the 2000 fishery, the *Loligo* fishery would have been closed for the entire year. Thus failure to replace the control rule could have unwarranted negative economic and social consequences. The best example is fishing year 2000. If the Council had followed the control rule, the fishery would have been closed and a significant source of revenue for the fisheries fleet in northeastern US would have been lost.

6.3.4 Allow for an exemption from the *Loligo* trip limit during periods of closure of the directed *Loligo* fishery for vessels engaged in the *Illex* fishery

6.3.4.1 Vessels possessing *Illex* squid moratorium permits would be permitted to possess *Loligo* taken seaward of the 50 fathom curve in an amount not to exceed 10% of the total weight of *Illex* on board during a period of closure of the *Loligo* fishery during the months of August or September.

The 2,500 pound trip limit for *Loligo* during directed *Loligo* fishery closures creates a compliance problem for *Illex* squid fishery vessels which occasionally take higher levels of *Loligo* incidental to pursuit of *Illex* squid. During the months of June, July, August, and September otter trawl vessels participating in the directed fishery for *Illex* are be exempt from the *Loligo* minimum mesh requirements if they possess *Loligo*. For the purposes of this mesh exemption, the directed *Illex* fishery for this time period is defined as otter trawl fishing for *Illex* seaward of the 50 fathom depth contour. This mesh exemption was included Amendment 5 because of concerns raised by fishermen that a small bycatch of *Loligo* can be expected in the *Illex* fishery. Industry advisors testified that the *Loligo* bycatch is very small and that almost all of the *Illex* fishing during this period occurs outside of the 50 fathom depth contour. The framework measure proposed here would build on the current mesh exemption but would be limited to the months of August or September. Under this measure, vessels which possess *Illex* squid moratorium permits fishing east of the 50 fathom contour would be permitted to possess *Loligo* in an amount not to exceed 10% of the total weight of *Illex* on board during a period of closure of the *Loligo* fishery during the months of August or September.
Due to a lack of an empirical model for these fisheries and knowledge of elasticities of supply and demand, a qualitative approach to the economic assessment was adopted. Nevertheless, quantitative measures are provided whenever possible.

Landings

Overall, there would be no change in the landings of *Loligo* under this alternative.

Prices

Since there would be no change in the landings of *Loligo* under this alternative, there will not be a change in the price for this species.

Consumer Surplus

Assuming prices will not be affected under the scenario constructed above, there will be no corresponding change in consumer surplus associated with the *Loligo* fishery.

Harvest Costs

No change in harvest costs are expected under this alternative.

Producer surplus

Assuming prices will not be affected under the scenario constructed above, there will be no corresponding change in producer surplus associated with the *Loligo* fishery.

Enforcement Costs

No change in enforcement costs are expected under this alternative.

Distributive Effects

There are some distributive effects related to this measure. The vessels operating in the *Illex* fishery during August or September will experience an increase in revenue because they will be permitted to retain a greater amount of *Loligo* during those months compared to the status quo. The increase in revenues experienced by these vessels will come at the expense of vessels operating in the directed fishery for *Loligo* during the last quarter of the fishing year. The level of this distributive effect depends upon when the directed fishery closes in the third quarter. In addition, there will be a negative effect on dealers which handle *Loligo* in the last quarter of the fishing year. The effect on dealers is expected to be similar to the effect on vessels during the last quarter.

Summary of Impacts

To estimate the possible impact of the 10% *Illex* exemption under this option, landings data from 1999 was examined. This year was chosen because it is the last year for which a complete data set is available for which no closures of the *Loligo* fishery occurred. In August or September 1999 there were 34 trips which landed more than 25,000 lbs of *Illex* in the NMFS Dealer report data base. Trips less than 25,000 lbs were not included in the analysis because the effect on these trips would be the same under either the current 2,500 lb trip limit or the proposed 10% bycatch allowance (i.e., these trips would be limited to 2,500 lb of *Loligo* under either scenario). Of these 34 trips, there were 20 (or 59%) which landed greater than 2,500 lb of *Loligo*. The amount of *Loligo* landed on these trips ranged from 2,700 lb - 60,405 lbs. If

the directed *Loligo* fishery had been closed on August 1 (i.e., directed *Loligo* fishery closed August or September of 1999), these trips would have landed 62,353 under the 2,500 lb trip limit. Under the 10% exemption option, these trips would have been expected to land 182,790 lbs of *Loligo* (i.e., under the condition that the amount of *Loligo* landed would not exceed 10% of the *Illex* landed on that trip). Therefore, under the 10% allowance these trips would have landed an additional 120,500 lb of *Loligo* relative to operating under the 2,500 lb trip limit. This amount represents the additional landings that would result from the 10% bycatch allowance and come at the "expense" of the quarter 4 allocation.

Current regulations specify that the directed *Loligo* fishery is to be closed during the last quarter when 95% of the total quota for the year is taken. The fishery remains open for the remainder of the fishing year at the bycatch level of 2,500 lbs. Assuming that no quota overages occur during the first three quarters (i.e., assuming that 100% of the quota allocation for each quarter is taken but not exceeded), the directed fishery quota for quarter 4 would be 10,066,204 lb. Therefore, the additional *Loligo* taken during quarter 3 due to the 10% *Illex* exemption would represent about 1.8% of the quarter 4 directed fishery quota if the directed *Loligo* fishery was closed on August 1, 2001 in quarter 3 (Table 30).

The most likely closure date of the directed *Loligo* fishery in quarter 3 (based on the 2001 specifications), was estimated based on the average weekly landings of *Loligo* for the period 1997-1999. This time frame was chosen because it is the most recent three year period during which no closure of the directed *Loligo* fishery occurred. Based on observed weekly landings during quarter 3 for the period 1997-1999, it was projected that the directed Loligo fishery would close at the end of week 37. Therefore, the projected closure date would be 19 September 2001 or the last two weeks of quarter 3. Assuming the directed *Loligo* fishery is closed on this date, the expected level of Loligo landings under the *Illex* exemption would be 40,620 pounds or about 0.4% of the directed fishery allocation in quarter 4 (Table 30). Based on the observed level of bycatch in 1999 and a projected closure during weeks weeks 38 and 39, this measure is not expected to increase the chance that an overage would occur relative to the annual quota. This level of *Loligo* bycatch is the most likely level expected under the 10% *Illex* exemption. Therefore, this measure is not expected to result in any negative economic or biological impacts due to a quota overage.

However, the worst case scenario under the 10% *lllex* exemption that can be constructed would be to assume that all trips that landed greater than 25,000 pounds of *Illex* during August or September would retain *Loligo* in the amount equal to 10% of the *Illex* landed. This analysis was based on unpublished NMFS dealer reports for trips that landed greater than 25,000 pounds of *Illex* during August or September for the period 1997-1999. An estimate of the amount of *Loligo* expected to be landed under these conditions was obtained as the product of 0.1 and the average amount of *Illex* landed per week for the three year period 1997-1999. Assuming that the directed *Loligo* fishery is closed on August 1, 2001 and the worst case level of *Loligo* retention is

realized, 1,228,287 lbs of *Loligo* would be the maximum amount expected under the 10% exemption rule (31). The expected level of *Loligo* retention under these conditions is given by closure week in Table 31. As noted above, the actual projected closure date based on 1997-1999 *Loligo* landings by week would be expected to occur on or about September 19, 2001 (i.e, the directed fishery would be closed for weeks 38 and 39). Assuming this closure period and if the worst case level of *Loligo* retention is realized, 113,448 lbs of *Loligo* would be the maximum amount expected under the 10% exemption rule (Table 31). This would represent about 1.1% of the directed fishery allocation in quarter 4 (Table 31). Based on the worst case scenario level of bycatch and a projected closure during weeks 38 and 39, this measure is not expected to increase the chance that an overage would occur relative to the annual quota. Therefore, this measure is not expected to result in any negative economic or social impacts due to a quota overage, even under the worst case senario assuming a closure during the last two weeks of quarter 3.

6.3.4.2 Vessels possessing *Illex* squid moratorium permits would be permitted to possess *Loligo* in an amount not to exceed 20%of the total weight of *Illex* on board during a period of closure of the *Loligo* fishery during the months of June-September.

The 2,500 pound trip limit for *Loligo* during directed *Loligo* fishery closures creates a compliance problem for *Illex* squid fishery vessels which occasionally take higher levels of *Loligo* incidental to pursuit of *Illex* squid. During the months of June, July, August, and September, otter trawl vessels participating in the directed fishery for *Illex* are be exempt from the *Loligo* minimum mesh requirements if they possess *Loligo*. For the purposes of this mesh exemption, the directed *Illex* fishery for this time period is defined as otter trawl fishing for *Illex* seaward of the 50 fathom depth contour. This mesh exemption was included Amendment 5 because of concerns raised by fishermen that a small bycatch of *Loligo* can be expected in the *Illex* fishery. Industry advisors testified that the *Loligo* bycatch is very small and that almost all of the *Illex* fishing during this period occurs outside of the 50 fathom depth contour. The framework measure proposed here would build on the current mesh exemption. Under this measure, vessels which possess *Illex* squid moratorium permits would be permitted to possess *Loligo* in an amount not to exceed 20% of the total weight of *Illex* on board during a period of closure of the *Loligo* fishery during the months of June-September.

Due to a lack of an empirical model for these fisheries and knowledge of elasticities of supply and demand, a qualitative approach to the economic assessment was adopted. Nevertheless, quantitative measures are provided whenever possible.

Landings

Overall, there would be no change in the landings of *Loligo* under this alternative.

Prices

Since there would be no change in the landings of *Loligo* under this alternative, there will not be a change in the price for this species.

Consumer Surplus

Assuming prices will not be affected under the scenario constructed above, there will be no corresponding change in consumer surplus associated with the *Loligo* fishery.

Harvest Costs

No change in harvest costs are expected under this alternative.

Producer surplus

Assuming prices will not be affected under the scenario constructed above, there will be no corresponding change in producer surplus associated with the *Loligo* fishery.

Enforcement Costs

No change in enforcement costs are expected under this alternative.

Distributive Effects

There could be severe distributive effects related to this measure. The vessels operating in the *Illex* fishery during June-September will experience an increase in revenue because they will be permitted to retain a greater amount of *Loligo* during those months compared to the status quo. The increase in revenues experienced by these vessels will come at the expense of vessels operating in the directed fishery for *Loligo* during the last quarter of the fishing year. The level of this distributive effect depends upon when the directed fishery closes in the third quarter. In addition, there will be a negative effect on dealers which handle *Loligo* in the last quarter of the fishing year. The effect on dealers is expected to be similar to the effect on vessels during the last quarter.

Summary of Impacts

Overall, since the annual quota is the chief mechanism used to control fishing mortality in the *Loligo* fishery, the *Illex* fishery exemption from the 2500 pound trip limit during periods of closure of the directed *Loligo* fishery during June-September is not expected to have any negative biological impacts on the *Loligo* stock. However, the bycatch allowance in the *Illex* fishery could result in an overage in the third quarter of the *Loligo* fishery and/or reduce the amount of *Loligo* available for quarter 4 relative to the status quo. Any additional landings that would result from the 20% bycatch allowance come at the “expense” of the quarter 4 allocation.

Current regulations specify that the directed *Loligo* fishery is to be closed

during the last quarter when 95% of the total quota for the year is taken. The fishery remains open for the remainder of the fishing year at the bycatch level of 2,500 lbs. Assuming that no quota overages occur during the first three quarters (i.e., assuming that 100% of the quota allocation for each quarter is taken but not exceeded), the directed fishery quota for quarter 4 would be 10,066,204 lb.

The most likely closure date of the directed *Loligo* fishery in quarter 3 (based on the 2001 specifications), was estimated based on the average weekly landings of *Loligo* for the period 1997-1999. This time frame was chosen because it is the most recent three year period during which no closure of the directed *Loligo* fishery occurred. Based on observed weekly landings during quarter 3 for the period 1997-1999, it was projected that the directed *Loligo* fishery would likely close at the end of week 37. Therefore, the projected closure date would be 19 September 2001 or the last two weeks of quarter 3.

The worst case scenario under the 20% *lllex* exemption that can be constructed would be to assume that all trips that landed greater than 12,500 pounds of *Illex* during June through September would retain *Loligo* in the amount equal to 20% of the *Illex* landed. This analysis was based on unpublished NMFS dealer reports for trips that landed greater than 12,500 pounds of *Illex* during June and September for the period 1997-1999. An estimate of the amount of *Loligo* expected to be landed under these conditions was obtained as the product of 0.2 and the average amount of *Illex* landed per week for the three year period 1997-1999. Assuming that the directed *Loligo* fishery is closed on June 1, 2001 and the worst case level of *Loligo* retention is realized, 3,845,307 lbs of *Loligo* would be the maximum amount expected under the 20% exemption rule (Table 32). The expected level of *Loligo* retention under these conditions is given by closure week in Table 32. As noted above, the actual projected closure date based on 1997-1999 *Loligo* landings by week would be expected to occur on or about September 19, 2001 (i.e, the directed fishery would be closed for weeks 38 and 39). Assuming this closure period and if the worst case level of *Loligo* retention is realized under the 20% rule, 205,517 lbs of *Loligo* would be the maximum amount expected under the 20% exemption rule (Table 32). This would represent about 2.0% of the directed fishery allocation in quarter 4 (Table 32). Based on the worst case scenario level of bycatch (20%) and a projected closure during weeks 22-39, this measure would be expected to increase the chance that an overage would occur relative to the annual quota. Therefore, this measure could result in negative economic and social impacts due to a quota overage if the worst case scenario was realized.

6.3.4.3 No exemption from the 2,500 lb *Loligo* trip limit during a period of closure of the *Loligo* fishery (no action).

Under the no action alternative vessels fishing in the *Illex* fishery would not be exempt from the *Loligo* trip limit during periods when the directed *Loligo* fishery is closed and would be restricted to 2,500 lbs per trip.

Due to a lack of an empirical model for these fisheries and knowledge of elasticities of supply and demand, a qualitative approach to the economic

assessment was adopted. Nevertheless, quantitative measures are provided whenever possible.

Landings

Overall, there would be no change in the landings of *Loligo* under this alternative.

Prices

Since there would be no change in the landings of *Loligo* under this alternative, there will not be a change in the price for this species.

Consumer Surplus

Assuming prices will not be affected under the scenario constructed above, there will be no corresponding change in consumer surplus associated with the *Loligo* fishery.

Harvest Costs

No change in harvest costs are expected under this alternative.

Producer surplus

Assuming prices will not be affected under the scenario constructed above, there will be no corresponding change in producer surplus associated with the *Loligo* fishery.

Enforcement Costs

No change in enforcement costs are expected under this alternative.

Distributive Effects

There are no distributive effects related to this measure.

Summary of Impacts

Overall, since the annual quota is the chief mechanism used to control fishing mortality in the *Loligo* fishery, the 2500 pound trip limit during periods of closure of the directed *Loligo* fishery is not expected to have any negative economic or social impacts due to quota overages. The *Illex* fleet will be forced to discard the amount of *Loligo* taken in excess of 2,500 lb per trip. These unavoidable discards represent biological and economic waste since most if not all of the discarded *Loligo* will be dead.

6.4 DETERMINATIONS OF A SIGNIFICANT REGULATORY ACTION

This framework action does not constitute a significant regulatory action

under Executive Order 12866 for the following reasons. (1) It will not have an annual effect on the economy of more than $100 million. Based on unpublished NMFS preliminary data (Maine-North Carolina) the total commercial value for the Atlantic mackerel, squid and butterfish fisheries was estimated at $42.3 million in 1999. The measures considered in this regulatory action will not affect total revenues generated by the commercial industry to the extent that a $100 million annual economic impact will occur. The action is necessary to maintain the harvest of Atlantic mackerel and squid at sustainable levels. The action benefits in a material way the economy, productivity, competition and jobs. The action will not adversely affect, in the long-term, competition, jobs, the environment, public health or safety, or state, local, or tribal government communities. (2) The action will not create a serious inconsistency or otherwise interfere with an action taken or planned by another agency. No other agency has indicated that it plans an action that will affect the Atlantic mackerel, squid and butterfish fisheries in the EEZ. (3) The 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) The final action does not raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this Executive Order.

6.5 REVIEW OF IMPACTS RELATIVE TO THE REGULATORY FLEXIBILITY ACT

6.5.1. Introduction

The purpose of the Regulatory Flexibility Act (RFA) is to minimize the adverse impacts from burdensome regulations and record keeping requirements on small businesses, small organizations, and small government entities. The category of small entities likely to be affected by the final plan is that of commercial Atlantic mackerel, squid and butterfish fishermen. The impacts of the final action on the fishing industry and the economy as a whole were discussed above. The following discussion of impacts centers specifically on the effects of the final actions on the mentioned small businesses entities.

6.5.2. Determination of Significant Economic Impact on a Substantial Number of Small Entities

Based on 1999 NMFS dealer reports, a total of 559 vessels landed 26.5 million pounds of Atlantic mackerel valued at $3.6 million (Table 4). Most of the vessels which landed mackerel also possessed *Loligo*/Butterfish moratorium permits and *Illex* permits (Table 5). There were 260 vessels which landed 0.8 million pounds of Atlantic mackerel which possessed incidental catch permits. A total of 523 vessels landed 41.4 million pounds of *Loligo* valued at 32.2 million in 1999. Most of these landings were taken by vessels which possessed *Loligo*/Butterfish moratorium permits (Table 5). A total of 86 vessels landed 16.3 million pounds of *Illex* valued at $3.6 million in 1999. Virtually all of these landings were taken by vessels which possessed *Illex* moratorium permits (Table 5). A total of 522 vessels landed 4.7 million pounds of *Illex* valued at $2.7 million in 1999.

The Small Business Administration (SBA) defines a small business in the

commercial fishing and recreational fishing activity, as a firm with receipts (gross revenues) of up to $2.0 and $3.0 million, respectively. According to NMFS permit file data (19 January 2001) 2007 commercial vessels were holding Atlantic mackerel permits, 400 vessels were holding *Loligo*/butterfish moratorium permits, 77 vessels possessed *Illex* permits, 1598 vessels held incidental catch permits and 522 vessels held party/charter permits. There was a total of 2700 distinct vessels holding one or more of the permits described above. All of these vessels readily fall within the definition of small business. In addition, there were 352 dealers which possessed Squid, Mackerel, Butterfish dealer permits which could be affected by the proposed actions.

6.5.3. Analysis of Economic Impacts of Proposed and Alternative Framework Management Measures

6.5.3.1 *Illex* moratorium extension

The implementation of the preferred framework management measure to extend the moratorium for an additional year or the first option to extend the moratorium for an additional five years maintain the status quo in this fishery, at least in the short term. As a result, neither of these measures are expected to change gross revenues as a consequence of the proposed actions. Therefore it is correct to assume that the these alternatives represent no constraint on vessels in these fisheries in aggregate or individually. In the absence of such constraints, there is no impact on revenues under the Regulatory Flexibility Act.

In the case of the no action alternative, the moratorium on entry into the *Illex* fishery would expire in July of 2002. Under this option, the fishery will revert to open access and which will result in an increase in fishing effort in the *Illex* fishery. There are currently 77 vessels which possess *Illex* moratorium permits. The distribution of these vessels by size and home port state is described in Tables 12 and 36. Overall, it appears that the state of NJ appears to be the most heavily impacted state under the no action alternative. In order to assess the potential impact associated with an increase in effort in the *Illex* fishery, three scenarios were examined in a threshold analysis. In the first scenario an increase in effort of 75% was assumed. In Scenarios II and III an increase in effort of 50% and 25% were assumed, respectively. The analysis was conducted under the assumption that an increase in effort would yield a proportional decrease in *Illex* revenue (i.e.,an increase in effort of 50% would yield a decrease in *Illex* revenues of 50%). Lastly, it was also assumed that changes in *Illex* revenues associated with changes in effort would be the same across all vessels participating in the fishery. The analysis was based on 1998 because this was the year that the *Illex* quota was completely taken and therefore, represents the greatest impact under the current quota specifications.

Analysis of Impacts for Participating Vessels - Scenario I

Scenario I is the most restrictive scenario. Under this scenario, it was assumed that revenues derived from landing *Illex* are reduced by 75% due to a

hypothetical increase in effort of 75%. The results of the threshold analysis are reported in Table 37. While overall fleet revenue remained the same, a total of 109 vessels were projected to be impacted by revenue losses that ranged from less than 5 percent for 84 vessels, to a maximum of 30-39 percent for one vessel. While overall fleet revenue remained the same, a total of 109 vessels were projected to be impacted by revenue losses that ranged from less than 5 percent for 79 vessels to a maximum of 40-49 percent for 2 vessels.

Impacts of the hypothetical increase in effort were examined relative to a vessel's home state as reported on the vessel's permit application (Table 38). "Home state" indicates the state where a vessel is based and primarily ported, and is presumed to reflect to where the costs and benefits of management actions return. However, home state is self-reported at the time an individual applies for a Federal permit and may not necessarily indicate where the vessel subsequently conducts most of its activity. There were no impacted vessels home-ported in Maryland, New Hampshire, or Virginia; a high of 15 vessels had home ports in New Jersey. Others were in Massachusetts, Maine, New York, Rhode Island, and North Carolina.

The number of impacted vessels (revenue reduction >5%) by home state ranged from none in Maryland, New Hampshire, and Virginia to a high of 15 in New Jersey. The larger number of impacted vessels in New Jersey may be due to a relatively larger *Illex* fleet in that state and higher dependence on *Illex*.

Analysis of Impacts for Participating Vessels - Scenario II

Under this scenario, it was assumed that revenues derived from landing *Illex* would be reduced by 50% due to a hypothetical increase in effort of 50%. The results of the threshold analysis are reported in Table 39. While overall fleet revenue remained the same, a total of 109 vessels were projected to be impacted by revenue losses that ranged from less than 5 percent for 84 vessels, to a maximum of 30-39 percent for one vessel. While overall fleet revenue remained the same, a total of 109 vessels were projected to be impacted by revenue losses that ranged from less than 5 percent for 84 vessels, to a maximum of 30-39 percent for one vessel.

Impacts of the hypothetical increase in effort were examined relative to a vessel's home state as reported on the vessel's permit application (Table 40). "Home state" indicates the state where a vessel is based and primarily ported, and is presumed to reflect to where the costs and benefits of management actions return. However, home state is self-reported at the time an individual applies for a Federal permit and may not necessarily indicate where the vessel subsequently conducts most of its activity. There were no impacted vessels home-ported in Maryland, New Hampshire, or Virginia; a high of 11 vessels had home ports in New Jersey. Others were in Massachusetts, Maine, Rhode Island, and North Carolina. The larger number of impacted vessels in New Jersey may be due to a relatively larger *Illex* fleet in that state and higher dependence on *Illex*.

Analysis of Impacts for Participating Vessels - Scenario III

Scenario III is the least restrictive scenario. Under this scenario, it was assumed that revenues derived from landing *Illex* would be reduced by 25% due to a hypothetical increase in effort of 25%. The results of the threshold analysis are reported in Table 41. While overall fleet revenue remained the same, a total of 109 vessels were projected to be impacted by revenue losses that ranged from less than 5 percent, for 88 vessels, to a maximum of 10-19 percent for 8 vessels.

Impacts of the hypothetical increase in effort were examined relative to a vessel's home state as reported on the vessel's permit application (Table 42). "Home state" indicates the state where a vessel is based and primarily ported, and is presumed to reflect to where the costs and benefits of management actions return. However, home state is self-reported at the time an individual applies for a Federal permit and may not necessarily indicate where the vessel subsequently conducts most of its activity. The number of impacted vessels by home state ranged from none in Maryland, New Hampshire, New York, and Virginia, to a high of 11 in New Jersey. Other impacted vessels were home ported in Massachusetts, Maine, Rhode Island, and North Carolina. The larger number of impacted vessels in New Jersey may be due to a relatively larger *Illex* fleet in that state and higher dependence on *Illex*.

6.5.3.2 Timeliness of Quota Specifications for Atlantic mackerel, *Loligo* and *Illex* squid and Butterfish

The only measure considered relative to quota specifications which would be expected to change gross revenues as a consequence of the proposed action would be the option which would close the fisheries in the event that the final rule for quota specifications is not published prior to the start of the fishing year. This measure would have significant negative economic consequences for vessels operating in the Atlantic mackerel, *Loligo* and butterfish fisheries because landings of these three species would be prohibited until the final rule for new specifications is published and significant landings occur early in the fishing year. Based on the recent publication date of the annual specifications for Atlantic mackerel, squid and butterfish, these fisheries would most likely be closed during the months of January and February under this alternative. The likely negative effects of this measure would be the loss of revenue associated with the landings of Atlantic mackerel, *Loligo* and butterfish during the months of January and February. During 1999, the value of the January and February landings of each species, respectively , was $1.7 million, $5.2 million, and $.0.9 million (Table 43). The total value of the landings of these three species during the first two months of 1999 represent about 20% of the annual revenue generated for all three species based on 1999 landings data. For Atlantic mackerel, there were 291 vessels which landed 12.1 million pounds of mackerel valued at $1.7 million. A closure in January and February would result in a loss of mackerel revenue of $5842 per vessel under this alternative. For *Loligo*, there were 281 vessels which landed 6.5 million pounds of *Loligo* valued at $5.1 million. A closure in January and February would result in a loss of *Loligo* revenue of $18,361 per vessel under this alternative. For butterfish, there were 228 vessels which landed 1.4 million pounds of butterfish valued at $0.9 million. A closure in January and February would

result in a loss of butterfish revenue of $4067 per vessel under this alternative. This measure would be expected to have little or no economic impact on the *Illex* fishery since the directed fishery occurs during in the summer months.

6.5.3.3 *Loligo* control rule

The implementation either option (preferred and non-preferred framework management measures described in section 5.3.3.3.1) relative to the *Loligo* control rule and in-season adjustment are not expected to change gross revenues as a consequence of the proposed actions. Therefore it is correct to assume that neither of the these alternatives represent a constraint on vessels in these fisheries in aggregate or individually. In the absence of such constraints, there is no impact on revenues under the Regulatory Flexibility Act.

However, the no action alternative could have severe economic consequences if the stock biomass falls below ½ Bmsy. If the Council had followed the control rule implemented in Amendment 8 for the 2000 fishery, the *Loligo* fishery would have been closed for the entire year. Thus failure to replace the control rule could have unwarranted negative economic and social consequences. The best example is for fishing year 2000. If the Council had followed the control rule, the fishery would have been closed and a significant source of revenue for the fisheries fleet in northeastern US would have been lost. Preliminary NMFS dealer data indicate that 525 vessels landed 34.9 million pounds of Loligo in 2000 valued at $27.3 million. A complete closure of the fishery in 2000 would have resulted in an economic loss of $52,000 per vessel due to loss of *Loligo* revenue.

6.5.3.4 Allow for an exemption from the *Loligo* trip limit during periods of closure of the directed *Loligo* fishery for vessels engaged in the *Illex* fishery

The preferred alternative would allow vessels possessing *Illex* squid moratorium permits to possess *Loligo* taken seaward of the 50 fathom curve in an amount not to exceed 10% of the total weight of *Illex* on board during a period of closure of the *Loligo* fishery during the months of August or September.

Overall, since the annual quota is the chief mechanism used to control fishing mortality in the *Loligo* fishery, the *Illex* fishery exemption from the 2500 pound trip limit during periods of closure of the directed *Loligo* fishery during August or September is not expected to change the gross revenues from the *Loligo* fishery. However, the bycatch allowance in the *Illex* fishery could result in an overage in the third quarter of the *Loligo* fishery and/or reduce the amount of *Loligo* available for quarter 4 relative to the status quo. To estimate the possible impact of the 10% *Illex* exemption under this option, landings data from 1999 were examined. This year was chosen because it is the last year for which a complete data set is available for which no closures of the *Loligo* fishery occurred. In August or September 1999 there were 34 trips which landed more than 25,000 lbs of *Illex* in the NMFS Dealer report data

base. Trips less than 25,000 lbs were not included in the analysis because the effect on these trips would be the same under either the current 2,500 lb trip limit or the proposed 10% bycatch allowance (i.e., these trips would be limited to 2,500 lb of *Loligo* under either scenario). Of these 34 trips, there were 20 (or 59%) which landed greater than 2,500 lb of *Loligo*. The amount of *Loligo* landed on these trips ranged from 2,700 lb - 60,405 lbs. If the directed *Loligo* fishery had been closed on August 1 (i.e., directed *Loligo* fishery closed August or September of 1999), these trips would have landed 62,353 under the 2,500 lb trip limit. Under the 10% exemption option, these trips would have been expected to land 182,790 lbs of *Loligo* (i.e., under the condition that the amount of *Loligo* landed would not exceed 10% of the *Illex* landed on that trip). Therefore, under the 10% allowance these trips would have landed an additional 120,500 lb of *Loligo* relative to operating under the 2,500 lb trip limit. This amount represents the additional landings that would result from the 10% bycatch allowance and come at the “expense” of the quarter 4 allocation.

Current regulations specify that the directed *Loligo* fishery is to be closed during the last quarter when 95% of the total quota for the year is taken. The fishery remains open for the remainder of the fishing year at the bycatch level of 2,500 lbs. Assuming that no quota overages occur during the first three quarters (i.e., assuming that 100% of the quota allocation for each quarter is taken but not exceeded), the directed fishery quota for quarter 4 would be 10,066,204 lb. Therefore, the additional *Loligo* taken during quarter 3 due to the 10% *Illex* exemption would represent about 1.8% of the quarter 4 directed fishery quota if the directed *Loligo* fishery was closed on August 1, 2001 in quarter 3 (Table 30). There would not be any vessels which would experience greater than a 5% reduction in total annual revenues as a result of this option based on observed levels of *Loligo* bycatch in the *Illex* fishery in 1999. If the fishery were closed in the first week of August, then the expected level of *Loligo* bycatch in quarter 3 would represent 0.44% of the annual revenue derived from *Loligo* in 1999. If the directed Loligo fishery was closed on August 19, 2001 the amount taken as bycatch under the 10% *Illex* exemption would represent 0.05 % of the annual revenue derived from *Loligo* fishing in 1999.

The most likely closure date of the directed *Loligo* fishery in quarter 3 (based on the 2001 specifications), was estimated based on the average weekly landings of *Loligo* for the period 1997-1999. This time frame was chosen because it is the most recent three year period during which no closure of the directed *Loligo* fishery occurred. Based on observed weekly landings during quarter 3 for the period 1997-1999, it was projected that the directed Loligo fishery would close at the end of week 37. Therefore, the projected closure date would be 19 September 2001 or the last two weeks of quarter 3. Assuming the directed *Loligo* fishery is closed on this date, the expected level of Loligo landings under the *Illex* exemption would be 40,620 pounds or about 0.4% of the directed fishery allocation in quarter 4 (Table 30). Based on the observed level of bycatch in 1999 and a projected closure during weeks weeks 38 and 39, this measure is not expected to increase the chance that an overage would occur relative to the annual quota. This level of *Loligo*

bycatch is the most likely level expected under the 10% *Illex* exemption. If the directed *Loligo* fishery was closed on August 19, 2001, the amount taken as bycatch under the 10% *Illex* exemption would represent 0.12 % of the annual revenue derived from *Loligo* fishing in 1999. No vessels would experience a loss of revenue greater than 5% under this scenario.

However, the worst case scenario under the 10% *lllex* exemption that can be constructed would be to assume that all trips that landed greater than 25,000 pounds of *Illex* during August or September would retain *Loligo* in the amount equal to 10% of the *Illex* landed. This analysis was based on unpublished NMFS dealer reports for trips that landed greater than 25,000 pounds of *Illex* during August or September for the period 1997-1999. An estimate of the amount of *Loligo* expected to be landed under these conditions was obtained as the product of 0.1 and the average amount of *Illex* landed per week for the three year period 1997-1999. Assuming that the directed *Loligo* fishery is closed on August 1, 2001 and the worst case level of Loligo retention is realized, 1,228,287 lbs of *Loligo* would be the maximum amount expected under the 10% exemption rule (Table 31). This would represent about12.2 % of the directed fishery allocation in quarter 4 and about 3.0% of annual *Loligo* revenues in 1999 (Table 31). The expected level of *Loligo* retention under the worst case scenario is given by closure week in Table 31. As noted above, the actual projected closure date based on 1997-1999 *Loligo* landings by week would be expected to occur on or about September 19, 2001 (i.e, the directed fishery would be closed for weeks 38 and 39). Assuming this closure period and if the worst case level of *Loligo* retention is realized, 113,448 lbs of *Loligo* would be the maximum amount expected under the 10% exemption rule (Table 31). This would represent about 1.1% of the directed fishery allocation in quarter 4 and about 0.3% of annual *Loligo* revenues in 1999 (Table 31). Based on the worst case scenario level of bycatch and a projected closure during weeks 38 and 39, this measure is not expected to increase the chance that an overage would occur relative to the annual quota. Therefore, this measure is not expected to result in any negative economic or social impacts due to a quota overage, even under the worst case scenario assuming a closure during the last two weeks of quarter 3. No vessels would experience a loss of revenue greater than 5% under any of the worst case scenarios.

The next alternative would allow vessels possessing *Illex* squid moratorium permits to possess *Loligo* in an amount not to exceed 20%of the total weight of *Illex* on board during a period of closure of the *Loligo* fishery during the months of June-September. Current regulations specify that the directed *Loligo* fishery is to be closed during the last quarter when 95% of the total quota for the year is taken. The fishery remains open for the remainder of the fishing year at the bycatch level of 2,500 lbs. Assuming that no quota overages occur during the first three quarters (i.e., assuming that 100% of the quota allocation for each quarter is taken but not exceeded), the directed fishery quota for quarter 4 would be 10,066,204 lb.

The most likely closure date of the directed *Loligo* fishery in quarter 3 (based on the 2001 specifications), was estimated based on the average weekly

landings of *Loligo* for the period 1997-1999. This time frame was chosen because it is the most recent three year period during which no closure of the directed *Loligo* fishery occurred. Based on observed weekly landings during quarter 3 for the period 1997-1999, it was projected that the directed *Loligo* fishery would likely close at the end of week 37. Therefore, the projected closure date would be 19 September 2001 or the last two weeks of quarter 3.

The worst case scenario under the 20% *lllex* exemption that can be constructed would be to assume that all trips that landed greater than 25,000 pounds of *Illex* during June through September would retain *Loligo* in the amount equal to 20% of the *Illex* landed. This analysis was based on unpublished NMFS dealer reports for trips that landed greater than 25,000 pounds of *Illex* during June and September for the period 1997-1999. An estimate of the amount of *Loligo* expected to be landed under these conditions was obtained as the product of 0.2 and the average amount of *Illex* landed per week for the three year period 1997-1999. Assuming that the directed *Loligo* fishery is closed on June 1, 2001 and the worst case level of Loligo retention is realized, 3,831,177 lbs of *Loligo* would be the maximum amount expected under the 20% exemption rule (Table 32). This would represent 38.1 % of the quarter 4 Loligo allocation and 9.3 % of the annual revenues for loligo in 1999. The expected level of *Loligo* retention under worst case conditions is given by closure week in Table 32. As noted above, the actual projected closure date based on 1997-1999 *Loligo* landings by week would be expected to occur on or about September 19, 2001 (i.e, the directed fishery would be closed for weeks 38 and 39). Assuming this closure period and if the worst case level of *Loligo* retention is realized under the 20% rule, 204,647 lbs of *Loligo* would be the maximum amount expected under the 10% exemption rule (Table 32). This would represent about 2.0% of the directed fishery allocation in quarter 4 and about 0.5 % of the annual revenues derived from Loligo in 1999 (Table 32). Based on the worst case scenario level of bycatch (20%) and a projected closure during weeks 22-39 a total of 33 vessels would be expected to experience total revenue reductions greater than 5% due to the 20% *Illex* exemption.

The no action alternative would maintain the status quo in this fishery. As a result, this option will not change gross revenues. Therefore it is correct to assume that the this alternative represents no constraint on vessels in these fisheries in aggregate or individually. In the absence of such constraints, there is no impact on revenues under the Regulatory Flexibility Act.

6.5.4 Explanation of Why The Action is Being Considered

Regulations implementing the Fishery Management Plan for the Atlantic Mackerel, Squid, and Butterfish Fisheries (FMP) prepared by the Council appear at 50 CFR Part 648. These regulations stipulate that the Secretary will publish a notice specifying the initial annual amounts of the initial optimum yield (IOY) as well as the amounts for allowable biological catch (ABC) domestic annual harvest (DAH), domestic annual processing (DAP), joint venture processing (JVP), and total allowable levels of foreign fishing (TALFF) for the species managed under the FMP. In addition, the regulations allow for the modifications through a framework adjustment procedure adopted in Amendment 8.

This framework action is being considered to remedy the problems outlined in section 2.2.

6.5.5. Objectives and Legal Basis for the Rule

Refer to the section on Management Objectives of the Amendment document (section 4.3). The Magnuson-Stevens Fishery Conservation and Management Act (Public Law 94-265) as amended through October 11, 1996 provides the legal basis for the rule.

6.5.6. Demographic Analysis

Refer to the sections on description of fishing activities (section 7), economic characteristics of the fishery (section 8), and the fishery impact statement (section 9.2.6) of Amendment 5 to the Atlantic mackerel squid and butterfish FMP.

6.5.7. Cost Analysis

Refer to the section on Regulatory Impact Analysis.

6.5.8. Competitive Effects Analysis

There are no large businesses involved in the industry, therefore, there are no disproportional small versus large business effects. There are no disproportional costs of compliance among the affected small entities.

6.5.9. Identification of Overlapping Regulations

The final action does not create regulations that conflict with any state regulations or other federal laws.

6.5.10. Conclusions

The preceding analysis of impacts relative to the Regulatory Flexibility Act indicates that the final regulatory actions do not result in significant economic impacts on small entities.

7. IMPACTS OF THE PLAN RELATIVE TO FEDERALISM

This Framework Action does not contain policies with federalism implications sufficient to warrant preparation of a federalism assessment under Executive

8.0 OTHER APPLICABLE LAWS

8.1 RELATION OF RECOMMENDED MEASURES TO EXISTING APPLICABLE LAWS AND POLICIES

8.1.1 FMPs

This FMP is related to other plans to the extent that all fisheries of the northwest Atlantic are part of the same general geophysical, biological, social, and economic setting. U.S. fishermen usually are active in more than a

single fishery. Thus regulations implemented to govern harvesting of one species or a group of related species may impact on other fisheries by causing transfers of fishing effort.

8.1.2 Treaties or International Agreements

No treaties or international agreements, other than GIFAs entered into pursuant to the MSFCMA, relate to this fishery.

8.1.3 Federal Law and Policies

8.1.3.1 Impacts on Protected Species Under the Endangered Species Act and Marine Mammal Protection Act

The numerous species which inhabit 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) are described in Section 5.4.

8.2 National Marine Sanctuaries

In addition to the issue of general habitat degradation, several habitats within the FMP's management unit are protected under the National Marine Sanctuaries Act of 1973. National marine sanctuaries are allowed to be established under the National Marine Sanctuaries Act of 1973. Currently, there are 11 designated marine sanctuaries that create a system that protects over 14,000 square miles (National Maine Sanctuary Program 1993).

There are two designated national marine sanctuaries in the area covered by the FMP: the Monitor National Marine Sanctuary off North Carolina, and the Stellwagen Bank National Marine Sanctuary off Massachusetts. There are currently five additional proposed sanctuaries, but only one, the Norfolk Canyon, is on the east coast. The Monitor National Marine Sanctuary was designated on January 30, 1975, under Title III of the Marine Protection, Research and Sanctuaries Act of 1972 (MPRSA). Implementing regulations (15 CFR 924) prohibit deploying any equipment in the Sanctuary, fishing activities which involve "anchoring in any manner, stopping, remaining, or drifting without power at any time" (924.3(a)), and trawling (924.3(h)). The Sanctuary is clearly designated on all National Ocean Service (NOS) charts by the caption "protected area." This minimizes the potential for damage to the Sanctuary by fishing operations. Correspondence for this sanctuary should be addressed to: Monitor, NMS, NOAA Building 1519, Fort Eustis, VA 23604.

NOAA/NOS issued a proposed rule on February 8, 1991 (56 FR 5282) proposing designation under MPRSA of the Stellwagen Bank National Marine Sanctuary, in Federal waters between Cape Cod and Cape Ann, Massachusetts. On November 4, 1992, the Sanctuary was Congressionally designated. Implementing regulations (15 CFR 940) became effective March 1994. Commercial fishing is not specifically regulated by the Stellwagen Bank regulations. The regulations do however call for consultation between Federal agencies and the Secretary of Commerce on proposed agency actions in the vicinity of the Sanctuary that "may affect" sanctuary resources. Correspondence for this sanctuary should be

addressed to: Stellwagen Bank NMS, 14 Union Street, Plymouth, MA 02360.

Details on sanctuary regulations may be obtained from the Chief, Sanctuaries and Resources Division (SSMC4) Office of Ocean and Coastal Resource Management, NOAA, 1305 East-West Highway, Silver Spring, MD 20910.

8.3 Indian Treaty Fishing Rights

No Indian treaty fishing rights are known to exist in the fishery.

8.4 Oil, Gas, Mineral, and Deep Water Port Development

While Outer Continental Shelf (OCS) development plans may involve areas overlapping those contemplated for offshore fishery management, no major conflicts have been identified to date. The Councils, through involvement in the Intergovernmental Planning Program of the MMS, monitor OCS activities and have opportunity to comment and to advise MMS of the Councils' activities. Certainly, the potential for conflict exists if communication between interests is not maintained or appreciation of each other's efforts is lacking. Potential conflicts include, from a fishery management position: (1) exclusion areas, (2) adverse impacts to sensitive biologically important areas, (3) oil contamination, (4) substrate hazards to conventional fishing gear, and (5) competition for crews and harbor space. The Councils are unaware of pending deep water port plans which would directly impact offshore fishery management goals in the areas under consideration, and are unaware of potential effects of offshore FMPs upon future development of deep water port facilities.

8.5 Paper Work Reduction Act of 1995

The Paperwork Reduction Act concerns the collection of information. The intent of the Act 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.

The Council is not proposing measures under this regulatory action that require review under PRA. There are no changes to existing reporting requirements previously approved under OMB Control Nos. 0648-0202 (Vessel permits), 0648-0229 (Dealer reporting) and 0648-0212 (Vessel logbooks).

As stated above, this action does not implement new reporting or record keeping measures. There are no changes to existing reporting requirements. Currently, all summer flounder, scup and/or black sea bass Federally-permitted dealers must submit weekly reports of fish purchases. The owner or operator of any vessel issued a vessel permit for summer flounder, scup, or black sea bass, must maintain on board the vessel, and submit, an accurate daily fishing log report for all fishing trips, regardless of species fished for or taken.

9.0 COUNCIL REVIEW AND MONITORING OF THE FMP

No reason to change this section at this time.

10.0 LIST OF PREPARERS

This Framework Action document was prepared by the following members of the MAFMC staff - Dr. Christopher M. Moore, Richard J. Seagraves, Jose Montanez, Dr. Thomas B. Hoff and Valerie M. Whalon. In addition Dr. Jeffrey Cross of NMFS Sandy Hook and Timothy Goodger of NMFS Oxford contributed greatly to the EFH information.

11.0 AGENCIES AND ORGANIZATIONS

In preparing the Framework Action, the Council consulted with the NMFS, the New England Fishery Management Council, the South Atlantic Fishery Management Council, the Fish and Wildlife Service, the Department of State, and the States of New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina through their membership on the Council and the following committees - MAFMC Atlantic Mackerel, Squid and Butterfish Committee, MAFMC Statistical and Science Committee, Mid-Atlantic EFH Technical Committee, Northeast Region Steering Committee, MAFMC Habitat Committee, and MAFMC Habitat Advisory Panel. In addition to the states that are members of this Council, Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, South Carolina, Georgia and Florida were also consulted through the Coastal Zone Management Program consistency process.

12.0 REFERENCES

Able, K.W., and M.P. Fahay. 1998. *Peprilus triacanthus* (Peck), butterfish. *In*: The First Year in the Life of Estuarine Fishes in the Middle Atlantic Bight. Rutgers University Press, New Brunswick, NJ.

Alliance for the Chesapeake Bay. 1993. Nutrients and the Chesapeake: Refining the Bay cleanup effort. 10 pp.

Alverson, D.L., M.H. Freeberg, J.G. Pope, and S.A. Murawski. 1994. A global assessment of fisheries bycatch and discards. FAO Fish. Tech. Pap. 339:1-233.

Aramatunga, T. 1980. Growth and maturation patterns of short-finned squid (*Illex illecebrosus*) on the Scotian Shelf. NAFO SCR Doc. No. 80/II/30.

Aramatunga, T., M. Roberge, J. Young, Y. Uozumi. 1980a. Summary of joint Canada/Japan research program on short-finned squid (*Illex illecebrosus*), 23 October to 29 November 1979: emigration and biology. NAFO SCR Doc. 80/II/40.

Anderson, E. D. 1973. Assessment of Atlantic mackerel in ICNAF subarea 5 and statistical area 6. Int. Comm. Northwest Atl. Fish. Res. Doc., 73/14 Ser. No. 2916.

Anderson, E. D. 1976. Measures of abundance of Atlantic mackerel off the northeastern coast of the United States. ICNAF Res. Bull. 12: 5-21.

Anderson, E. D. 1982. Status of the northwest Atlantic mackerel stock - 1982. NMFS, NEFC, Woods Hole Lab Ref. No. 85-03. 46 p.

Anderson, E. D. 1995. Atlantic mackerel. *In:* Status of the fishery resources of the northeastern United States for 1994, (Conservation and Utilization Division, Northeast Fisheries Science Center, eds.), p. 100-101. NOAA Tech. Memo. NMFS-NE-108.

Anderson, E.D. and A.J. Paciorkowski. 1978. A review of the Northwest Atlantic mackerel fishery. ICES Symposium on the Biological Basis of Pelagic Fish Stock Management. No. 11, 63p.

Anderson, E. D., and A.J. Paciorkowski. 1980. A review of the northwest Atlantic mackerel fishery. Rapp. P-V. Reun. Cons. Int. Explor. Mer 177:175-211.

Applegate, A.J., S. Cadrin, J. Hoenig, C. Moore, S. Murawski, and E. Pikitch. 1998. Evaluation of existing overfishing definitions and recommendations for new overfishing definitions to comply with the Sustainable Fisheries Act. Overfishing Definition Review Panel. 179 p.

Arnold, J.M., W.C. Summers, D.L. Gilbert, R.S. Manalis, N.W. Daw, and R.J. Lasek. 1974. A guide to laboratory use of the squid, *Loligo pealei*. U.S. Nat. Mar. Fish. Serv., Northeast Fish. Sci. Cent., Woods Hole, Mar. Biol. Lab. Rep., 74 p.

Arntz, W., E. Rachor, and S. Kuhne. 1994. Mid- and long-term effects of bottom trawling on the benthic fauna of the German Bight. p. 59-74. NIOZ Rapport 1994-11, Netherlands Institute of Fisheries Research, Texel.

Aschman, S.G., D. Anderson, and R.J. Croft. 1997. Challenges for Sustainable Nutrient Cycling in Watersheds. Presented at the 89th Annual Meeting, American Society of Agronomy, October 26-30, 1997, Anaheim, CA.

Atlantic States Marine Fisheries Commission (ASMFC). 1992. Reef Material Criteria Handbook. Artificial Reef Advisory Committee. Washington, D.C.

_____. 1993. Resolution II: In opposition to the use of combustion/incineration ash for artificial reef construction. *In*: Resolutions Adopted by the Atlantic States Marine Fisheries Commission: 52nd Annual Meeting. Washington, D.C. 1 p.

_____. 1997. Atlantic Coastal Wetlands Losses and the Economic Value of Fisheries: A State by State Review.

Auster, P.J. and R.W. Langton. 1998. The Indirect Effects of Fishing.

Auster, P.J., C.A. Griswold, M.J. Youngbluth, and T.G. Bailey. 1992. Aggregations of myctophid fishes with other pelagic fauna. Env. Biol. Fish. 35:133-139.

Auster, P.J., R.J. Malatesta, R.W. Langton, L. Watling, P.C. Valentine, C.L.S. Donaldson, E.W. Langton, A.N. Shepard and I.G. Babb. 1996. The impacts of mobile fishing gear on seafloor habitats in the Gulf of Maine (Northwest

Atlantic): implications for conservation of fish populations. Reviews in Fisheries Science 4(2):185-202.

Azarovitz, T.R., C.J. Byrne, E.S. Bevacqua, L.I. Despres, and H.A. Foster. 1980. Distribution and abundance trends of 22 selected species in the Middle Atlantic Bight from bottom trawl surveys during 1967-1979. Final report to the U.S. Minerals Management Service. 568 p.

Barans, C.A. and V.G. Burrell, Jr. 1976. Preliminary findings of trawling on the continental shelf off the southeastern United States during four seasons (1973-1975). Tech. Rep. No. 13. South Carolina Marine Resources Center, South Carolina Wildlife and Marine Resources Dept., Charleston. 16 p.

Bergman, M.J.N. and M. Hup. 1992. Direct effects of beamtrawling on macrofauna in a sandy sediment in the southern North Sea. ICES J. mar. Sci. 49:5-11.

Berrien, P.L. 1975. A description of Atlantic mackerel, *Scomber scombrus*, eggs and early larvae. Fish. Bull. 73(1): 186-192.

Berrien, P.L. 1978. Eggs and larvae of *Scomber scombrus* and *Scomber japonicus* in continental shelf waters between Massachusetts and Florida. Fish. Bull. 76(1): 95-115.

Berrien, P.L. 1982. Atlantic mackerel, *Scomber scombrus*. *In*: M. D. Grosslein and T. R. Azarovitz, eds., Fish Distribution, MESA New York Bight Atlas Monogr. 15: 99-102.

Beukema, J.J. 1995. Long-term effects of mechanical harvesting of lugworms, *Arenicola marina*, on the zoobenthic community of a tidal flat in the Wadden Sea. Netherlands J. Sea Res. 33:219-227.

Bigelow, H.B. 1924. Plankton of the offshore waters of the Gulf of Maine, part II. Bull. U.S. Bur. Fish. 40: 1-509

Bigelow, H.B. and W.C. Schroeder. 1953. Fishes of the Gulf of Maine. U.S. Fish. Wildl Ser. Fish. Bull. 53: 577 p.

Bigford, T.E. 1991. Sea-level rise, nearshore fisheries, and the fishing industry. Coastal Management 19:417-437

Black, G. A. P., T. W. Rowell, and E. G. Dawe. 1987. Atlas of the biology and distribution of the squids *Illex illecebrosus* and *Loligo pealei* in the Northwest Atlantic. Can. Spec. Publ. Fish. Aquat. Sci. 100, 62 p.

Boesch, D.F. D.A. Anderson, R.A. Horner, S.E. Shumway, P.A. Tester, and T.E. Whitledge. 1997. Harmful Algal Blooms in Coastal Waters: Options for Prevention, Control, and Mitigation. NOAA Coastal Ocean Program, Decision Analysis Series No. 10. Special Joint Report with the National Fish and Wildlife Foundation, February 1997.

Bourne, D.W., and J.J. Govoni. 1988. Distribution of fish eggs and larvae and patterns of water circulation in Narragansett Bay, 1972-1973. Am. Fish. Soc. Symp., 3:132-148.

Bowman, R. E., R. Eppi, and M. C. Grosslein. 1984. Diet and consumption of spring dogfish in the northwest Atlantic. ICES Demersal Fish. Comm., ICES CM 1984/G:27. 16 p.

Bowman, R. E. and W. L. Michaels. 1984. Food of seventeen species of northwest Atlantic fish. NOAA Tech. Memo. NMFS-F/NEC-28, Northeast Fish. Sci. Ctr., Natl. Mar. Fish. Serv., NOAA, Woods Hole, MA. 193 p.

Bradstock, M. and D. Gordon. 1983. Coral-like bryozoan growths in Tasman Bay, and their protection to conserve commercial fish stocks. New Zealand Journal of Marine and Freshwater Research 17:159-163.

Bridger, J.P. 1970. Some effects of the passage of a trawl over the seabed. ICES C.M. 1970/B:10 Gear and Behavior Committee. 8p.

Bridger, J.P. 1972. Some observations on the penetration into the sea bed of tickler chains on a beam trawl. ICES C.M. 1972/B:7. 9 p.

Briggs, J.C. 1960. Fishes of world-wide (circumtropical) distribution. Copeia 3:171-180.

Brodeur, R.D. In press. In situ observations of the association between juvenile fishes and scyphomedusae in the Bering Sea. Mar. Ecol. Prog. Ser.

Brodziak, J. 1995a. Atlantic butterfish. Pp. 102-103, *In*: Status of the Fishery Resources off the Northeast U.S. for 1994. NOAA Tech. Mem. NMFS-F/NEC-108.

Brodziak, J.T. 1995b. Long-finned squid, p. 112-113. *In:* Status of the fishery resources off the northeast U.S. for 1994, U.S. Nat. Oceanic Atmos. Adm. NMFS Northeast Fish. Cent. Tech. Memo. NMFS-F/NEC-108.

Brodziak, J. 1995c. Short-finned squid, p. 110-111. *In:* Status of the Fishery Resources off the Northeast U.S. for 1994, NOAA Tech. Memo. NMFS-F/NEC-108.

Brodziak, J.K.T. and W.K. Macy. 1994. Revised estimates of growth of long-finned squid, *Loligo pealei,* in the Northwest Atlantic based on statolith ageing: implications for stock assessment and fishery management. ICES C.M. 1994/K:13. 46 p.

Brodziak, J.T. and W.K. Macy. 1996. Growth of long-finned squid, *Loligo pealei*, in the Northwest Atlantic. U.S. Nat. Mar. Fish. Serv. Fish. Bull. 94: 212-236.

Brodziak, J.T. and L.C. Hendrickson. 1997. An analysis of some factors affecting survey catches of squid *Loligo pealei* and *Illex illecebrosus* in the

Northwest Atlantic. U.S. Nat. Mar. Fish. Serv. Northeast Fish. Sci. Cent. Ref. Doc. 97-03.

Brouha, P. 1994. Population growth: the real problem. Fisheries 19(9):4.

Brown, R.A. 1989. Bottom trawling on Strangford Lough: problems and policies. Proceedings reprints, Distress Signals, signals from the environment in policy and decision making, May 31-June 2, 1989 Rotterdam, Netherlands. 11p.

Brown, R. G. B., S. P. Barker, D. E. Gaskin, and M. R. Sandeman. 1981. The foods of Great and Sooty Shearwaters, Puffinus gravis and P. griseus, in eastern Canadian waters. Ibis 123: 19-30.

Brylinsky, M., J. Gibson, and D.C. Gordon Jr. 1994. Impacts of flounder trawls on the intertidal habitat and community of the Minas Basin, Bay of Fundy. Can. J. Fish. Aquat. Sci. 51:650-661.

Butler, M. 1971. Biological investigation of aspects of the life history of bluefin tuna, 1970-71. Nfld. Lab. Tour. Develop. Off., St. John's, Nfld. 169 p.

Caddy, J.F. 1973. Underwater observations on tracks of dredges and trawls and some effects of dredging n a scallop ground. J. Fish. Bd. Can. 30:173-180.

Cahoon, L.B., and J.E. Cooke. 1992. Benthic microalgal production in Onslow Bay, North Carolina. Mar. Ecol. Prog. Ser. 84:185-196.

Cahoon, L.B., R.L. Redman, and C.R. Tronzo. 1990. Benthic microalgal biomass in sediments of Onslow Bay, North Carolina. Est. Coast. and Shelf Sci. 31:805-816.

Cahoon, L.B., and C.R. Tronzo. 1992. Quantitative estimates of demersal zooplankton abundance in Onslow Bay, North Carolina. Mar. Ecol. Prog. Ser. 87:197-200.

Cairns, J. Coping with point source discharges. Fisheries 5(6):3.

Caldwell, D.K. 1961. Populations of butterfish, *Peprilus triacanthus*, with systematic comments. Bull. S. Calif. Acad. Sci., 60:19-31.

Cargnelli, L., S. Griesbach, and K. McBride. 1998a. Essential Fish Habitat Source Document: Long-Finned Squid, *Loligo peale*i, Life History and Habitat Requirements. Northeast Fisheries Science Ceter, National Marine Fisheries Service, James J. Howard Marine Sciences Laboratory, Highlands, NJ 07732.

Cargnelli, L., S. Griesbach, and K. McBride. 1998b. Essential Fish Habitat Source Document: Northern Shortfin Squid, *Illex illecebrosus*, Life History and Habitat Characteristics (Draft). Northeast Fisheries Science Ceter, National Marine Fisheries Service, James J. Howard Marine Sciences Laboratory, Highlands, NJ 07732.

Castonguay, M., G.A. Rose, and W.C. Leggett. 1992. Onshore movements of Atlantic mackerel (*Scomber scombrus*) in the northern Gulf of St. Lawrence: associations with wind-forced advections of warmed surface waters. Can. J. Fish. Aquat. Sci. 49: 2232-241.

Castonguay, M., P. Simard, and P. Gagnon. 1991. Usefulness of Fourier analysis of otolith shape for Atlantic mackerel (*Scomber scombrus*) stock discrimination. Can. J. Fish. Aquat. Sci. 48: 296-302.

Chang, S. 1993. Analysis of fishery resources: potential risk from sewage sludge dumping at the deepwater dumpsite off New Jersey. Fishery Bulletin 91:594-610.

Chopin, F.S. and T. Arimoto. 1995. The condition of fish escaping from fishing gears - a review. Fish. Res. 21:315-327.

Churchill, J.H., 1989. The effect of commercial trawling on sediment resuspension and transport over the Middle Atlantic Bight continental shelf. Continental Shelf Research 9(9):841-864.

Chytalo, K. 1996. Summary of Long Island sound dredging windows strategy workshop. *In*: Management of Atlantic Coastal Marine Fish Habitat: Proceedings of a Workshop for Habitat Managers. ASMFC Habitat Management Series #2.

Coelho, M.L. and R.K. O'Dor. 1993. Maturation, spawning patterns, and mean size at maturity in the short-finned squid *Illex illecebrosus*. *In:* T. Okutani, R.K. O'Dor, and T. Kubodera (eds.). Recent advances in cephalopod fisheries biology, p. 81-91. Tokai Univ. Press, Tokyo.

Cohen, A.C. 1976. The systematics and distribution of *Loligo* (Cephalopoda, Myopsida) in the western North Atlantic, with descriptions of two new species. Malacologia 15: 299-367.

Collie, J.S., G.A. Escanero and L. Hunke and P.C. Valentine. 1996. Scallop dredging on Georges Bank: photographic evaluation of effects on benthic fauna. ICES C.M. 1996/Mini:9.
14 p.

Collie, J.S., G.A. Escanero and P.C. Valentine, 1997. Effects of bottom fishing on the benthic megafauna of Georges bank. Mar. Ecol. Prog. Ser. 155:159-172.

Colton, J.B., Jr. 1972. Temperature trends and distribution in continental shelf waters, Nova Scotia to Long Island. Fish. Bull., 70:637-658.

Colton, J.B., Jr. and K.A. Honey. 1963. The eggs and larval stages of the butterfish, *Peprilus triacanthus*. Copeia, 2:447-450.

Colton, J.B., Jr., and R.R. Marak. 1969. Guide for identifying the common planktonic fish eggs and larvae of continental shelf waters, Cape Sable to

Block Island. Bur. Comm. Fish., Woods Hole, MA, Lab. Ref. Doc. No. 69-9. 43 p.

Cooley, N.R. 1978. An inventory of the estuarine fauna in the vicinity of Pensacola, Florida. Florida Dept. Natural Resources, Florida Mar. Res. Publ. No. 31. 119 p.

Croker, R.A. 1965. Planktonic fish eggs and larvae of Sandy Hook estuary. Chesapeake Sci., 6:92-95.

Cross, J. 1998. Personal communication. NMFS, NEFSC, Sandy Hook, NJ.

Currie, D.R. and G.D. Parry. 1994. The impact of scallop dredging on a soft sediment community using multivariate techniques. Mem. Queensl. Mus. 36:316-326.

Currie, D.R. and G.D. Parry. 1996. Effects of scallop dredging on a soft sediment community: a large-scale experimental study. Mar. Ecol. Prog, Ser. 134:131-150.

D'Amours, D. and M. Castonguay. 1992. Spring migration of Atlantic mackerel, *Scomber scombrus*, in relation to water temperature through Cabot Strait (Gulf of St. Lawrence). Environ. Biol. Fish. 34: 393-399.

D'Amours, D., J.G. Landry, and T.C. Lambert. 1990. Growth of juvenile (0-group) Atlantic mackerel (*Scomber scombrus*) in the Gulf of St. Lawrence. Can. J. Fish. Aquat. Sci., 47: 2112-2218.

Dahl, T.E., R.D. Young, and M.C. Caldwell. 1997. Status and trends of wetlands in the conterminous United States. U.S. Department of Interior, Fish and Wildlife Service, Washington D.C. Draft.

Dawe, E. G. and P. C. Beck. 1985. Population structure, growth and sexual maturation of short-finned squid (*Illex illecebrosus*) larvae in the Northwest Atlantic from winter surveys in 1969, 1981, and 1982. J. Northw. Atl. Fish. Sci. 6(1): 43-55.

Dawe, E.G. and P.C. Beck. 1997 Population structure, growth, and sexual maturation of short-finned squid (*Illex illecebrosus*) at Newfoundland. Can. J. Fish. Aquat. Sci. 54: 137-146.

Dawe, E. G., P. C. Beck, H. J. Drew, and G. H. Winters. 1981. Long-distance migration of a short-finned squid, *Illex illecebrosus*. J. Northw. Atl. Fish. Sci. 2: 75-76.

Dawe, E.G., R.K. O'Dor, P.H. Odense, and G.V. Hurley. 1985. Validation and application of an ageing technique for short-finned squid *(Illex illecebrosus*). J. Northw. Atl. Fish. Sci. 6:107-116.

Dawe, E.G., J.C. Shears, N.E. Balch, and R.K. O'Dor. 1990. Occurrence, size, and sexual maturity of long-finned squid, *Loligo pealei*, at Nova Scotia and Newfoundland, Canada. Can. J. Fish. Aquat. Sci. 47: 1830-1835.

Dawe, E. G., E. L. Dalley, and W. W. Lidster. 1997. Fish prey spectrum of short-finned squid (*Illex illecebrosus)* at Newfoundland. Can. J. Fish. Aquat. Sci. 54: 200-208.

DeAlteris, J.T. and D.M. Riefsteck. 1993. Escapement and survival of fish from the codend of a demersal trawl. ICES Mar. Sci. Symp. 196:128-131.

DeGroot, S.J. 1984. The impact of bottom trawling on benthic fauna of the North Sea. Ocean Management 9:177-190.

Dery, L.M. 1988. Butterfish, *Peprilus triacanthus.* Pp. 85-98, *In*: J. Penttila and L.M. Dery (eds.), Age determination methods for northwest Atlantic species. NOAA Tech. Rep. NMFS 72.

Dery, L.M. and E.D. Anderson. 1983. Recent problems with the aging of northwest Atlantic mackerel, concerning the 1977 and 1978 year classes. NMFS, NEFC, Woods Hole Lab. Ref. No. 83-02.30 p.

Ditty, J.G., and F.M. Truesdale. 1983. Comparative larval development of *Peprilus burti*, *P. triacanthus* and *P.paru* (Pisces: Stromateidae) from the Western North Atlantic. Copeia, 2:397-406.

Driscoll, C. 1998. Personal Communication - April 1998. NMFS, Oxford, MD.

DuPaul, W.D., and J.D. McEachran. 1973. Age and growth of butterfish, *Peprilus triacanthus* in the lower York River. Chesapeake Sci., 14:205-207.

Durward, R. D., E. Vessey, R. K. O'Dor, and T. Amaratunga. 1980. Reproduction in the squid, I*llex illecebrosus*: first observations in captivity and implications for the life cycle. ICNAF Sel. Pap. 6: 7-13.

Durward, R. D., T. Amaratunga, and R. K. O'Dor. 1978. Maturation index and fecundity for female squid, *Illex illecebrosus* (LeSueur, 1821). In: N. Balch, T. Amaratunga, and R. K. O'Dor (eds.), Proceedings of a workshop on the squid *Illex illecebrosus*. ICNAF Fish. Mar. Serv. Tech. Rep. 833, 24.1-24.6.

Eleftheriou, A. and M.R. Robertson. 1992. The effects of experimental scallop dredging on the fauna and physical environment of a shallow sandy community. Netherlands J. Sea Res. 30:289-299.

Elliott, E.M., and D. Jimenez. 1981. Laboratory manual for the identification of ichthyoplankton from Beverly-Salem Harbor area. Mass. Dep. Fish., Div. Mar. Fish. 230 p.

Engel, J. and R. Kvitek. MS1997. Bottom trawling: impact interpretation a matter of perspective. Submitted to Conservation Biology.

Eno, N.C., D.S. MacDonald and S.C. Amos. 1996. A study on the effects of fish (crustacea/mollusc) traps on benthic habitats and species. Final Report to the European Commission.

Essential Fish Habitat (EFH) Butterfish Team. Essential Fish Habitat Source Document Atlantic Butterfish, Peprilus triacanthus, Life History and Habitat Requirements. Northeast Fisheries Science Center, National Marine Fisheries Service, James J. Howard Laboratory, Highlands, NJ.

Fahay, M.P. 1975. An annotated list of larval and juvenile fishes captured with surface-towed meter net in the South Atlantic Bight during four RV Dolphin cruises between May 1967 and February 1968. NOAA Tech. Rep. NMFS-SSRF-685. 39 p.

Fedulov, P. P. and Yu. M. Froerman. 1980. Effect of abiotic factors on distribution of young shortfin squids, *Illex illecebrosus* (LeSueur, 1821). NAFO SCR Doc. 80/VI/98.

Fehring, W.K. 1983. Ports, industry, and fisheries-can they coexist? *In*: Improving Multiple Use of Coastal and Marine Resources. American Fisheries Society Symposium. 8 p.

Ferraro, S.P. 1980. Daily time of spawning of 12 fishes in the Peconic Bays, New York. Fish. Bull., 78:455-464.

Florida Department of Environmental Protection (FDEP). 1998. *Pfiesteria* Summary. Prepared by Karen Steidinger and Jan Landsberg.

Foerster. 1998. Personal communication - April 1998. Department of Naval Research.

Fogarty, M.J. and S.A. Murawski. 1998. Large-scale disturbance and the structure of marine systems: Fishery impacts on Georges Bank. Ecol. Appl. 8(1) Supplement:S6-S22.

Fonds, M. 1994. Mortality of fish and invertebrates in beam trawl catches and the survival chances of discards. p. 131-146. NIOZ Rapport 1994-11, Netherlands Institute for Fisheries Research, Texel.

Fonseca, M.S., G.W. Tanyer, A.J. Chester and C. Foltz, 1984. Impact of scallop harvesting on eelgrass (Zostera marina) meadows: implications for management. North American Journal of Fisheries Management 4:286-293.

Fortier, L. and A. Villeneuve. 1996. Cannibalism and predation on fish larvae by larvae of Atlantic mackerel, *Scomber scombrus*: trophodynamics, and potential impact on recruitment. Fish. Bull. 94: 268-281.

Freese, L., J. Hiefetz, B. Wing, and P. Auster. In prep. The impacts of trawling on seafloor habitat in the Gulf of Alaska: I. Changes in habitat structure and associated invertebrate taxa.

Fritz, R.L. 1965. Autumn distribution of groundfish species in the Gulf of Maine and adjacent waters, 1955-1961. Am. Geol. Soc. Ser. Atlas Mar. Environ., Folio 10. 48 p.

Fritzsche, R.A. 1978. Development of Fishes of the Mid-Atlantic Bight. An Atlas of Egg, Larval, and Juvenile Stages. Vol. V: Chaetodontidae through Ophidiidae. Chesapeake Biological Laboratory, Center for Environmental and Estuarine Studies. Univ of Maryland, Solomons, Md. FWS/OBS-78/12. 340 p.

Froerman, Y. M. 1979. Biomass estimates of the short-finned squid, *Illex illecebrosus*, in ICNAF Division 4W, 1978. ICNAF Res. Doc. 79/II/28, Serial No. 5354, 9 p.

Gannon, D.P., A.J. Read, J.E. Craddock, K.M. Fristrup, and J.R. Nicolas. 1997. Feeding ecology of long-finned pilot whales, *Glopicephala melas*, in the western North Atlantic. Mar. Ecol. Prog. Ser. 148: 1-10.

Gaspar, M.B., C.A. Richardson and C.C. Monteiro. 1994. The effects of dredging on shell formation in the razor clam *Ensis siliqua* from Barrinha, Southern Portugal. J. mar. biol. Ass. U.K. 74:927-938.

Geer, P.J. and H.M Austin. 1997 Estimation of relative abundance of recreationally important finfish in the Virginia portion of Chesapeake Bay. Ann. Prog. Rep., Virginia Inst. Mar. Sci., Gloucester Point. 153 p. + appendices.

Gibbs, P.J., A.J. Collins and L.C. Collett. 1980. Effect of otter prawn trawling on the macrobenthos of a sandy substratum in a New South Wales estuary. Aust. J. Mar. Freshwater Res. 31:509-516.

Gislason, H. 1994. Ecosystem effects of fishing activities in the North Sea. Marine Pollution Bulletin 29(6-12):520-527.

Goldsborough, W.J. 1997. Human impacts on SAV - a Chesapeake Bay case study. *In*: Aquatic Coastal Submerged Aquatic Vegetation. ASMFC Management Series #1. Washington, DC.

Goodger, T. 1998. Personal Communication - April 1998. NMFS, Oxford, MD.

Gosner, K.L. 1978. A Field Guide to the Atlantic Seashore from the Bay of Fundy to Cape Hatteras. Houghton Mifflin Company, Boston, Ma., p. 162-163.

Gregoire, F. And M. Castonguay. 1989. Etude de dimensions au premier anulus d'otoliths de maquereau bleu (*Scomber scombrus*) du nord-ouest de l'Atlantique. Can. Tech. Rep. Fish. Aquat. Sci. 1680: vi + 15 p.

Griswold, C.A. and J. Prezioso. 1981. In-situ observations on reproductive behavior of the long-finned squid, *Loligo pealei*. U.S. Nat. Mar. Fish. Serv. Fish. Bull. 78: 945-947.

Grosslein, M.D. and T.R. Azarovitz. 1982. Fish distribution. MESA New York Bight Atlas Monograph 15. 182 p.

Guillén, J.E., A.A. Ramos, L.Martínez and J. Sánchez Lizaso. 1994. Antitrawling reefs and the protection of *Posidonia oceanica* (L.) Delile

Meadows in the western Mediterranean Sea: Demand and aims. Bull. Mar. Sci. 55(2-3):645-650.

Haedrich, R.L. 1967. The stromateiod fishes: systematics and a classification. Bull. Mus. Comp. Zool. 135:35-129.

Haefner, P.A., Jr. 1959. Morphometry and biology of Loligo pealei (Leseur, 1921), and Lolliguncula brevis (Blainville, 1823) in Delaware Bay. M.S. Thesis, Univ. of Delaware. 61 p.

Hall, S.J. 1994. Physical disturbance and marine benthic communities: life in unconsolidated sediments. Oceanography and Marine Biology: An Annual review 32:179-239.

Roper, C.F.E. and C.C. Lu/ 1979. Rhynchoteuthion larvae of omnastrephid squids of the western Norht Atlantic with the first description of larvae and juveniles of *Illex illecebrosus* Proc. Biol. Soc. Wash. 91(4):1039-1059.

Hatanaka, H. 1986. Body size of short-finned squid, *Illex illecebrosus*, larvae in the Northwest Atlantic. Bull. Jap. Soc. Sci. Fish. Nissuishi. 52(1):19-22.

Hatanaka, H., A. M. T. Lange, and T. Amaratunga. 1985. Geographical and vertical distribution of short-finned squid (*Illex illecebrosus*) larvae in the Northwest Atlantic. NAFO Sci. Counc. Studies 9: 93-99.

Hendrickson, L.C., J. Brodziak, M. Basson, and P. Rago. 1996. Stock assessment of northern shortfin squid in the northwest Atlantic during 1993. Northeast Fish. Sci. Cent. Ref. Doc. 96-05. 63 p.

Hendrickson, L. 1998. Personal communication. NMFS, NEFSC, Woods Hole, MA.

Hendrickson, L. In press. Northern shortfin squid. *In:* S.H. Clark (ed.). Status of the fishery resources off the northeastern United States, 1998. NOAA Tech. Mem. NMFS-NE.
Herman, S.S. 1963. Planktonic fish eggs and larvae of Narragansett Bay, RI. Limnol. Oceanogr., 8:103-109.

High, W.L. MS1992. A scientist/diver’s marine science and technology observations. Alaska Fisheries Science Center, NMFS, Seattle.

Hildebrand, S.F., and W.C. Schroeder. 1928. Fishes of Chesapeake Bay. Bull. U.S. Bur. Fish., 43(1): 366 p.

Hill, J. 1996. Environmental considerations in licensing hydropower projects: policies and practices at the federal energy regulatory commission. American Fisheries Society Symposium 16:190-199.

Holme, N.A. 1983. Fluctuations in the benthos of the western English Channel. Oceanol. Acta, Procedings 17th European Maine Biology Symposium, Brest, France, 27 Set.-1 Oct., 1982, pp.121-124.

Horn, M.H. 1970a. Systematics and biology of the stromateiod fishes of the genus *Peprilus*. Bull. Mus. Comp. Zool., Harv. Univ., 140:165-262.

Horn, M.H. 1970b. The swim bladder as a juvenile organ in stromateoid fishes. *Breviora*, 359:1-9.

Horn, M.H. 1975. Swim-bladder state and structure in relation to behavior and mode of life in stromateoid fishes. U.S. Fish. Bull., 73:95-109.

Howarth, R.W. 1991. Assessing the ecological effects of oil pollution from outer continental shelf oil development. *In*: Fisheries and Oil Development on the Continental Shelf. American Fisheries Society Symposium 11:1-8.

Howell, P. and D. Simpson. 1994. Abundance of marine resources in relation to dissolved oxygen in Long Island Sound. Estuaries 17: 394-402.

Hughes Commission Report. 1997. Blue Ribbon Citizens *Pfiesteria* Action Commission. Final Report. Governor Harry R. Hughes Commission Chairman.

Hurley, G. V. 1980. Recent developments in the squid, *Illex illecebrosus*, fishery of Newfoundland, Canada. Mar. Fish. Rev. 42(1-2): 15-22.

ICNAF (International Commission for the Northwest Atlantic Fisheries). 1975. Report of Standing Committee on Research and Statistics, May-June, 1975. App. 1. Report of Assessments Subcommittee. ICNAF, Redbook 1975: 23-63.

International Convention for the Exploration of the Seas (ICES). 1993. Report of the Working Group on Methods of Fish Stock Assessment, Copenhagen, 3-10 February 1993. ICES CM 1993/Assess:12, 86 p.

Industrial Science Division. 1990. The impact of commercial trawling on the benthos of Strangford Lough. Interim Report No. TI/3160/90. Industrial Science Division, 17 Antrim Rd., Lisburn, Co., Antrim B128 3AL.

Isakov, V. I. 1973. Growth and total mortality of mackerel from the New England area. Int. Comm. Northwest Atl. Fish. Res. Doc. 73/23 Ser. No. 2956.

Isakov, V. I. 1976. On some results of biological studies on mackerel from Northwest Atlantic. Int. Comm. Northwest Atl. Fish. Res. Doc. 76/52: 14 p.

Jackson G.D. and J.H. Choat. 1992. Growth in tropical cephalopods: an analysis based on statolith microstructure. Can. J. Fish. Aquat. Sci. 49:218-228.

Jamieson, G.S. and Campbell. 1985. Sea scallop fishing impact on American lobsters in the Gulf of St. Lawrence. Fish. Bull., U.S. 83:575-586.

Jennings, S. and M.J. Kaiser. 1998. The effects of fishing on marine ecosystems. Adv. Mar. Biol. 34:In press.

Jereb, P., S. Ragonese, S. von Boletzky *[Eds.].* 1991. Squid age determination using statoliths. Proceedings of the International Workshop held at the

Institutio di Technilogica della Pesce e del Pescato (ITPP-CNR), Mazara del Vallo, Italy, 9-14 October 1989. N.T.R. - I.T.P.P. Special Publication,, Vol. 1, 127 p.

Jury, S.H., J.D. Field, S.L. Stone, D.M. Nelson and M.E. Monaco. 1994. Distribution and abundance of fishes and invertebrates in North Atlantic estuaries. ELMR Rep. No. 13. NOAA/NOS Strategic Environmental Assessments Division, Silver Spring, MD. 221 p.

Kaiser, M. 1996. Starfish damage as an indicator of trawling intensity. Mar. Ecol. Prog. Ser. 134:303-307.

Kaiser, M.J. and B.E. Spencer. 1994. Fish scavenging behavior in recently trawled areas. Mar. Eol. Prog. Ser. 112:41-49.

Kaiser, M.J. and B.E. Spencer. 1995. Survival of by-catch from a beam trawl. Mar. Ecol. Prog. Ser. 126:31-38.

Kaiser, M.J. and B.E. Spencer. 1996a. The effects of beam-trawl disturbance on infaunal communities in different habitats. J. Animal Ecol. 65:348-358.

Kaiser, M.J., D.B. Edwards and B.E. Spencer. 1996a. Infaunal community changes as a result of commercial clam cultivation and harvesting. Aquat. Living Resour. 9:57-63.

Kaiser, M.J., K. Cheney, F.E. Spencer, D.B. Edwards, K. Radford. 1997b. Implications of bottom trawling for biogenic structures and their importance in seabed assemblages. Fisheries Research (submitted).

Kawahara, S. 1977a. Age and growth of butterfish, *Poronotus triacanthus* (Peck), in ICNAF Subarea 5 and Statistical Area 6. Int. Comm. Northwest Atl. Fish. Sel. Pap. 3:73-78.

Keiser, R.K., Jr. 1976. Species composition, magnitude and utilization of the incidental catch of the South Carolina shrimp fishery. Tech. Rep. No. 16, South Carolina Marine Resources Center, South Carolina Wildlife and Marine Resources Dept., Charleston. 55 p. + appendices.

Kendall, A. W. and D. Gordon. 1981. Growth rate of Atlantic mackerel (*Scomber scombrus*) larvae in the Middle Atlantic Bight. Rapp. P-V. Reun. Cons. Int. Explor. Mer 178: 337-341.

Kendall, A.W., and N.A. Naplin. 1981. Diel-depth distribution of summer ichthyoplankton in the Middle Atlantic Bight. Fish. Bull., 79:705-726.

Kier, W.M. 1982. The functional morphology of the musculature of squid (Loliginidae). Arms and tentacles. J. Morph. 172: 179-192.

Klein-MacPhee, G., In review. Suborder Stromateoidei. *In*: Collette, B.B., and Klein-MacPhee, G. (eds.), Bigelow and Schroeder=s Fishes of the Gulf of Maine. Smithsonian Institute Press, Washington.

Kohler, C.C. and W.R. Courtenay, Jr. 1986. Introduction of aquatic species. Fisheries 11(2):39-42.

Kroger, R.L. and J.F. Guthrie. 1972. Effect of predators on juvenile menhaden in clear and turbid estuaries. Mar. Fish. Rev. 34:78-80.

Lanctot, M. 1980. The development and early growth of embryos and larvae of the Atlantic mackerel, *Scomber scombrus*, at different temperatures. Can. Tech. Rep. Fish. Aquat. Sci. 927: 77p.

Lange, A.M.T. 1980. The biology and population dynamics of the squids, *Loligo pealei* (LeSueur) and *Illex illecebrosus* (LeSueur), from the Northwest Atlantic. M.Sc. Thesis,University of Washington, 178 p.

Lange, A.M.T. 1982. Long-finned squid, *Loligo pealei*, p.133-135. *In*: Grosslein, M. D. and Azarovitz, T. R. (eds.), Fish Distribution. MESA New York Bight Atlas Monograph 15. New York Sea Grant Institute, Albany, New York, NY.

Lange, A.M.T. 1984. Status of the short-finned squid *(Illex illecebrosus)* off the northeastern USA November 1984. NMFS, NEFC, Woods Hole Lab. Ref. No. 84-38. 18 p.

Lange, A. M. T. and M. P. Sissenwine. 1980. Biological considerations relevant to the management of squid (*Loligo pealei* and *Illex illecebrosus*) of the Northwest Atlantic. Mar. Fish. Rev. 42: 23-38.

Langton, R. W. and R. E. Bowman. 1977. An abridged account of predator-prey interactions for some Northwest Atlantic species of fish and squid. NEFSC Lab. Ref. Doc. No 77-17.

Leim, A.H., and W.B. Scott. 1966. Fishes of the Atlantic coast of Canada. Bull. Fish. Res. Bd. Canada, 155, 485 p.

Lilly, G. R. and D. R. Osborne. 1984. Predation by Atlantic Cod (*Gadus morhua*) on short-finned squid (*Illex illecebrosus*) off Eastern Newfoundland and in the Northeastern Gulf of St Lawrence. NAFO SCR Doc. 84/108, Serial No. N905, 16 p.

Lindholm, J., M. Ruth, L. Kaufman, and P. Auster. 1998. A modeling approach to the design of marine refugia for fishery management. In: Linking Protected Areas With Working Landscapes. Science and Management of Protected Areas Association, Wolfville, Nova Scotia. In press.

Lippson, A.J., and R.L. Lippson. 1984. Life in the Chesapeake Bay. Johns Hopkins University Press Ltd., London, 219 p.

Lippson, A.J., and R.L. Moran. 1974. Manual for Identification of Early Developmental Stages of Fishes of the Potomac River Estuary. Environmental Technology Center, Martin Marietta Corp., Baltimore, MD. pp. 10-11, 252, 255-257.

Lockwood, S. J., J. H. Nichols, and S. H. Coombs. 1977. The development rates of mackerel (*Scomber scombrus* L.) eggs over a range of temperatures. ICES CM 1977/J:13. 8 p.

Ludwig, M. and E. Gould. 1988. Contaminant input, fate, and biological effects. *In:* Characterization of the Middle Atlantic Water Management Unit of the Northeast Regional Action Plan. U.S. Department of Commerce, NOAA, NMFS. NOAA Technical Memorandum NMFS-F/NEC-56.

Lux, F.E., W.D. Handwork, and W.F. Rathjen. 1974. The potential for an offshore squid fishery in New England. U.S. Nat. Mar. Fish. Serv. Mar. Fish. Rev. 36: 24-27.

Lux, F.E., and C.L. Wheeler. 1992. Larval and juvenile fishes caught in a neuston survey of Buzzards Bay, Massachusetts in 1979. NOAA, NMFS, NEFSC Ref. Doc. 92-09, 12 p.

MacKay, K.T. 1967. An ecological study of mackerel *Scomber scombrus* (Linnaeus) in the coastal waters of Canada. Fish. Res. Bd. Can., Tech. Rep. 31. 127p.

MacKay, K. T. 1973. Aspects of the biology of Atlantic mackerel in ICNAF Subarea 4. Int. Comm. Northwest Atl. Fish. Res. Doc. 73/70 Serv. No. 3019.

MacKay, K. T. 1979. Synopsis of biological data of the northern population of Atlantic mackerel (*Scomber scombrus*). Can. Tech. Rep. 885. 26 pp.

MacKay, K. T. And E. T. Garside. 1969. Meristic analyses of Atlantic mackerel, *Scomber scombrus*, from the North American coastal populations. J. Fish. Res. Bd. Can. 26(9): 2537-2540.

MacKenzie, C.L., Jr., 1982. Compatibility of invertebrate populations and commercial fishing for ocean quahogs. North American Journal of Fisheries Management 2:270-275.

Macy, W.K., III. 1980. The ecology of the common squid, *Loligo pealei* LeSueur 1821, in Rhode Island waters. Ph.D. Thesis. Dalhousie University, Halifax, Nova Scotia.

Macy, W.K. Ill. 1992. Preliminary age determination of the squid, *Loligo pealei,* using digital imaging. ICES CM 1992/K:, 9 p.

Magorrian, B.H. 1995. The impact of commercial trawling on the benthos of Strangford Lough. Ph.D. dissertation. The Queen’s University of Belfast, Northern Ireland.

Maguire, J.-J., Y. C. Chagnon, M. Castonguay, and B. Mercille. 1987. A review of mackerel management areas in the Northwest Atlantic. CAFSAC Res. Doc. 87/71: 31 p.

Major, P. F. 1986. Notes on a predator-prey interaction between common dolphins (*Delphinus delphis*) and short-finned squid (*Illex illecebrosus*) in

Lydonia Submarine Canyon, Western North Atlantic Ocean. J. Mamm. 67(4): 769-770.

Mansueti, R.J. 1963. Symbiotic behavior between small fishes and jellyfishes, with new data on that between the stromateoid, *Peprilus alepidotus*, and the scyphomedusa, *Chrysaora quinquecirrha*. Copeia 1:40-80.

Markle, D.F., and L.A. Frost. 1985. Comparative morphology, seasonality, and a key to planktonic fish eggs from the Nova Scotian Shelf. Can. J. Zool. 63:246-257.

Martin, F.D., and G.E. Drewry. 1978. Development of Fishes of Mid Atlantic Bight. An Atlas of Egg, Larval, and Juvenile Stages. Vol. 6: Stromateidae through Ogcocephalidae. Chesapeake Biological Center for Environmental and Estuarine Studies, University of Maryland. Prepared for U.S. Fish Wild. Serv. Biol. Serv. Prog. FWS/OBS-78/12. 416 p.

Maurer, R. 1975. A preliminary description of some important feeding relationships. ICNAF, Res. Doc. No. 76/IX/130. Ser. No. 3681.

Maurer, R. O., Jr. and R. E. Bowman. 1975. Food habits of marine fishes of the northwest Atlantic - Data Report. NEFSC, NOAA, Woods Hole Lab., Ref. Doc. 75-3. 90 p.

Maurer, R. O. and R. E. Bowman. 1985. Food consumption of squids (*Illex illecebrosus* and *Loligo pealei*) off the northeastern United States. NAFO Sci. Counc. Studies 9: 117-124.

Mayer, L.M., D.F. Schick, R.H. Findlay and D.L. Rice, 1991. Effects of commercial dragging on sedimentary organic matter. Mar. Environ. Res 31:249-261.

McConathy, D.A., R.T. Hanlon, and R.F. Hixon. 1980. Chromatophore arrangements of hatchling loliginid squids (Cephalopoda, Myopsida). Malacologia 19: 279-288.

McMahon, J.J. and W.C. Summers. 1971. Temperature effects on the developmental rate of squid (*Loligo pealei*) embryos. Biol. Bull. (Woods Hole) 141: 561-567.

Medcof, J.C. and J.F. Caddy. 1971. Underwater observations on the performance of clam dredges of three types. ICES C.M. 1971/B:10

Mercer, M.C. 1969. A.T. Cameron Cruise 150, Otter-trawl survey of the Mid-Atlantic Bight, August-September 1968. Can. Fish. Res. Bd. Tech. Rep., 122 p.

Mesnil, B. 1977. Growth and life cycle of squid, *Loligo pealei* and *Illex illecebrosus,* from the
northwest Atlantic. ICNAF Selected Papers 2: 55-69.

Meyer, T L., R.A. Cooper and K.J. Pecci, 1981. The performance and environmental effects of a hydraulic clam dredge. Mar. Fish. Rev. 43(9):14-

22.

Mid-Atlantic Fishery Management Council (MAFMC). 1990. Ocean Disposal Policy. Dover, DE.

_____. 1990b. Amendment to the fishery management plan for the bluefish fishery (Draft). Dover, DE.

_____. 1994. Amendment 5 to the Fishery Management Plan for the Atlantic Mackerel, Squid and Butterfish Fisheries. Mid-Atlantic Fishery Management Council, November 1994.

_____. 1995. Amendment 5 to the fishery management plan and the final Environmental Impact Statement for the Atlantic mackerel, squid, and butterfish fisheries. Mid-Atlantic Fishery Management Council, 168 p. + Appendices.

Mid-Atlantic Regional Marine Research Program (MARMPP). 1994. Mid-Atlantic Research Plan. University of MD. College Park, MD. 163 p.

Milstein, C.B. and D.P. Hamer. 1976. Fishes taken in the vicinity of the site, the Great Bay-Mullica River Estuary, and offshore with 25 ft trawl. Pp. 21-42. *In*: C.B. Milstein (ed.). Ecological studies in the bays and other waterways near Little Egg Inlet and in the ocean in the vicinity of the proposed Atlantic Generating Station, NJ. Prepared for Public Service Electric and Gas Co. by Ichthyological Associates, Inc. 709 p.

Montevecchi, W.A. and R.A. Myers. 1995. Prey harvests of seabirds reflect pelagic fish and squid abundance on multiple spatial and temporal scales. Mar. Ecol. Prog. Ser. 117: 1-9.

Moores, J.A., G.H. Winters, and L.S. Parsons. 1975. Migrations and biological characteristics of Atlantic mackerel (*Scomber scombrus*) occurring in Newfoundland waters. J. Fish. Res. Bd. Can. 32: 1347-1357.

Morse, W.W. 1980. The fecundity of Atlantic mackerel, *Scomber scombrus*, in the Middle Atlantic Bight. Fish. Bull., 78: 103-108.

Moser, M.L., P.J. Auster and J.B. Bichy. 1998. Effects of mat morphology on large *Sargassum*-associated fishes: observations from a remotely operated vehicle (ROV) and free-floating video camcorders. Env. Biol. Fish. 51:391-398.

Moyle, P.B. 1991. AFS Position Statement - Ballast Water Introductions. Fisheries 16(1):4-6.

Murawski S.A. and F.M. Serchuk, 1989. Environmental effects of offshore dredge fisheries for bivalves. ICES 1989 Statutory Meeting The Hague Netherlands. 12p. 7 figs.

Murawski, S.A. and G.T. Waring. 1979. A population assessment of butterfish,

Peprilus triacanthus, in the Northwest Atlantic Ocean. Trans. Am. Fish. Soc., 108:427-439.

Murawski, S.A., D.G. Frank, and S. Chang. 1978. Biological and fisheries data on butterfish, *Peprilus triacanthus* (Peck). NOAA, NMFS, NEFC Tech. Ser. Rep. No. 6, 39 p.

Murdy, E.O., R.S. Birdsong, and J.A. Musick. 1997. Fishes of the Chesapeake Bay. Smithsonian Institution Press. Washington, DC. 324 p.

Murray, T. 1984. Unpublished Ms. Predicting the timing and duration of Atlantic mackerel migrations in the Middle Atlantic Bight using sea surface temperature. National Marine Fisheries Service, Woods Hole, MA.

Murray, T., S. LeDuc, and M. Ingham. 1983. Inpact of climatic factors on early life stages of Atlantic mackerel, *Scomber scombrus* L.; an application of meteorological data to a fishery problem. J. Climat. Appl. Meteorol. 22: 57-68.

National Marine Fisheries Service (NMFS). 1991. Report of the Twelfth Northeast Regional Stock Assessment Workshop (12th SAW), Spring 1991. Woods Hole, MA: NOAA/NMFS/NEFSC. NEFSC. Ref. Doc. 91-03. 187 p.

_____. 1994. Report of the 1 7th Northeast Regional Stock Assessment Workshop (17th SAW). Stock Assessment Review Committee (SARC), Consensus Summary of Assessments. Northeast Fisheries Science Center, Woods Hole Laboratory Reference Document 94-06. 124 p.

_____. 1996a. Report of the 21st Northeast Region Stock Assessment Workshop (21st SAW): Stock Assessment Review Committee (SARC) consensus summary of assessments. NEFSC Ref. Doc. 96-05; 200 p.

_____. 1996b. Report of the 20th Northeast Region Stock Assessment Workshop (20th SAW): Stock Assessment Review Committee (SARC) consensus summary of assessments. NEFSC Ref. Doc. 96-05; 200 p.

National Oceanic and Atmospheric Administration (NOAA). 1996. NOAA’s Estuarine Eutrophication Survey, Volume 1: South Atlantic Region. Office of Ocean Resources Conservation and Assessment, Silver Spring, MD.

_____. 1997a. NOAA’s Estuarine Eutrophication Survey, Volume 2: Mid-Atlantic Region. Office of Ocean Resources Conservation and Assessment, Silver Spring, MD.

_____. 1997b. NOAA’s Estuarine Eutrophication Survey, Volume 3: North Atlantic Region. NOAA, NOS, Office of Ocean Resources Conservation and Assessment, Silver Spring, MD.

Nelson, D.M. and M.E. Monaco. 1994. Distribution and abundance of fishes and invertebrates in Southeast estuaries. ELMR Rep. No. 9. NOAA/NOS Strategic Environmental Assessments Division, Silver Spring, MD. 167 p.

O'Brien, L., J. Burnett, and R.K. Mayo. 1993. Maturation of nineteen species of finfish off the northeast coast of the United States, 1985-1990. NOAA, NMFS, Tech. Rep. 113. 66 p.

O'Dor, R. K. 1983. *Illex illecebrosus*, p. 175-199. In: Boyle, P. R. (ed.), Cephalopod life cycles, Vol. I, Species Accounts. Academic Press Inc., London, LTD.

O'Dor, R. K. and N. Balch. 1985. Properties of *Illex illecebrosus* egg masses potentially influencing larval oceanographic distribution. NAFO Sci. Counc. Studies, 9: 69-76.

O'Dor, R.K. and E.G. Dawe. 1998. *Illex illecebrosus*. *In:* P.G. Rodhouse, E.G. Dawe, and R.K. O'Dor (eds.). Squid recruitment dynamics: the genus *Illex* as a model, the commercial *Illex* species and influences on variability, p. 77-104. FAO Fish. Tech. Pap. No. 376. 273 p.

O'Dor, R. K., R. D. Durward, E. Vessey, and T. Amaratunga. 1980. Feeding and growth in captive squid, *Illex illecebrosus*, and the influence of food availability on growth in the natural population. ICNAF Sel. Pap. No. 6: 15-21.

Olla, B. L., A. L. Studholme, A. J. Bejda, C. Samet, and A. D. Martin. 1975. The effect of temperature on the behaviour of marine fishes: a comparison among Atlantic mackerel, *Scomber scombrus*, bluefish, *Pomatomus saltatrix*, and tautog, *Tautoga onitis*. Pp. 299-308: *In* Combined effects of radioactive, chemical and thermal releases to the environment. International Atomic Energy Agency, Vienna, IAEA/SM/197/4.

Olla, B.L., A.J. Bejda, and A.L. Studholme. 1976. Swimming speeds of Atlantic mackerel, *Scomber scombrus*, under laboratory conditions: relation to capture by trawling. ICNAF Res. Doc. 76/XII/143. 6p.

OTA (Office of Technology Assessment). 1987. Wastes in Marine Environments. OTA Pub. OTA-O-335.

Overholtz, W.J. 1989. Density-dependent growth in the Northwest Atlantic stock of Atlantic mackerel (*Scomber scombrus*). J. Northw. Atl. Fish Sci. 9: 115-121.

Overholtz, W.J. and E.D. Anderson. 1976. Relationship between mackerel catches, water temperature, and vessel velocity during USA spring bottom trawl surveys in SA 5-6. ICNAF Res. Doc. 76/XIII/170. 7p.

Overholtz, W.J. R.S. Armstrong, D.G. Mountain, and M. Terceiro. 1991a. Factors influencing spring distribution, availability and recreational catch of Atlantic mackerel, *Scomber scombrus*, in the middle Atlantic and southern New England regions. NOAA Tech. Mem. NMFS-F/NEC-85: 13p.

Overholtz, W. J., S. A. Murawski, and W. L. Michaels. 1991b. Impact of compensatory responses on assessment advice for the Northwest Atlantic mackerel stock. Fish. Bull. 89: 117-128.

Overholtz, W.J. and G.T. Waring. 1991. Diet composition of pilot whales *Globicephala* sp. and common dolphins *Delphinus delphis* in the Mid-Atlantic Bight during Spring 1989. Fish. Bull. 89: 723-728.

Parsons, L.S. 1970. Northern range extension of the Atlantic mackerel, *Scomber scombrus*, to Black Island, Labrador. J. Fish. Res. Bd. Can. 27: 610-613.

Parsons, L.S. and J.A. Moores. 1974. Long-distance migration of an Atlantic mackerel (*Scomber scombrus*). J. Fish. Res. Bd. Can. 31: 1521-1522.

Payne, P. M. and L. A. Selzer. 1983. Population distribution, abundance and prey requirements of the harbor seal in southern new England. NMFS contract Rep. NA-82-FA 00007 by Manomet Bird Observatory, Manomet, MA. Northeast Fish. Ctr., Nat. Mar. Fish. Sev., NOAA, Woods Hole, MA. 51 p.

Pearson, J.C. 1941. The young of some marine fishes taken in lower Chesapeake Bay, Virginia, with special reference to the gray sea trout, *Cynoscion regalis*. *Fish. Bull.*, 50:79-102.

Pearson, T.H., A.B. Josefson and R. Rosenberg. 1985. Petersen's benthic stations revisited. 1. Is the Kattagatt becoming eutrophic? J. Exp. Mar. Biol. Ecol. 92:157-206.

Penkal, R.F. and G.R. Phillips. 1984. Construction and operation of oil and gas pipelines. Fisheries 9(3):6-8

Pepin, P., J.A. Koslow, and S. Pearre, Jr. 1988. A laboratory study of foraging by Atlantic mackerel, *Scomber scombrus*, on natural zooplankton assemblages. Can. J. Fish. Aquat. Sci. 45: 879-887

Pepin, P., S. Pearre, Jr., and J.A. Koslow. 1987. Predation on larval fish by Atlantic mackerel, *Scomber scombrus*, with a comparison of predation by zooplankton. Can. J. Fish. Aquat. Sci. 44: 2012-2018.

Perez, J. A. A. 1994. The early life history of the short-finned squid, *Illex illecebrosus* (Cephalopoda: Ommastrephidae), as reconstructed from the gladius structure. Ph.D. Thesis. Dalhousie University, Halifax, Nova Scotia, 150 p.

Perlmutter, A. 1939. An ecological survey of young fish and eggs identified from tow net collections. Pp. 9-70, *In*: A biological survey of the salt waters of Long Island, 1938. Part II. NY State Conservation Dept.

Peterson, W.T. and S.J. Ausubel. 1984. Diets and selective feeding by larvae of Atlantic mackerel *Scomber scombrus* on zooplankton. Mar. Ecol. Prog. Ser. 17: 65-75.

Peters, D.S. and F.A. Cross. 1992. What is coastal fish habitat? p. 17-22. In: R.H. Stroud (ed.), Stemming the Tide of Coastal Fish Habitat Loss. Marine Recreational Fisheries Vol. 14. National Coalition for Marine Conservation, Savannah, Georgia.

Peterson, C.H., H.C. Summerson and S.R. Fegley. 1983. Relative efficiency of two clam rakes and their contrasting impacts on seagrass biomass. Fish. Bull., U.S. 81: 429-434.

Peterson, C.H., H.C. Summerson and S.R. Fegley, 1987. Ecological consequences of mechanical harvesting of clams. Fish. Bull. 85(2):281-298.

Pickett, S. T .A. and P. S. White, editors. 1985. The Ecology of Natural Disturbance and Patch Dynamics. Academic Press, New York.

Powell, D., L.M. Dwinell, and S.E. Dwinell. 1972. An annotated listing of the fish reference collection at the Florida Department of Natural Resources Marine Research Laboratory. Spec. Sci. Rep. No. 36. Florida Marine ReserachLaboratory, Department of Natural Resources, St. Petersburg. 179 p.

Powles, H. and B.W. Stender. 1976. Observations on composition, seasonality and distribution of ichthyoplankton from MARMAP cruises in the South Atlantic Bight in 1973. Tech. Rep. No. 11. Marine Resources Research Inst., South Carolina Wildlife and Marine Resources Dept., Charleston. 47 p.

Prena, J., T.W. Rowell,, P. Schwinghamer, K. Gilkinson, and D.C. Gordon Jr. 1996. Grand banks otter trawling impact experiment: 1.Site selection process, with a description of macrofaunal communities. Can.Tech. Rep. Fish. Aqua. Sci. 2094:38pp.

Rader, D. 1998. Personal communication - April 1998.

Ramsay, K., M.J. Kaiser and R.N. Hughes. 1996. Changes in hermit crab feeding patterns in response to trawling disturbance. Mar. Ecol. Prog. Ser. 144: 63-72.

Ramsay, K., M.J. Kaiser and R.N. Hughes. 1997a. Responses of benthic scavengers to fishing disturbance by towed gear in different habitats. J. Exp. Mar. Biol. Ecol.

Ramsay, K. M.J. Kaiser, P.G. Moore and R.N. Hughes. 1997b. Consumption of fisheries discards by benthic scavengers: utilization of energy subsidies in different marine habitats. J. Animal Ecol. (in press)

Reid, R., F. Almeida, and C. Zetlin. 1998. Methods used in Federal, State and Other Surveys (Draft). NMFS, NEFSC, Highlands, NJ.

Reise, K. 1982. Long-term changes in the macrobenthic invertebrate fauna of the Wadden Sea: are polychaetes about to take over? Netherlands Journal of Sea Research 16:29-36.

Reiswig, H.M. 1973. Population dynamics of three Jamaican Demspongiae. Bull. Mar. Sci. 23:191-226.

Riesen W. and K. Reise. 1982. Macrobenthos of the subtidal Wadden Sea: revisited after 55 years. Helgoländer Meersunters. 35:409-423.

Robinette, H.R., J. Hynes, N.C. Parker, R. Putz, R.E. Stevens, and R. Stickney. 1991. Commercial aquaculture. Fisheries 16(1):18-22.

Roper, C.F.E. and K. Mangold. 1998. Systematic and distributional relationships of *Illex coindetii* to the genus *Illex* (Cephalopoda; Ommastrephidae). *In:* P.G. Rodhouse, E.G. Dawe and R.K. O'Dor (eds.). Squid recruitment dynamics: the genus *Illex* as a model, the commercial *Illex* species, and influences on variability, p. 13-26. FAO Fish. Tech. Pap. No. 376. 273 p.

Roper, C.F.E., C.C. Lu, and M. Vecchione. 1998. Systematics and distribution of *Illex* species; a revision (Cephalopoda, Ommastrephidae). Smithson. Contrib. to Zool. No. 586. 599 p.

Rotunno, T.K. 1992. Species identification and temporal spawning patterns of butterfish, *Peprilus* spp. in the South and Mid-Atlantic Bights. M.S. thesis, State University New York at Stony Brook. 77 p.

Rotunno, T., and R.K. Cowen. 1997. Temporal and spatial spawning patterns of the Atlantic butterfish, *Peprilus triacanthus*, in the South and Middle Atlantic Bights. Fish. Bull., 95:785-799.

Rowell, T. W., R. W. Trites, and E. G. Dawe. 1985a. Distribution of short-finned squid (*Illex illecebrosus*) larvae and juveniles in relation to the Gulf Stream frontal zone between Florida and Cape Hatteras. NAFO Sci. Counc. Studies 9: 77-92.

Rulifson, R.A., M.J. Dadaswell, and G.K. Mahoney. 1986. Tidal power development and estuarine and marine environments. Fisheries 11(4):36-39

Rumhor, H. and P. Krost. 1991. Experimental evidence of damage to benthos by bottom trawling with special reference to *Artica islandica*. Meeresforsch 33:340-345.

Rumhor, H., H. Schomann, and T. Kujawski. 1994. Environmental impact of bottom gears on benthic fauna in the German Bight. p. 75-86. NIOZ Rapport 1994-11, Netherlands Institute for Fisheries Research, Texel.

Runge, J.A., P. Pepin, and W. Silvert. 1987. Feeding behavior of the Atlantic mackerel, *Scomber scombrus*, on the hydromedusa, *Aglantha digitale*. Mar. Biol. 94: 329-333.

Sainsbury, K.J. 1987. Assessment and management of the demersal fishery on the continental
shelf of northwestern Australia. pp. 465-503. In: Tropical Snappers and Groupers: Biology and Fisheries Management (J.J. Polovina and S. Ralston, Eds.). Boulder, Colorado: Westview Press.

Sainsbury, K.J. 1988. The ecological basis of multispecies fisheries and management of a
demersal fishery in tropical Australia. pp. 349-382. In: Fish Population

Dynamics, 2nd edition. (J.A. Gulland, Ed.). London: John Wiley and Sons.

Sainsbury, K.J. 1991. Application of an experimental approach to management of a demersal fishery with highly uncertain dynamics. ICES Mar. Sci. Symp. 193:301-320.

Sainsbury, K.J., R.A. Campbell, R. Lindholm, and A.W. Whitelaw. In press. Experimental management of an Australian multispecies fishery: examining the possibility of trawl-induced habitat modification. Amer. Fish. Soc. Symp. 20: 107-112.

Santbrink, J.W. van and M.J.N. Bergman. 1994. Direct effects of beam trawling on macrofauna in a soft bottom area in the southern North Sea. p. 147-178. NIOZ Rapport 1994-11, Netherlands Institute for Fisheries Research, Texel.

Schaefer, R.H. 1967. Species composition, size and seasonal abundance of fish in the surf waters of Long Island. NY Fish Game J., 14:1-46.

Schaefer, R.H. 1995. Memorandum on NMFS Policy of Risk Aversion in Face of Uncertainty.

Schreiber, R.A. 1973. The fishes of Great South Bay. M.S. thesis, State University of New York, Stony Brook. 199 p.

Scott, J.S. 1982. Depth, temperature, and salinity preferences of common fishes of the Scotian Shelf. J. Northw. Atl. Fish. Sci. 3: 29-39.

Scott, W. B. and M. G. Scott. 1988. Atlantic Fishes of Canada. Can. Bull. Fish. Aquat. Sci. 219: 1-731.

Scott, W.B., and S.N. Tibbo. 1968. Food and feeding habits of swordfish, *Xiphias gladius*, in the western North Atlantic. J. Fish. Res. Bd. Canada, 25:174-179.

Serchuk, F.M. and W.J. Rathjen. 1974. Aspects of the distribution and abundance of the long-finned squid, *Loligo pealei*, between Cape Hatteras and Georges Bank. U.S. Nat. Mar. Fish. Serv. Mar. Fish. Rev. 36: 10-17.

Sette, O.E. 1943. Biology of Atlantic mackerel (*Scomber scombrus*) of North America. Part 1: Early life history including growth, drift, and mortality of the egg and larval populations. Fish. Bull. 50: 149-237.

Sette, O.E. 1950. Biology of Atlantic mackerel (*Scomber scombrus*) of North America. Part 2. Migrations and habitats. Fish. Bull. 51: 251-358

Sharp, J.H. 1976. Anoxia on the middle Atlantic shelf during the summer of 1976. Report on a workshop held in Washington, D.C., 15-16 October 1976. NSF Contract No. OCE 7700465.

Simard, P., M. Castonguay, D. D'Amours, and P. Magnan. 1992. Growth comparison

between juvenile Atlantic mackerel (*Scomber scombrus*) from the two spawning groups of the Northwest Atlantic. Can. J. Fish. Aquat. Sci. 49: 2242-2248.

Sindermann, C.J. 1992. Disease risks associated with importation of nonindigenous marine animals. Marine Fisheries Review 54(3):1-9.

Sissenwine, M.P., and A.M. Tibbetts. 1977. Simulating the effect of fishing on squid *(Loligo* and *Illex)* populations off the northeastern United States. ICNAF Sel. Pap. 2: 71-84.

Smith, E.M., M.A. Alexander, M.M. Blake, L. Gunn, P.T. Howell, M.W. Johnson, R.E. MacLeod, R.F. Sampson, Jr., D.G. Simpson, W.H. Webb, L.L. Stewart, P.J. Auster, N.K. Bender, K. Buchholz, J. Crawford, and T.J. Visel. 1985. A study of lobster fisheries in the Connecticut waters of Long Island Sound with special reference to the effects of trawling on lobsters. Connecticut Department of Environmental Protection, Marine Fisheries Program, Hartford, Connecticut.

Smith, G. J. D. and D. E. Gaskin. 1974. The diet of harbor porpoises (*Phocoena phocoena* (L.)) in coastal waters of Eastern Canada, with special reference to the Bay of Fundy. Can. J. Zool. 52: 777-782.

Smith, W.G., A.W. Kendall, Jr., P.L. Berrien, and M.P. Fahay. 1979. Principal spawning areas and time of marine fishes, Cape Sable to Cape Hatteras. Fish. Bull., 76:911-915.

Smith, W.G., D.G. McMillan, C. Obenchain, P. Rosenberg, A. Wells, and M. Silverman. 1980. Spawning cycles of marine fishes of northeastern United States based on broadscale surveys of eggs and larvae, 1977-79. Int. Coun. Explor. Sea ICES CM 1980/L:66, 22 p.

South-Atlantic Fishery Management Council (SAFMC). 1991. South Atlantic Fishery Management Council. Amendment 4 (Gear Restrictions and Size Limits), Regulatory Impact Review, Initial Regulatory Flexibility Analysis and Environmental Assessment for the Fishery Management Plan, for the Snapper Grouper Fishery of the South Atlantic Region.

_____. 1998. Habitat Plan for the South Atlantic Region: Essential Fish Habitat Requirements for Fishery Management Plans of the South Atlantic Fishery Management Council (Public Hearing Draft). Charleston, SC.

Squires, H. J. 1957. Squid, *Illex illecebrosus,* in the Newfoundland fishing area. J. Fish. Res. Bd. Canada 14: 693-728.

Squires, H. J. 1966. Feeding habits of the squid *Illex illecebrosus*. Nature (London) 211: 1321.

Squires, H. J. 1967. Growth and hypothetical age of the Newfoundland bait squid, *Illex illecebrosus illecebrosus*. J. Fish. Res. Bd. Canada. 24: 1209-1217.

Stedman, S. and J. Hanson. 1997. Wetlands fisheries and economics in the mid-Atlantic coastal states. USDC Office of Habitat Conservation. Habitat Connections 1(5):1-4.

Steele, J.H. 1996. Regime shifts in fisheries management. Fish. Res. 25:19-23.

Steimle, F. 1976. A summary of the fish kill-anoxia phenomenon off New Jersey and its impact on resources species. *In:* Sharp (ed.). Anoxia on the middle Atlantic shelf during the cummer of 1976. pp.5-11. Report on a workshop held in Washington D.C., 15-16 October 1976. NSF Contract OCE 7700465, University of Delaware.

Steimle, F. Personal communication. NMFS, Sandy Hook, N.J.

Stephan, C.D. and K. Beidler. 1997. Management of Atlantic Coastal Marine Habitat: Proceedings of a Workshop for Habitat Managers. ASMFC Management Series #2.

Stevenson, J.A. 1934. On the behavior of the long-finned squid *Loligo pealei* (LeSueur). Can. Field Nat. 48: 4-7.

Stillwell, C. E. and N. E. Kohler. 1982. Food, feeding habits, and estimates of daily ration of the shortfin mako (*Isurus oxyrinchus*) in the northwest Atlantic. Can. J. Fish. Aquat. Sci. 39: 407-414.

Stillwell, C. E. and N. E. Kohler. 1985. Food and feeding ecology of the swordfish *Xiphias gladius* in the western North Atlantic with estimates of daily ration. Mar. Ecol. Prog. Ser. 22: 239-247.

Stobo, W. T. and J. J. Hunt. 1974. Mackerel biology and history of the fishery in Subarea 4. Int. Comm. Northw. Atl. Fish. Res. Doc. 74/9, Ser. No. 3155.

Stolpe, N. 1997. New Jersey Fishnet. November 2, 1997 Issue.

Stone, S.L., T.A. Lowery, J.D. Field, C.D. Williams, D.M. Nelson, S.H. Jury, M.E. Monaco, and L. Andreasen. 1994. Distribution and abundance of fishes and invertebrates in Mid-Atlantic estuaries. *ELMR Rep.* No. 12. NOAA/NOS Strategic Environmental Assessments Division, Silver Spring, MD. 280 p.

Studholme, A., D. Packer, K. McBride. 1998. Essential Fish Habitat Source Dcoument: Atlantic Mackerel, *Scomer scombrus* L., Life History and Habitat Requirements. Northeast Fisheries Science Center, National Marine Fisheries Service, James J. Howard Laboratory, Highlands, NJ.

Suffolk County Department of Health Services. 1998. Brown Tide Fact Sheet. Office of Ecology.

Summers, W.C. 1968. Winter distribution of *Loligo pealei* determined by exploratory trawling. Biol. Bull. 133: 489.

Summers, W.C. 1968. The growth and size distribution of current year class *Loligo pealei*. Biol. Bull. 135: 366-377.

Summers, W.C. 1969. Winter population of *Loligo pealei* in the Mid-Atlantic Bight. Biol. Bull. 137: 202-216.

Summers, W.C. 1971. Age and growth of *Loligo pealei*, a population study of the common Atlantic coast squid. Biol. Bull. 141: 189-201.

Summers, W.C. 1983. *Loligo pealei*, p. 115-142. *In*: Boyle, P.R. (ed.), Cephalopod Life Cycles, Vol. I: Species Accounts. Academic Press, London, England.

Templeman, W. 1944. The life history of the spiny dogfish (*Squalus acanthias*) and the vitamin A values of dogfish liver oil. Nfld. Dept. Nat. Res. Bull. No. 15: 1-102.

Thomas, C.J., and L.B. Cahoon. 1993. Stable isotope analyses differentiate between different trophic pathways supporting rocky-reef fishes. Mar. Ecol. Prog. Ser. 95:19-24

Thomas, D.L. and C.B. Milstein. 1973. Ecological studies in the bays and other waterways near Little Egg Inlet and in the ocean in the vicinity of the proposed site for the Atlantic Generating Station, New Jersey. Progress report for the period January-December 1972. Ithaca, NY. Ichthyological Associates, Inc. 1065 p.

Thorne-Miller, B. and J. Catena. 1991. The Living Ocean. Island Press. Washington, D.C.

Thrush, S.F., J.E. Hewitt, V.J. Cummings, and P.K. Dayton. 1995. The impact of habitat disturbance by scallop dredging on marine benthic communities: what can be predicted from the results of experiments?. Mar. Ecol. Prog. Ser. 129:141-150.

Thrush, S.F., V.J. Cummings, J.E. Hewitt, P.K. Dayton, S.J. Turner, G. Funnell, R. Budd, C. Milburn, and M.R. Wilkinson. In press. Disturbance of the marine benthic habitat by commercial fishing: impacts at the scale of the fishery. Ecol. Appl.

Tibbetts, A.M. 1977. Squid fisheries (*Loligo pealei* and *Illex illecebrosus*) off the northeastern coast of the United States of America, 1963-1974. Int. Comm. Northwest Atl .Fish., Sel. Pap., 2:85-109.

Trites, R.W. 1983. Physical oceanographic features and processes relevant to *Illex illecebrosus* spawning in the western North Atlantic and subsequent larval distribution. Northwest Atl. Fish. Organ. (NAFO) Sci. Counc. Stud. 6: 39-55.

Turek, J.G., T.E. Goodger, T.E. Bigford, and J.S. Nichols. 1987. Influence of freshwater inflows on estuarine productivity. NOAA. Tech. memo. NMFS-

F/NEC-46. 26 p.

U.S. Department of Commerce (USDC). 1984. Status of the fishery resources off the northeastern United States for 1983. NOAA, NMFS-F/NEC-29. 132 p.

_____. 1985a. Regional action plan: northeast regional office and northeast fisheries center. *In*: NOAA. NMFS. Tech. memo. F/NEC-37. 20 p.

_____. 1985b. National Artificial Reef Plan. NOAA Technical Memorandum NMFS OF-6. Washington, D.C.

_____. 1990. Estuaries of the Untied States. NOAA, NOS, Ocean Assessment Division, Strategic Assessment Branch. Washington, D.C.

_____. 1993a. Assessment of Chemical Contaminants in the Hudson-Raritan Estuary and Coastal New Jersey Area. National Status and Trends Program. Silver Spring, MD.

_____. 1996. NMFS Habitat Conservation Program. NMFS, Silver Spring, MD.

_____. 1997a. Technical guidance manual for implementation of essential fish habitat.

_____. 1997b. National shellfish register nothing to clam up about. NOAA, Silver Spring, MD. 2 p.

_____. 1997c. Four hundred years of Arctic data provide insight into climate change. 2 p.

_____. 1998. Draft Technical Guidance Manual to NMFS Implementing the Essential Fish Habitat Requirements for the Magnuson-Stevens Act. NOAA, NMFS, Office of Habitat Conservation, Silver Spring, MD.

U.S. Environmental Protection Agency (USEPA). 1993. Guidance for specifying management measures for sources of nonpoint pollution in coastal waters. Office of Water. 840-B-92-002. 500+ p.

U.S. Geological Survey (USGS). 1997. News Release - What we know so far...Nutrients, Ground Water, and the Chesapeake Bay - A Link with *Pfiesteria*? Office of outreach, Reston, VA.

University of Rhode Island. 1982. A characterization of marine mammals and turtles in the Mid and North Atlantic areas of the US outer continental shelf . Final Report. Prepared for USDI under contract #AA551-CT8-48.

Valentine, P.C. and E.A. Schmuck. 1995. Geological mapping of biological habitats on Georges Bank and Stellwagen Bank, Gulf of Maine region. p. 31-40. In: Applications of side-scan sonar and laser-line systems in fisheries research. Alaska Department of Fish and Game, Special Publication No. 9.

Van Dolah, R. F., P.H. Wendt and N. Nicholson. 1987. Effects of a research trawl on a hard bottom assemblage of sponges and corals. Fish. Res. 5:39-54.

Van Dolah, R. F., P.H. Wendt and M.V. Levisen. 1991. A study of the effects of shrimp trawling on benthic communities in two South Carolina sounds. Fish Res., 12:139-156.

Vecchione, M. 1979. Larval development of *Illex* Steenstrup, 1880, in the northwestern Atlantic, with comments on *Illex* larval distribution. Proc. Biol. Soc. Wash. 91(4): 1060-1075.

Vecchione, M. 1981. Aspects of the early life history of Loligo pealei (Cephalopoda: Myopsida). J. Shellf. Res. 1: 171-180.

Vecchione, M. and C.F.E. Roper. 1986. Occurrence of larval *Illex illecebrosus* and other young cephalopods in the Slope Water/Gulf Stream interface. Proc. Biol. Soc. Wash. 99(4): 703-708.

Vecchione, M., C.F.E. Roper, and M.J. Sweeney. 1989. *Loligo pealei*. *In*: Marine Flora and Fauna of the Eastern United States Mollusca: Cephalopoda. U.S. Nat. Oceanic Atmos. Adm. Tech. Rep. NMFS 73.

Vinogradov, V. I. 1972. Studies of the food habits of silver and red hake in the Northwest Atlantic. ICNAF Res. Bull. No. 9: 41-50.

Vinogradov, V.E. and A.S. Noskov. 1979. Feeding of short-finned squid, *Illex illecebrosus*, and long-finned squid, *Loligo pealei*, off Nova Scotia and New England, 1974-1975. Int. Comm. Northwest Atl. Fish., Sel. Pap. 5: 31-36.

Vovk, A.N. 1972. Method of determining maturing stages in gonads of the squid *Loligo pealei*. Zool. ZH 51: 127-132. Can. Fish. Res. Transl. Ser. 2337.

Vovk, A.N. 1985. Feeding spectrum of longfin squid (*Loligo pealei*) in the Northwest Atlantic and its position in the ecosystem. Northwest Atl. Fish. Org. Sci. Counc. Stud. 8: 33-38.

Vovk, A.N. and L.A. Khvichiya. 1980. On feeding of long-finned squid (*Loligo pealei*) juveniles in Subareas 5 and 6. Northwest Atl. Fish. Org. Sci. Counc. Sci. Counc. Res. Doc. 80/VI/50.

Wang, J.C.S., and R.J. Kernehan. 1979. Pp. 289-292, *In*: Fishes of the Delaware Estuaries. Ecological Analysts, Inc., Towson, MD.

Ware, D.M. and T.C. Lambert. 1985. Early life history of Atlantic mackerel (*Scomber scombrus*) in the Southern Gulf of St. Lawrence. Can. J. Fish. Aquat. Sci. 42: 577-592.

Waring, G.T. 1975. A preliminary analysis of status of butterfish in ICNAF Subarea 5 and Statistical Area 6. Int. Comm. Northwest Atl. Fish. Res. Doc., 75/74, Serial No. 3558, 27 p.

Waring, G.T. and S. Murawski. 1982. Butterfish. *In*: Fish distribution. (M.D. Grosslein and T.R. Azarovitz, eds.), p. 105-107. MESA New York Bight Monograph 15. New York Sea Grant Inst. Albany, NY.

Waring, G.T., P. Gerrior, P.M. Payne, B.L. Parry, and J.R. Nicolas. 1990. Incidental take of marine mammals in foreign fishery activities off the Northeast United States, 1977-1988. U.S. Nat. Mar. Fish. Serv. Fish. Bull. 88: 347-30.

Watling, L. and E.A. Norse. 1997. Physical disturbance of the sea bottom by mobile fishing gear: a comparison with forest clear-cutting. (Submitted to Conservation Biology).

Watling L., R.H. Findlay, L.M. Mayer, and D.F. Schick. 1997. Impact of scallop dragging on a shallow subtidal marine benthic community.

Wheatland, S.B. 1956. Pelagic fish eggs and larvae. *In*: Oceanography of Long Island Sound, 1952-1954. Bull. Bingham Oceanog. Coll. Peabody Mus. Nat. Hist. Yale Univ. 15: 234-314.

Wigley, R. L. 1982. Short-finned squid, *Illex illecebosus*, p. 135-138. In: M. D. Grosslein and T. R. Azarovitz (eds.). Fish distribution. MESA NY Bight Monograph 15. NY Sea Grant Institute, Albany, NY.

Wilk, S.J., W.W. Morse, and L.L. Stehlik. 1990. Annual cycles of gonad-somatic indices as indicators of spawning activity for selected species of finfish collected from the New York Bight. Fish. Bull., 88:775-786.

Witbaard, R. and R. Klein. 1994. Long-term trends on the effects of the southern North Sea beantrawl fishery on the bivalve mollusc Arctica islandica L. (Mollusca, bivalvia). ICES J. mar. Sci. 51: 99-105.

Witman, J.D. and K.P. Sebens. 1985. Distribution and ecology of sponges at a subtidal rock ledge in the central Gulf of Maine. p. 391-396 In: K. Rutzler (ed.) New Perspectives in Sponge Biology. Smithsonian Insitution Press, Washington, D.C.

Whitaker, J.D. 1978. A contribution to the biology of *Loligo pealei* and *Loligo plei* (Cephalopoda, Myopsida) off the southeastern coast of the United States. M.Sc. Thesis, College of Charleston, 164 p.

Worley, L. G. 1933. Development of the egg of mackerel at different constant temperatures. J. Gen. Physiol. 16: 841-857.

Young, R.E., and R.F. Harman. 1988. “Larva,” “paralarva,” and “subadult” in cephalopod terminology. Malacologia 29: 201-207.

13.0 TABLES AND FIGURES

Table 1. Frequency distribution of home port state (HPST) of vessels with Atlantic mackerel permits in 1999.

HPST	Frequency	Percent	Cumulative Frequency	Cumulative Percent
AL	1	0.1	1	0.1
CT	31	1.6	32	1.6
DE	13	0.7	45	2.3
FL	6	0.3	51	2.6
GA	1	0.1	52	2.6
MA	865	43.6	917	46.2
MD	18	0.9	935	47.1
ME	216	10.9	1151	58.0
NC	63	3.2	1214	61.2
NH	67	3.4	1281	64.6
NJ	181	9.1	1462	73.7
NY	249	12.6	1711	86.2
PA	20	1.0	1731	87.2
RI	127	6.4	1858	93.6
SC	2	0.1	1860	93.8
TX	1	0.1	1861	93.8
VA	118	5.9	1979	99.7
VT	1	0.1	1980	99.8
WV	4	0.2	1984	100.0

Frequency Missing = 23

Table 2. Frequency distribution of dealers which possessed Atlantic mackerel, squid and butterfish dealer permits by state in 1999.

STATE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
CA	1	0.3	1	0.3
CT	6	1.8	7	2.1
DE	2	0.6	9	2.6
FL	5	1.5	14	4.1
HI	1	0.3	15	4.4
LA	3	0.9	18	5.3
MA	106	31.2	124	36.5
MD	4	1.2	128	37.6
ME	20	5.9	148	43.5
NC	26	7.6	174	51.2
NH	5	1.5	179	52.6
NJ	27	7.9	206	60.6
NY	69	20.3	275	80.9
PA	1	0.3	276	81.2
PR	1	0.3	277	81.5
RI	40	11.8	317	93.2
VA	21	6.2	338	99.4
VI	2	0.6	340	100.0

Table 3 . Frequency distribution of dealers which bought Atlantic mackerel in 1999 by state.

STATE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
CT	1	0.9	1	0.9
MA	36	31.3	37	32.2
MD	2	1.7	39	33.9
ME	2	1.7	41	35.7
NC	10	8.7	51	44.3
NH	3	2.6	54	47.0
NJ	9	7.8	63	54.8
NY	25	21.7	88	76.5
RI	21	18.3	109	94.8
VA	6	5.2	115	100.0

Table 4. Total landings and value of Atlantic mackerel, *Loligo*, *Illex*, and butterfish during 1999.

	Landings (pounds)	Value ($)	Vessels (number)	Trips (number)
Mackerel	26,555,136	3,569,684	559	5,303
Loligo	41,367,001	32,190,312	523	17,042
Illex	16,288,661	3,850,094	86	485
Butterfish	4,664,642	2,660,492	522	12,235

Source: Unpublished NMFS Dealer reports.

Table 5. Total landings of Atlantic mackerel, *Loligo*, *Illex*, and butterfish during 1999 by permit category.

	Permit Categories							
	Loligo/Butterfish Moratorium		Squid/Butterfish Incidental Catch		Atlantic Mackerel		*Illex* Squid Moratorium	
	Landings (pounds)	Vessels (number)	Landings (pounds)	Vessels (number)	Landings (pounds)	Vessels (number)	Landings (pounds)	Vessels (number)
Mackerel	25,099,638	219	774,495	260	25,101,827	395	24,002,396	52
Loligo	39,073,574	316	6,565,291	224	35,282,886	341	20,836,628	66
Illex	16,276,446	43	28,916	38	16,085,032	64	16,241,696	34
Butterfish	4,096,409	276	533,816	229	3,787,781	334	2,636,116	59

Source: Unpublished NMFS Dealer reports.

Table 6. Atlantic mackerel landings (pounds and value) by port in 1999.

Port	Pounds	Percent (%)	Value ($)	Percent (%)
Cape May, NJ	**19,660,186**	**74.04**	**2,082,906**	**58.35**
North Kingstown, RI	**3,329,331**	**12.54**	**675,545**	**18.92**
Point Judith, RI	**646,144**	**2.43**	**96,880**	**2.71**
Chatham, MA	**618,012**	**2.33**	**134,738**	**3.77**
New Bedford, MA	**362,702**	**1.37**	**89,745**	**2.51**
Gloucester, MA	**307,631**	**1.16**	**97,050**	**2.72**

Source: Unpublished NMFS Dealer Reports (for ports landing >1% of total Atlantic

mackerel landings)

Table 7. Value of landings all species landed and Atlantic mackerel by port in 1999 (for ports where mackerel comprised >1% of total value of all species) .

	Number of vessels	Value All species ($)	Mackerel value ($)	Percent (%)
North Kingstown, RI	5	6,992,943	675,545	9.7
Cape May, NJ	22	22,398,888	2,082,906	9.3
Little Compton, RI	11	1,853,977	47,806	2.6
Chatham, MA	36	9,371,639	134,738	1.4

Table 8. Home port state of vessels with *Loligo*/butterfish moratorium permits in 1999.

HPST	Frequency	Percent	Cumulative Frequency	Cumulative Percent
CT	6	1.5	6	1.5
DE	3	0.8	9	2.3
FL	1	0.3	10	2.5
MA	110	27.6	120	30.2
MD	3	0.8	123	30.9
ME	7	1.8	130	32.7
NC	21	5.3	151	37.9
NH	1	0.3	152	38.2
NJ	56	14.1	208	52.3
NY	97	24.4	305	76.6
PA	8	2.0	313	78.6
RI	66	16.6	379	95.2
VA	19	4.8	398	100.0

Frequency Missing = 2

Table 9. Frequency distribution of dealers which bought *Loligo* in 1999 by state.

STATE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
CT	1	0.7	1	0.7
MA	34	24.8	35	25.5
MD	1	0.7	36	26.3
ME	1	0.7	37	27.0
NC	17	12.4	54	39.4
NJ	11	8.0	65	47.4
NY	40	29.2	105	76.6
RI	25	18.2	130	94.9
VA	7	5.1	137	100.0

Table 10. *Loligo* squid landings (pounds and value) by port in 1999.

Port	Pounds	Percent (%)	Value ($)	Percent (%)
Point Judith, RI	15,157,795	36.6	11,938,056	37.1
Cape May, NJ	5,360,296	12.9	3,844,517	11.9
Montauk, NY	4,078,258	9.9	3,296,185	10.2
Hampton Bay, NY	3,477,635	8.4	2,778,874	8.6
North Kingstown, RI	3,255,368	7.9	2,995,041	9.2
New Bedford, MA	1,929,067	4.7	1,408,062	4.4
Newport, RI	1,745,424	4.2	1,189,611	3.7
Point Pleasant, NJ	1,051,695	2.5	667,219	2.1
Greenport, NY	960,018	2.3	746,461	2.3
Other Essex, NJ	885,420	2.1	742,101	2.3
Stonington, CT	821,176	1.9	550,983	1.7
Freeport, NY	724,829	1.8	576,219	1.8

Source: Unpublished NMFS Dealer Reports (for ports landing >1% of total *Loligo* landings in 1999).

Table 11. Value of landings all species landed and *Loligo* by port in 1999 (for ports where *Loligo* comprised >10% of total value of all species) .

Port	Number of Vessels	Value All Species ($)	Loligo Value ($)	Percent (%) of Total
Newport, RI	41	8,740,253	1,189,611	13.61
Cape May, NJ	50	22,398,888	3,844,517	17.16
Greenport, NY	23	3,388,111	746,461	22.03
Point Judith, RI	107	51,190,033	11,938,056	23.32
Montauk, NY	52	11,499,567	3,296,185	28.66
Hampton Bay, NY	49	8,471,407	2,778,874	32.81
Freeport, NY	18	1,492,839	576,219	38.59
North Kingstown, RI	8	6,992,943	2,955,041	42.26

Falmouth, MA	**11**	**118,464**	**58,707**	**49.56**
Other Essex, NJ	**5**	**906,139**	**742,101**	**81.89**

Table 12. Distribution of vessels by home port state which possessed *Illex* moratorium permits in 2000.

Home Port State	# vessels	% vessels
CT	1	1.3
MA	10	13.0
DE	1	1.3
FL	1	1.3
ME	1	1.3
NC	6	7.8
NH	1	1.3
NJ	24	31.2
NY	11	14.3
PA	4	5.2
RI	9	11.7
VA	8	10.4
Total	77	100.0

Source: unpublished NMFS permit file data.

Table 13. Frequency distribution of dealers which bought *Illex* in 1999 by state.

STATE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
MA	5	17.9	5	17.9
ME	1	3.6	6	21.4
NC	5	17.9	11	39.3
NH	2	7.1	13	46.4
NJ	5	17.9	18	64.3
NY	3	10.7	21	75.0
RI	4	14.3	25	89.3
VA	3	10.7	28	100.0

Table 14. *Illex* squid landings (pounds and value) by port in 1999.

Port	Pounds	Percent (%)	Value ($)	Percent (%)
Cape May, NJ	5,572,091	34.21	1,112,757	29.16
Point Judith, RI	5,443,149	33.36	1,369,009	35.56
North Kingstown, RI	3,381,599	20.76	890,165	23.12
New Bedford, MA	1,002,139	6.15	305,307	7.93
Hampton, VA	472,868	2.9	70,932	1.84
Other Essex, NJ	208,153	1.28	44,744	1.16
Wanchese, NC	173,381	1.06	26,021	0.68

Source: Unpublished NMFS Dealer Reports (for ports which landed >1% of *Illex* landed in 1999).

Table 15. Value of landings all species landed and *Illex* by port in 1999 (for ports where *Illex* comprised >1% of total value of all species) .

Port	Number of Vessels	Value All Species ($)	Illex Value ($)	% of Total
North Kingstown, RI	3	28,113,287	890,165	12.73
Cape May, NJ	18	22,398,888	1,122,757	5
Point Judith, RI	6	51,190,033	1,369,009	2.7

Table 16. Frequency distribution of dealers which bought butterfish in 1999 by state.

STATE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
CT	1	0.8	1	0.8
MA	30	23.4	31	24.2
MD	1	0.8	32	25.0
ME	1	0.8	33	25.8
NC	21	16.4	54	42.2
NH	1	0.8	55	43.0
NJ	11	8.6	66	51.6
NY	29	22.7	95	74.2
RI	24	18.8	119	93.0
VA	9	7.0	128	100.0

Table 17. Landings of butterfish (pounds and value) by port in 1999.

Port	Pounds	Percent (%)	Value ($)	Percent (%)
Point Judith, RI	1,628,843	34.29	860,566	32.3
North Kingstown, RI	1,013,277	21.72	675,981	25.4
Cape May, NJ	449,604	9.64	172,635	6.5
Montauk, NY	324,748	6.96	200,579	7.5
Hampton Bay, NY	245,240	5.26	168,374	6.3
Greenport, NY	143,665	3.08	93,147	3.5
New Bedford, MA	137,327	2.94	68,722	2.6
Newport, RI	95,312	2.04	40,147	1.5
Ocean City, MD	81,137	1.74	38,871	1.5
New London, CT	72,599	1.56	39,691	1.6
Stonington, CT	60,917	1.31	32,945	1.2
Virginia Beach, VA	48,296	1.04	32,180	1.2

Source: Unpublished NMFS Dealer Reports (for ports landing >1% of total butterfish landings)

Table 18. Value of landings all species landed and butterfish by port in 1999 (for ports where butterfish comprised >1% of total value of all species) .

Port	Number of Vessels	Value All Species ($)	Butterfish Value ($)	Percent (%) of Total
North Kingstown, RI	8	6,992,943	675,981	9.7
Mattituck, NY	7	233,472	15,067	6.5
Brooklyn, NY	4	72,185	2,270	3.1
Greenport, NY	22	3,388,111	93,147	2.7
Hampton Bay, NY	51	8,471,407	168,374	1.9
Freeport, NY	17	1,492,839	26,269	1.7
Montauk, NY	41	1,149,567	200,579	1.7
Point Judith, RI	100	51,190,033	860,566	1.7

Table 19. Home port state of vessels with squid/butterfish incidental catch permits in 1999.

HPST	Frequency	Percent	Cumulative Frequency	Cumulative Percent
AK	1	0.1	1	0.1
AL	1	0.1	2	0.1
CO	1	0.1	3	0.2
CT	26	1.6	29	1.8
DE	12	0.8	41	2.6
FL	7	0.4	48	3.0
GA	1	0.1	49	3.1
MA	719	45.6	768	48.7
MD	12	0.8	780	49.4
ME	142	9.0	922	58.4
NC	78	4.9	1000	63.4
NH	44	2.8	1044	66.2
NJ	140	8.9	1184	75.0
NY	176	11.2	1360	86.2
PA	11	0.7	1371	86.9
RI	95	6.0	1466	92.9
SC	1	0.1	1467	93.0
TX	1	0.1	1468	93.0
VA	106	6.7	1574	99.7
WV	4	0.3	1578	100.0

Frequency Missing = 20

Table 20. Home port state of vessels with Atlantic mackerel, squid and butterfish part/charter permits in 1999.

HPST	Frequency	Percent	Cumulative Frequency	Cumulative Percent
CT	10	2.0	10	2.0
DE	13	2.5	23	4.5
FL	6	1.2	29	5.7
MA	119	23.3	148	29.0
MD	3	0.6	151	29.5
ME	22	4.3	173	33.9
NC	6	1.2	179	35.0
NH	24	4.7	203	39.7
NJ	110	21.5	313	61.3
NY	119	23.3	432	84.5
PA	20	3.9	452	88.5
RI	30	5.9	482	94.3
RO	1	0.2	483	94.5
VA	28	5.5	511	100.0

Frequency Missing = 11

Table 21. Catch disposition of trips that caught and kept 1000 lbs or more of Atlantic mackerel (n=37) based on 1996 NMFS sea sampling data (all gears combined).

Table 22. Catch disposition for trips that kept 2,500 lbs. Or more of Mackerel based on 1999 VTR data

SP	KEPT	PKEPT	% T KEPT	DISC	PDISC	% T DISC	TOTAL
ANGLER	3194	100	0.01	0	0	0	3194
BLUEFISH	16932	100	0.06	0	0	0	16932
BONITO	4	100	0	0	0	0	4
BUTTERFISH	226211	98.39	0.83	3700	1.61	3.76	229911
COD	30	100	0	0	0	0	30
CROAKER, ATLANTIC	58725	100	0.22	0	0	0	58725
EEL, CONGER	210	100	0	0	0	0	210
FLOUNDER, SUMMER	4575	100	0.02	0	0	0	4575
HAKE, RED	21119	99.18	0.08	175	0.82	0.18	21294
HAKE, WHITE	28681	97.78	0.11	650	2.22	0.66	29331
HERRING, ATLANTIC	2738941	98.92	10.06	29800	1.08	30.3	2768741
JOHN DORY	10	100	0	0	0	0	10
WHITING, KING	11	100	0	0	0	0	11
MACKEREL, ATLANTIC	2331527	99.77	85.62	53700	0.23	54.61	2336897
	2						2
MENHADEN	15440	83.73	0.06	3000	16.27	3.05	18440
POLLOCK	2405	100	0.01	0	0	0	2405
SCUP	26623	100	0.1	0	0	0	26623
SEA BASS, BLACK	6818	100	0.03	0	0	0	6818
WEAKFISH, SQUETEAGUE	34126	100	0.13	0	0	0	34126
DOGFISH CHAIN	144	100	0	0	0	0	144
SHAD, AMERICAN	477	100	0	0	0	0	477
DOGFISH (NK)	5600	100	0.02	0	0	0	5600
DOGFISH SPINY	4409	47.36	0.02	4900	52.64	4.98	9309
SHARK, THRESHER	960	99.9	0	1	0.1	0	961
BASS, STRIPED	325	24.53	0	1000	75.47	1.02	1325
TILEFISH	743	100	0	0	0	0	743
TUNA, BLUEFIN	4980	87.52	0.02	710	12.48	0.72	5690
WHITING, BLACK	13150	100	0.05	0	0	0	13150
HAKE, SILVER	200232	100	0.74	0	0	0	200232
WOLFFISHES	5	100	0	0	0	0	5
CRAB, HORSESHOE	200	100	0	0	0	0	200
LOBSTER	282	100	0	0	0	0	282
SQUID (LOLIGO)	409705	99.83	1.5	700	0.17	0.71	410405
SQUID (ILLEX)	82547	100	0.3	0	0	0	82547
SQUIDS (NS)	7200	100	0.03	0	0	0	7200
TOTAL	2723028			98336			2732862
	6						2

Table 23. Catch disposition of trips that caught and kept 500 lbs or more of *Loligo* squid (n=77) based on 1996 NMFS sea sampling data (all gears combined).

Table 24. Catch disposition for trips that kept 2,500 lbs. Or more of Loligo based on 1999 VTR data

SP	KEPT	PKEPT	% T KEPT	DISC	PDISC	% T DISC	TOTAL
ANGLER	224771	99.64	0.45	823	0.37	0.40	225594
BLUEFISH	179985	99.62	0.36	689	0.38	0.34	180674
BONITO	308	100.00	0.00	0	0.00	0.00	308
BUTTERFISH	2068428	97.44	4.13	54254	2.56	26.63	2122682
COBIA	59	100.00	0.00	0	0.00	0.00	59
COD	9	81.82	0.00	2	18.18	0.00	11
CROAKER, ATLANTIC	51647	100.00	0.10	0	0.00	0.00	51647
HERRING, BLUE BACK	180	100.00	0.00	0	0.00	0.00	180
EEL, CONGER	1760	100.00	0.00	0	0.00	0.00	1760
EEL, NK	2478	100.00	0.00	0	0.00	0.00	2478
FLOUNDER, WINTER	2133	88.58	0.00	275	11.42	0.13	2408
FLOUNDER, SUMMER	554697	95.49	1.11	26225	4.51	12.87	580922
FLOUNDER, WITCH	177	89.85	0.00	20	10.15	0.01	197
FLOUNDER, YELLOWTAIL	217	64.39	0.00	120	35.61	0.06	337
FLOUNDER, SAND-DAB	175	100.00	0.00	0	0.00	0.00	175
FLOUNDERS (NK)	1052	100.00	0.00	0	0.00	0.00	1052
FLOUNDER, FOURSPOT	2112	91.35	0.00	200	8.65	0.10	2312
MACKEREL, FRIGATE	15	100.00	0.00	0	0.00	0.00	15
GROUPER	802	100.00	0.00	0	0.00	0.00	802
HADDOCK	0	0.00	0.00	10	100.00	0.00	10
HAKE, RED	673069	97.24	1.34	19135	2.76	9.39	692204
HAKE, WHITE	274830	98.58	0.55	3950	1.42	1.94	278780
HAKE MIX RED & WHITE	15845	96.35	0.03	600	3.65	0.29	16445
HERRING, ATLANTIC	538275	98.09	1.08	10500	1.91	5.15	548775
JOHN DORY	15788	99.65	0.03	55	0.35	0.03	15843
MACKEREL, KING	100	100.00	0.00	0	0.00	0.00	100
WHITING, KING	221804	99.78	0.44	500	0.23	0.25	222304
MACKEREL, ATLANTIC	2973666	99.78	5.94	6675	0.22	3.28	2980341
MACKEREL, CHUB	241	100.00	0.00	0	0.00	0.00	241
MENHADEN	9020	100.00	0.02	0	0.00	0.00	9020
REDFISH	20	100.00	0.00	0	0.00	0.00	20
POUT, OCEAN	295	100.00	0.00	0	0.00	0.00	295
POLLOCK	60	100.00	0.00	0	0.00	0.00	60
SEA RAVEN	260	100.00	0.00	0	0.00	0.00	260
SCUP	159336	98.91	0.32	1750	1.09	0.86	161086
SEA BASS, BLACK	115482	99.43	0.23	663	0.57	0.33	116145
SEA ROBINS	7719	94.96	0.02	410	5.04	0.20	8129
WEAKFISH, SQUETEAGUE	9683	99.98	0.02	2	0.02	0.00	9685
WEAKFISH, SPOTTED	3475	98.58	0.01	50	1.42	0.02	3525
DOGFISH CHAIN	4513	99.78	0.01	10	0.22	0.00	4523

SHAD, AMERICAN	1215	100.00	0.00	0	0.00	0.00	1215
DOGFISH (NK)	59416	100.00	0.12	0	0.00	0.00	59416
DOGFISH SMOOTH	16463	99.79	0.03	35	0.21	0.02	16498
DOGFISH SPINY	117166	96.24	0.23	4581	3.76	2.25	121747
SHARK, NK	53	100.00	0.00	0	0.00	0.00	53
SKATES	9886	59.50	0.02	6730	40.50	3.30	16616
MACKEREL, SPAN	79	100.00	0.00	0	0.00	0.00	79
BASS, STRIPED	856	94.48	0.00	50	5.52	0.02	906
SUNFISHES	0	0.00	0.00	600	100.00	0.29	600
SWORDFISH	4062	96.78	0.01	135	3.22	0.07	4197
TAUTOG	841	100.00	0.00	0	0.00	0.00	841
TILEFISH	20427	99.88	0.04	24	0.12	0.01	20451
TRIGGERFISH	61	100.00	0.00	0	0.00	0.00	61
TUNA NK	20	100.00	0.00	0	0.00	0.00	20
TUNA, BLUEFIN	324515	98.33	0.65	5500	1.67	2.70	330015
TUNA, LITTLE	10	100.00	0.00	0	0.00	0.00	10
TUNA, BIG EYE	544	100.00	0.00	0	0.00	0.00	544
TUNA, ALBACORE	312	100.00	0.00	0	0.00	0.00	312
TUNA, YELLOWFIN	11006	100.00	0.02	0	0.00	0.00	11006
SHARK, DUSKY	25	100.00	0.00	0	0.00	0.00	25
SHARK, HAMMERHEAD	0	0.00	0.00	100	100.00	0.05	100
WHITING, BLACK	238010	99.40	0.48	1426	0.60	0.70	239436
HAKE, SILVER	5427515	99.37	10.85	34380	0.63	16.88	5461895
WOLFFISHES	10	100.00	0.00	0	0.00	0.00	10
OTHER FISH	2833	100.00	0.01	0	0.00	0.00	2833
CRAB, JONAH	235	100.00	0.00	0	0.00	0.00	235
CRAB, NK	40	100.00	0.00	0	0.00	0.00	40
CRAB, HORSESHOE	1650	100.00	0.00	0	0.00	0.00	1650
LOBSTER	8689	97.65	0.02	209	2.35	0.10	8898
CONCHS	72	100.00	0.00	0	0.00	0.00	72
SCALLOP, SEA	1497	100.00	0.00	0	0.00	0.00	1497
SQUID (LOLIGO)	3075230	99.93	61.45	21775	0.07	10.69	3077408
	7						2
SQUID (ILLEX)	4879601	99.97	9.75	1250	0.03	0.61	4880851
SQUIDS (NS)	52110	100.00	0.10	0	0.00	0.00	52110
TOTAL	5004601		100.00	203713		100.00	5024972
	2						5

Table 25. Catch disposition of trips that caught and kept 1000 lbs or more of *Illex* squid (n=116) based on 1996 NMFS sea sampling data (all gears combined).

Table 26. Catch disposition for trips that kept 2,500 lbs. Or more of Illex based on 1999 VTR data

SP	KEPT	PKEPT	% T Kept	DISC	PDISC	% T DISC	TOTAL
ANGLER	5615	99.65	0.03	20	0.36	0.04	5635
BLUEFISH	17185	100.00	0.09	0	0.00	0.00	17185
BUTTERFISH	549237	92.60	2.93	43900	7.40	90.65	593137
CROAKER, ATLANTIC	7500	100.00	0.04	0	0.00	0.00	7500
FLOUNDER, SUMMER	3195	83.10	0.02	650	16.91	1.34	3845
FLOUNDER, WITCH	34	100.00	0.00	0	0.00	0.00	34
FLOUNDER, YELLOWTAIL	825	100.00	0.00	0	0.00	0.00	825
FLOUNDERS (NK)	800	100.00	0.00	0	0.00	0.00	800
HAKE, RED	4179	98.82	0.02	50	1.18	0.10	4229
HAKE MIX RED & WHITE	1250	100.00	0.01	0	0.00	0.00	1250
HERRING, ATLANTIC	324055	100.00	1.73	0	0.00	0.00	324055
JOHN DORY	454	100.00	0.00	0	0.00	0.00	454
MACKEREL, ATLANTIC	736758	100.00	3.93	0	0.00	0.00	736758
SCUP	1700	100.00	0.01	0	0.00	0.00	1700
SEA BASS, BLACK	120	100.00	0.00	0	0.00	0.00	120
DOGFISH CHAIN	25	100.00	0.00	0	0.00	0.00	25
SKATES	8000	100.00	0.04	0	0.00	0.00	8000
SUNFISHES	0	0.00	0.00	600	100.00	1.24	600
SWORDFISH	5312	93.32	0.03	380	6.68	0.78	5692
TILEFISH	424	100.00	0.00	0	0.00	0.00	424
TUNA, BIG EYE	919	100.00	0.00	0	0.00	0.00	919
TUNA, YELLOWFIN	10767	100.00	0.06	0	0.00	0.00	10767
SHARK, PORBEAGLE	200	100.00	0.00	0	0.00	0.00	200
SHARK, DUSKY	25	100.00	0.00	0	0.00	0.00	25
SHARK, HAMMERHEAD	0	0.00	0.00	100	100.00	0.21	100
WHITING, BLACK	40575	100.00	0.22	0	0.00	0.00	40575
HAKE, SILVER	40196	99.75	0.21	100	0.25	0.21	40296
LOBSTER	393	100.00	0.00	0	0.00	0.00	393
SHRIMP (PANDALID)	40	100.00	0.00	0	0.00	0.00	40
SQUID (LOLIGO)	2364491	100.00	12.61	50	0.00	0.10	2364541
SQUID (ILLEX)	1462221	99.98	78.00	2580	0.02	5.33	1462479
	5						5
TOTAL	1874648			48430			1879491
	9						9

Table 27. Catch disposition of trips that caught and kept 500 lbs or more of butterfish squid (n=26) based on 1996 NMFS sea sampling data (all gears combined).

Table 28. Catch disposition for trips that kept 2,500 lbs. Or more of butterfish based on 1999 VTR data

SPECIES	LBS KEPT	% KEPT	% TOTAL LANDED	LBS DISCARD	% DISCARD	TOT DISC	LBS TOTAL
ANGLER	209252	99.69	0.77	650	0.31	0.46	209902
BLUEFISH	172308	99.83	0.63	298	0.17	0.21	172606
BONITO	246	100	0	0	0	0	246
BUTTERFISH	3032904	99.12	11.1	26855	0.88	19.18	3059759
COBIA	40	100	0	0	0	0	40
COD	80721	98.77	0.3	1007	1.23	0.72	81728
CROAKER, ATLANTIC	993720	99.66	3.64	3375	0.34	2.41	997095
RIBBONFISH	702	100	0	0	0	0	702
DRUM, BLACK	1000	100	0	0	0	0	1000
HERRING, BLUE BACK	5975	96.76	0.02	200	3.24	0.14	6175
EEL, CONGER	1460	100	0.01	0	0	0	1460
EEL, NK	2842	100	0.01	0	0	0	2842
FLOUNDER, WINTER	5879	98.03	0.02	118	1.97	0.08	5997
FLOUNDER, SUMMER	597415	94.43	2.19	35226	5.57	25.16	632641
FLOUNDER, WITCH	4060	99.75	0.01	10	0.25	0.01	4070
FLOUNDER, YELLOWTA	0	0	0	101	100	0.07	101
FLOUNDER, AM. PLAI	135	81.82	0	30	18.18	0.02	165
FLOUNDER, SAND-DAB	792	100	0	0	0	0	792
FLOUNDERS (NK)	549	100	0	0	0	0	549
FLOUNDER, FOURSPOT	2545	100	0.01	0	0	0	2545
GROUPER	295	100	0	0	0	0	295
HADDOCK	0	0	0	10	100	0.01	10
HAKE, RED	808142	98.76	2.96	10125	1.24	7.23	818267
HAKE, WHITE	483711	98.54	1.77	7175	1.46	5.12	490886
HAKE MIX RED & WHI	50525	99.8	0.18	100	0.2	0.07	50625
HERRING, ATLANTIC	248600	99.52	0.91	1200	0.48	0.86	249800
JOHN DORY	21573	100	0.08	0	0	0	21573
WHITING, KING	101768	100	0.37	0	0	0	101768
MACKEREL, ATLANTIC	1184765	99.43	4.33	6775	0.57	4.84	1191540
MENHADEN	17626	100	0.06	0	0	0	17626
MULLETS	566	100	0	0	0	0	566
REDFISH	20	100	0	0	0	0	20
POUT, OCEAN	615	100	0	0	0	0	615
PIGFISH	90	100	0	0	0	0	90
POMPANO, COMMON	4	100	0	0	0	0	4
SEA RAVEN	410	100	0	0	0	0	410
SCUP	326610	98.99	1.2	3325	1.01	2.37	329935
SEA BASS, BLACK	133569	99.85	0.49	204	0.15	0.15	133773
SEA ROBINS	5149	100	0.02	0	0	0	5149
WEAKFISH, SQUETEAG	254532	98.63	0.93	3533	1.37	2.52	258065

WEAKFISH, SPOTTED	57158	99.4	0.21	345	0.6	0.25	57503
DOGFISH CHAIN	13393	99.58	0.05	56	0.42	0.04	13449
SHAD, AMERICAN	9806	96.94	0.04	310	3.06	0.22	10116
DOGFISH (NK)	28815	100	0.11	0	0	0	28815
DOGFISH SMOOTH	1279	98.01	0	26	1.99	0.02	1305
DOGFISH SPINY	14465	94.57	0.05	830	5.43	0.59	15295
SHARK, THRESHER	386	100	0	0	0	0	386
SHEEPSHEAD	34	100	0	0	0	0	34
SKATES	6613	47.05	0.02	7442	52.95	5.32	14055
MACKEREL, SPAN	1527	100	0.01	0	0	0	1527
SPOT	1769	100	0.01	0	0	0	1769
BASS, STRIPED	3604	97.64	0.01	87	2.36	0.06	3691
SUNFISHES	0	0	0	600	100	0.43	600
PUFFER, NORTHERN	164	100	0	0	0	0	164
SWORDFISH	1276	92.73	0	100	7.27	0.07	1376
TAUTOG	1163	100	0	0	0	0	1163
TILEFISH	18616	99.92	0.07	15	0.08	0.01	18631
TRIGGERFISH	48	100	0	0	0	0	48
TUNA NK	15	100	0	0	0	0	15
TUNA, BLUEFIN	889	100	0	0	0	0	889
TUNA, BIG EYE	636	100	0	0	0	0	636
TUNA, YELLOWFIN	2976	100	0.01	0	0	0	2976
SHARK, HAMMERHEAD	0	0.00	0	100	100	0.07	100
WHITING, BLACK	141897	99.38	0.52	890	0.62	0.64	142787
HAKE, SILVER	5406033	99.57	19.78	23200	0.43	16.57	5429233
WOLFFISHES	8	100	0	0	0	0	8
OTHER FISH	7620	100	0.03	0	0	0	7620
CRAB, JONAH	120	100	0	0	0	0	120
CRAB, HORSESHOE	269	100	0	0	0	0	269
LOBSTER	9118	94.33	0.03	548	5.67	0.39	9666
SHRIMP (PANDALID)	19144	100	0.07	0	0	0	19144
WHELK, CHANNELED	109	100	0	0	0	0	109
WHELK, KNOBBED	177	100	0	0	0	0	177
SCALLOP, SEA	20	100	0	0	0	0	20
SQUID (LOLIGO)	9749936	99.95	35.67	4945	0.05	3.53	9754881
SQUID (ILLEX)	2057280	100	7.53	0	0	0	2057280
SQUIDS (NS)	1023053	99.98	3.74	200	0.02	0.14	1023253
TOTAL	2733053			140011			27470542
	1						

Table 29. *Illex* landings by month during 1999.

Month	LBS	%
January	129,857	0.8
February	15,406	0.1
March	78,982	0.5
April	70,040	0.4
May	41,372	0.2
June	3,507,783	21.5
July	5,016,326	30.8
August	5,741,221	35.2
September	1,335,146	8.2
October	334,815	2.1
November	12,122	0.1
December	5,591	0.0

Source: Unpublished NMFS Dealer Reports

Table 30. Expected level of *Loligo* bycatch under the 10% exemption allowance based on the observed level of *Loligo* landed in the *Illex* fishery in 1999.

Closure Week	Closure Date	*Loligo* Landed in Q3 Under 10% Exemption	% of Q4 Directed *Loligo* Quota	No. of Affected Vessels[1]	% of 1999 Loligo Revenues
31	1 - Aug	182,790	1.8	0	0.44
32	8 - Aug	162,480	1.6	0	0.39
33	15 - Aug	142,170	1.4	0	0.34
34	22 - Aug	121,860	1.2	0	0.29
35	29 - Aug	101,550	1.0	0	0.25
36	5 - Sep	81,240	0.8	0	0.20
37	12 - Sep	60,930	0.6	0	0.15
38	19 - Sep	40,620	0.4	0	0.09
39	26 - Sep	20,310	0.2	0	0.05

[1]Affected Vessels = vessels expected to experience >5% reduction in total revenue as a result of early closure of the directed *Loligo* fishery in Q3.
Source: Unpublished NMFS Dealer Reports

Table 31. Estimated level of *Loligo* landings under the 10% exemption allowance based on the assumption that all *Illex* trips in August or September would land Loligo in the amount equal to 10% of the *Illex* landed (worst-case scenario). Estimates computed as 10% of the average amount of *Illex* landed by week based on 1997-1999 landings.

Closure Week	Closure Date	*Loligo* Landed in Q3 Under 10% Exemption	% of Q4 Directed Loligo Quota	% of 1999 *Loligo* Revenue	No. of Affected Vessels[1]	No. of Vessels w/ 5 - 10% reductions	No. of Vessels w/ 10 - 20% Reductions
31	1 - Aug	1,228,287	12.2	3.0	523	42	3
32	8 - Aug	949,284	9.4	2.3	523	20	0
33	15 - Aug	752,981	7.5	1.8	523	10	0
34	22 - Aug	525,981	5.2	1.3	523	0	0
35	29 - Aug	341,877	3.4	0.8	523	0	0
36	5 - Sep	216,216	2.1	0.5	523	0	0
37	12 - Sep	188,927	1.9	0.5	523	0	0
38	19 - Sep	113,448	1.1	0.3	523	0	0
39	26 - Sep	57,049	0.6	0.1	523	0	0

[1]Affected Vessels = vessels expected to experience >5% reduction in total revenue as a result of early closure of the directed *Loligo* fishery in Q3.
Source: Unpublished NMFS Dealer Reports

Table 32 Estimated level of *Loligo* landings under a 20% exemption allowance based on the assumption that all *Illex* trips in June - September would land Loligo in the amount equal to 20% of the *Illex* landed (worst-case scenario). Estimates computed as 20% of the average amount of *Illex* landed by week based on 1997-1999 landings. RIR - 3.

Closure Week	Closure Date	Weight in lbs.	% Reduction in Q4 Loligo Quota	% Annual Revenue Reduction	No. of Affected Vessels[1]	No. of Vessels w/ no Reductions	No. of Vessels w/ Revenue Reductions <5%%
22	28 - May	3,845,307	38.2	9.3	33	18	472
23	4 - June	3,774,935	37.5	9.1	32	18	473
24	11 - June	3,683,334	36.6	8.9	32	18	473
25	18 - June	3,499,910	34.8	8.4	30	18	475
26	25 - June	3,305,897	32.7	7.9	24	18	481
27	2 - July	3,111,884	30.9	7.5	18	18	487
28	9 - July	2,753,698	27.4	6.6	9	18	496
29	16 - July	2,391,347	23.8	5.7	5	18	500
30	23 - July	2,062,525	20.5	4.9	0	18	505
31	30 - July	1,708,441	17.0	4.1	0	18	505
32	6 - Aug	1,318,664	13.1	3.2	0	18	505
33	13 - Aug	1,067,012	10.6	2.6	0	18	505
34	20 - Aug	783,797	7.8	1.9	0	18	505
35	27 - Aug	568,090	5.6	1.4	0	18	505
36	3 - Sep	377,382	3.7	0.9	0	18	505
37	10 - Sep	343,637	3.4	0.8	0	18	505
38	17 - Sep	205,517	2.0	0.5	0	18	505
39	24 - Sep	109,513	1.1	0.3	0	18	505

[1]Affected Vessels = vessels expected to experience >5% reduction in total revenue as a result of early closure of the directed *Loligo* fishery in Q3.
Source: Unpublished NMFS Dealer Reports

Table 33. Size distribution of all vessels which possessed *Illex* moratorium permits in 2000.

length (ft)	# vessels	% vessels
25 - 49	0	0.0
50 - 74	19	24.6
75 - 99	47	61.0
>100	11	14.3
total	77	100

ton class	# vessels	% vessels
1	0	0.0
2	0	0.0
3	39	50.6
4	38	49.4
total	77	100

Table 34. Default specification for Atlantic mackerel, *Loligo*, *Illex* and butterfish based on 1999 - 2001 specifications.

	Loligo	**Illex**	**Butterfish**	**Atlantic Mackerel**
Max OY	26,000	24,000	16,000	N.A.
ABC	17,600	22,300	7,200	359,000
IOY	17,600	22,300	5,900	78,300
OY	17,600	22,300	5,900	78,300
DAH	17,600	22,300	5,900	50,000
DAP	17,600	22,300	5,900	13,000
JVP	0	0	0	0
TALFF	0	0	0	0

Table 35. Value of landings all species landed and Atlantic mackerel, *Loligo and Illex* and butterfish by port in 1999 (for ports where SMB complex comprised >1% of total value of all species) .

All Species	Number of Vessels	Value ($) All Species	Value ($) SMB Complex	Percent (%) SMB Complex of Total $
Other Essex, NJ	6	906,139	789,140	87.1
North Kingstown, RI	9	6,992,943	5,196,732	74.3
Falmouth, MA	11	118,464	58,854	49.7
Freeport, NY	26	1,492,839	611,350	40.9
Hampton Bay, NY	56	8,471,407	2,970,279	35.0
Cape May, NJ	54	22,398,888	7,222,815	32.2
Montauk, NY	58	11,499,567	3,525,024	30.7
Point Judith, RI	114	51,190,033	14,264,511	27.9
Greenport, NY	24	3,388,111	844,362	24.9
Newport, RI	41	8,740,253	1,256,923	14.4
Amagansett, NY	4	181,625	20,620	11.3
Mattituck, NY	7	233,472	20,560	8.8
Brooklyn, NY	6	72,135	3,728	5.2
Belford, NJ	18	2,993,513	154,398	5.2
Plymouth, MA	10	1,026,261	49,955	4.9
Little Compton, RI	11	1,853,977	89,445	4.8
Other Suffolk, NY	3	272,104	12,740	4.7
Other Dukes, MA	18	2,196,255	99,253	4.5
Point Pleasant, NJ	43	17,186,410	702,160	4.1
Warren, RI	37	9,371,639	286,289	3.0
Barnstable, MA	28	12,682,453	319,588	2.5
Hampton, VA	26	8,670,343	2,161,174	2.5
Chincoteague, VA	29	2,138,891	46,858	2.2
Ocean City, MD	24	6,192,175	102,897	1.7
New Bedford, MA	71	129,892,463	1,871,886	1.5

Table 36. Analysis of Impacts of revenue impacts for participating vessels, assuming a 75% decrease in *Illex* revenues associated with a 75% increase in effort.

Scenario I		Number of Impacted Vessels by Reduction Percentile (%)						
Total Vessels	Number of Vessels Impacted by ≥ 5 Reduction	<5	5-9	10-19	20-29	30-39	40-49	≥50
109	30	79	6	6	10	6	2	0

Table 37. Analysis of Impacts - Review of revenue impacts under Scenario I, by home state.

State	Participating Vessels	Number of Vessels Impacted ≥5 percent	Number of Impacted Vessels by Reduction Percentile (percent)						
			<5	5-9	10-19	20-29	30-39	40-49	≥50
MA	16	3	13	1	1	0	1	0	0
MD	5	0	5	0	0	0	0	0	0
ME	5	1	4	0	0	1	0	0	0
NC	21	4	17	0	1	3	0	0	0
NH	13	0	13	0	0	0	0	0	0
NJ	20	15	5	4	1	4	4	2	0
NY	11	1	10	1	0	0	0	0	0
RI	7	3	4	0	2	1	0	0	0
VA	6	0	6	0	0	0	0	0	0
OTHER[a]	5	3	2	0	1	1	1	0	0
Total	109	30	79	6	6	10	6	2	0

[a]States with fewer than 4 vessels were aggregated.

Table 38. Analysis of Impacts of revenue impacts for participating vessels, assuming a 50% decrease in *Illex* revenues associated with a 50% increase effort.

Scenario II		Number of Impacted Vessels by Reduction Percentile (%)						
Total Vessels	Number of Vessels Impacted by ≥ 5 Reduction	<5	5-9	10-19	20-29	30-39	40-49	≥50
109	25	84	4	13	7	1	0	0

Table 39. Analysis of Impacts - Review of revenue impacts under Scenario II, by home state.

State	Participating Vessels	Number of Vessels Impacted ≥5 percent	Number of Impacted Vessels by Reduction Percentile (percent)						
			<5	5-9	10-19	20-29	30-39	40-49	≥50
MA	16	3	13	1	1	1	0	0	0
MD	5	0	5	0	0	0	0	0	0
ME	5	1	4	0	1	0	0	0	0
NC	21	4	17	1	3	0	0	0	0
NH	13	0	13	0	0	0	0	0	0
NJ	20	11	9	0	5	5	1	0	0
NY	11	0	11	0	0	0	0	0	0
RI	7	3	4	1	2	0	0	0	0
VA	6	0	6	0	0	0	0	0	0
OTHER[a]	5	3	2	1	1	1	0	0	0
Total	109	25	84	4	13	7	1	0	0

[a]States with fewer than 4 vessels were aggregated.

Table 40. Analysis of Impacts of revenue impacts for participating vessels, assuming a 25% decrease in *Illex* revenues associated with a 25% increase effort.

Scenario III		Number of Impacted Vessels by Reduction Percentile (%)						
Total Vessels	Number of Vessels Impacted by ≥ 5 Reduction	<5	5-9	10-19	20-29	30-39	40-49	≥50
109	21	88	13	8	0	0	0	0

Table 41. Analysis of Impacts - Review of revenue impacts under Scenario III, by home state.

State	Participating Vessels	Number of Vessels Impacted ≥5 percent	Number of Impacted Vessels by Reduction Percentile (percent)						
			<5	5-9	10-19	20-29	30-39	40-49	≥50
MA	16	2	14	1	1	0	0	0	0
MD	5	0	5	0	0	0	0	0	0
ME	5	1	4	1	0	0	0	0	0
NC	21	3	18	3	0	0	0	0	0
NH	13	0	13	0	0	0	0	0	0
NJ	20	11	9	5	6	0	0	0	0
NY	11	0	11	0	0	0	0	0	0
RI	7	2	5	2	0	0	0	0	0
VA	6	0	6	0	0	0	0	0	0
OTHER[a]	5	2	3	1	1	0	0	0	0
Total	109	21	88	13	8	0	0	0	0

[a]States with fewer than 4 vessels were aggregated.

Table 42. Total landings and value of Atlantic mackerel, *Loligo*, *Illex*, and butterfish during January and February 1999.

	Landings (pounds)	Value ($)	Vessels (number)	Trips (number)
Mackerel	12,144,881	1,690,528	291	1,343
Loligo	6,500,761	5,146,885	281	2,068
Illex	145,263	42,193	23	50
Butterfish	1,386,672	927,330	228	1,532

Source: Unpublished NMFS Dealer reports